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André M. Thapedi

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A.D.A.M. — THE COMPUTER GENERATED CADAVER: A NEW DEVELOPMENT IN MEDICAL MALPRACTICE AND PERSONAL INJURY LITIGATION

I. INTRODUCTION

Medical illustrations trace their origin to Leonardo da Vinci¹, who was the first person to illustrate the entire anatomical structure of the human body.² Medical illustrations not only serve the medical profession, but they also aid the legal profession in articulating to the layman the intricacies of the human body. Nonetheless, because of the technical nature of medical testimony, it is virtually impossible to present such testimony today without the benefit of some visual aids. As a result, in several jurisdictions, various visual aids such as: charts,³ motion pictures and photographs,⁴ X-rays,⁵ MRI's,⁶ CAT or CT Scans,⁷ therapeutic

1. Leonardo da Vinci was born in 1452, and died in 1519. THE WORLD BOOK ENCYCLOPEDIA 870 (77th ed. 1993).

2. THE ENCYCLOPEDIA BRITANNICA 960 (15th ed. 1987). Leonardo da Vinci was the first person to accurately depict the compact position of the human embryo. *Id.* da Vinci went far beyond his contemporaries' concern with the purely mechanical structure of the body to discover the fuller truth of its functioning. *Id.* Investigating and describing the internal organs, he studied the processes of breathing, digestion, and reproduction. *Id.* The anatomical treatise he projected was to begin with the moment of conception and describe the nature of the womb, the development of the fetus, the birth of the infant, and subsequent growth of the human body. *Id.* The Vitruvian man proportioned in a circle and square, as prescribed by the Roman architect Vitruvius, is da Vinci's most well known anatomical structure illustration. *Id.*

3. *Dabareiner v. Weisflog*, 33 N.W.2d 220 (Wis. 1948). In *Dabareiner*, the plaintiff was injured in an automobile collision with the defendants. *Id.* at 222. The plaintiff suffered trauma to the sacroiliac region, and was diagnosed with sacroiliac neuritis. *Id.* At trial, the trial judge admitted into evidence several charts of the human pelvis. *Id.* at 223. The court held that there was nothing about the charts that would prejudice the jury or jeopardize the defendants. *Id.* *Accord* *Cavallaro v. Welch*, 84 A.2d 279 (Conn. 1951) (holding that chart of a human skeleton was admissible after the expert witness testified that it would "help the jury understand his testimony").

4. *Cisarik v. Palos Community Hosp.*, 579 N.E.2d 873 (Ill. 1991). In *Cisarik*, the plaintiff, a brain damaged infant, brought a medical malpractice action against the defendant hospital. *Id.* at 874. The trial court entered a protective order regarding the filming of a "Day in the Life Movie" of the plaintiff. *Id.* The appellate court modified and affirmed the

devices,⁸ EEG's,⁹ and model skeletons¹⁰ serve as forms of demonstrative

order. *Id.* The court reversed, holding that the movie is merely a form of demonstrative evidence and is admissible into evidence on the same basis as photographs. *Id.* See also, *LeMaster v. Chicago Rock Island & Pacific R.R. Co.*, 343 N.E.2d 65 (Ill. App. Ct. 1976) (discussing the use of photographs as demonstrative evidence). In *LeMaster*, the plaintiff sued the defendant employer for personal injuries after the plaintiff was run over by a train, resulting in the amputation of the plaintiff's leg, hand and three toes. *Id.* at 70. The trial judge allowed into evidence, over defendant's objection, photographs depicting the extent of plaintiff's injuries. *Id.* at 83. The jury returned a verdict of \$1,000,000.00 for the plaintiff. *Id.* at 70. The Illinois Appellate Court affirmed the judgment holding that the photographs were accurate, material, relevant and correctly portrayed the extent of the plaintiff's injuries. *Id.* at 86.

5. *Marion v. B.G. Coon Constr. Co.*, 110 N.E. 444 (N.Y. 1915). In *Marion*, the plaintiff-employee sued the defendant-employer for work related injuries. *Id.* at 445. The court held that the plaintiff was entitled to admit X-rays for his expert witness to testify as to the extent of his injuries. *Id.* at 446. See e.g., *Vander Wel v. Palazzo*, 548 N.Y.S.2d 14 (N.Y. App. Div. 1989) (holding that X-rays were relevant and admissible as demonstrative evidence). Cf. *Hartman v. Md. Casualty Co.*, 417 S.W.2d 640 (Tex. Civ. App. 1967) (holding that trial court committed reversible error when it admitted X-rays into evidence without proper foundation).

6. MRI is an acronym for Magnetic Resonance Imaging. *STEDMAN'S MEDICAL DICTIONARY* 764 (25th ed. 1990). A MRI is a "diagnostic imaging modality . . . in which the patient's body is placed in a magnetic field and its nuclei (hydrogen) are excited by radiofrequency pulses at angles to the field's axis; resulting signals from the hydrogen ions, varying in strength where hydrogen is in greater or lesser concentrations in the body, are processed through a computer to produce an image; by varying the radiofrequency pulse sequences, the apparent contrast of adjacent tissues and of black and white values can be altered." *Id.* See *Phillips v. Ficarra*, 618 So.2d 312 (Fla. Dist. Ct. App. 1993). In *Phillips*, the plaintiff injured her back in an accident, and was diagnosed with a herniated disc. *Id.* at 312. At trial, MRI scans of the plaintiff were used in opening and closing arguments and by expert witnesses. *Id.* However, the trial judge would not allow the jury to refer to the MRI scans during its deliberations. *Id.* at 313. The court reversed and remanded holding that the trial court abused its discretion in refusing to allow the MRI scans to go to the jury. *Id.* at 314.

7. CAT or CT scan is an acronym for Computerized Axial Tomography. *STEDMAN'S MEDICAL DICTIONARY* 1607 (25th. ed. 1990). A CT scan is defined as "the gathering of anatomical information from a cross-sectional plane of the body, presented as an image generated by a computer synthesis of x-ray transmission data obtained in many different directions through a given plane." *Id.* See *Kennelly v. Burgess*, 636 A.2d 32 (Md. Ct. Spec. App. Jan. 27, 1994). In *Kennelly*, the plaintiffs (husband and wife) sued the defendant doctor for medical malpractice involving surgical procedures performed on the plaintiff husband. *Id.* at 33. The court affirmed a ruling allowing an expert witness to refer to a CT scan depicting defects in the plaintiff husband's fovea ethmoidalis and cribriform plate (cranium). *Id.* at 36.

8. *Hampton v. Rautenstrauch*, 338 S.W.2d 105 (Mo. 1960) (holding that the admissibility of a Thomas collar, back brace or corset, and pelvic transaction brace were not erroneous in a personal injury matter where the plaintiff suffered whip-lash and various injuries).

9. EEG is an acronym for electroencephalogram. *STEDMAN'S MEDICAL DICTIONARY* 496 (25th ed. 1990). An EEG is the record obtained by recording the electric potentials of the brain derived from electrodes attached to the scalp. *Id.* See *Berry v. Hatmon*, 329 S.W.2d 784 (Mo. 1959). In *Berry*, the plaintiff was injured in an accident while a guest in

evidence¹¹ in litigation.

Sophisticated computer animation¹² is the newest form of demonstrative evidence available to practicing medical malpractice and personal injury trial lawyers.¹³ Recently, in the largest study on medical malpractice ever conducted in the United States, researchers from Harvard University found that one of every 7.5 negligently inflicted injuries results in a medical malpractice claim.¹⁴ Unfortunately, "[w]hen it comes to the touchy subject of medical malpractice, doctors often claim that lawyers simply don't understand the complexities and demands of medicine."¹⁵

However, computer animation transforms complicated medical information into a more easily understood visual form. As a result, judges and juries can grasp the complex medical intricacies of a case within a

the defendant's automobile. *Id.* at 787. At trial, the trial judge allowed the comparison of a normal EEG with the plaintiff's EEG indicating abnormalities in the plaintiff's brain resulting from trauma. *Id.* at 793. The Supreme Court of Missouri held the comparison proper. *Id.*

10. *Flanagan v. Redondo*, 595 N.E.2d 1077 (Ill. App. Ct. 1992). In *Flanagan*, the plaintiff sued the defendant, an orthopedic surgeon, for medical malpractice in the treatment of the plaintiff's broken leg. *Id.* at 1079. The appellate court held that the use of the model skeleton was proper because the defendant's expert witness testified that the model skeleton was "a true and accurate and fair representation of the skeletal anatomy including the fibula and the tibia." *Id.* at 1084.

11. Demonstrative evidence is defined as "[t]hat evidence addressed directly to the senses without intervention of testimony." BLACK'S LAW DICTIONARY 432 (6th ed. 1990).

12. Computer animation is defined as "a series of computer-generated images shown in rapid succession to create the illustration of motion." Barry Sullivan, *Computer-Generated Re-Enactments as Evidence in Accident Cases*, 3 HIGH TECH L.J. 193, 194 (1989).

13. A recent American Bar Association poll of medium-sized law firms indicated that "one in six lawyers used some form of computer animation last year." Claire Cooper, *When Justice Starts Watching Videos*, SACRAMENTO BEE, Jan. 4, 1993, at A1. "Half of the respondents said that they were planning to use it." *Id.*

14. Paul C. Weiler et al., *Proposal for Medical Liability Reform*, JAMA, May 6, 1992, at 2355. As part of a comprehensive analysis of medical injury and litigation, the researchers in the Harvard Medical Practice Study III interviewed a random sample of 794 individuals who suffered medically adverse events in New York hospitals in 1984. Harvard Medical Practice Study Group, *Patients, Doctors, and Lawyers: Medical Injury, Malpractice Litigation, and Patient Compensation in New York*, HARVARD UNIV. (1990). The study was designed to measure the adequacy of compensation under the existing medical malpractice tort system, and to provide information that would help the researchers estimate the feasibility of an alternate tort reform theory. Weiler et al., *supra*, at 2355.

15. Sandra G. Boodman, *The Menace of Malpractice*, WASH. POST, Dec. 21, 1993, HEALTH, at Z15 (reviewing HARVEY F. WACHSMAN, *LETHAL MEDICINE: THE EPIDEMIC OF MEDICAL MALPRACTICE IN AMERICA* (1993)). The author of the book, Mr. Wachsmann, gave up a career as a neurosurgeon to become one of the country's leading medical malpractice attorneys. *Id.* Mr. Wachsmann writes that medical malpractice kills 100,000 Americans a year, more than double the amount that die in traffic accidents. *Id.* He continued by enunciating that medical malpractice is "tolerated by the medical profession and abetted by a pathetically inadequate disciplinary system that catches only a handful of bad doctors." *Id.*

short period of time.¹⁶ Thus, computer animation promises to bridge the gap between the layman and the medical profession.

Recently, a computer animation program known as A.D.A.M.¹⁷ has provided the legal profession with the most sophisticated medical illustrations since "Gray's Anatomy."¹⁸ A.D.A.M. is a CD-ROM¹⁹ based interactive²⁰ anatomical program that allows attorneys to use colorful anatomical images to demonstrate injuries, surgeries and other medical eruditions.²¹ A.D.A.M. is a computer generated cadaver that permits the user to peel away several layers of the human body including the fat, superficial veins, and subcutaneous nerves.²² Additionally, A.D.A.M. provides a basic education in anatomy, medical terminology, and diagnostic and surgical theory.²³ Because of its broad range of uses, A.D.A.M. promises to become a new standard tool in tort litigation.

While A.D.A.M. has been used by several attorneys in medical malpractice and personal injury cases in the United States,²⁴ there exist no reported decisions that specifically address A.D.A.M.'s admissibility as evidence. Accordingly, this comment will consider the potential uses of A.D.A.M., with a brief discussion of its technological aspects. However, the primary focus of this comment will be a practical consideration of the

16. In fact, due to the large number of medical malpractice cases, the impact of technology on the legal profession is perceptible. Peter Jacobson, *Medical Malpractice and the Tort System*, JAMA, Dec. 15, 1989, at 3320. As technology changes, medical standards change, and what constitutes a minimum standard of care also changes. *Id.* at 3321.

17. A.D.A.M. is an acronym for Animated Dissection of Anatomy for Medicine. See *infra* note 21.

18. "Gray's Anatomy" was first published in London in 1858 by J.W. Parker and Son. GRAY'S ANATOMY viii (29th Am. ed. 1973). "Gray's Anatomy is 'the decades-old bible of medical dissection.'" *Computer Cadaver Helps Teach Surgery*, MIAMI HERALD, May 31, 1992, at 7B.

19. CD-ROM is a revolutionary information storage medium, much as was papyrus when it replaced stone, clay, and wood as surfaces on which early Egyptians recorded significant events in their lives. Bill Gates, *CD-ROM: The New Papyrus*, MICROSOFT CORPORATION, 1986, at 2.

20. An "interactive video" is defined as "[t]he mixing of video and computer technologies which uses a video program (moving pictures and voice tracks) and computer programs run together so that the user's actions or choices affect the way in which the program unfolds." Kathy Fox et al., *Optical/Laser Technology: A Glossary of Basic Terms*, LASERDISK PROFESSIONAL, May 1988, at 102.

21. A.D.A.M. Software, Inc. informational marketing pamphlet: *Making Anatomy Come Alive*, (1993).

22. *Id.*

23. *Id.*

24. Telephone Interview with Robert J. Glenn, Partner, Motherway & Glenn (Feb. 22, 1994); Telephone Interview with Charles F. Redden, Attorney, Pretzel & Stouffer Chartered (Feb. 22, 1994). See Jim Meyer, *Body of Evidence*, A.B.A. J., December 1993, at 88 (noting that Mark Clayton Choate of Juneau, Ala., Tommy Lee Maddox of Atlanta, Ga., and Charles Saladino of Paducah, Ky, have also utilized A.D.A.M.).

admissibility standards a trial lawyer may face upon introduction of evidence generated by A.D.A.M. Additionally, this comment will address potential arguments that a trial lawyer may assert to lay a proper foundation for the introduction of A.D.A.M.²⁵ pursuant to the common law principles of demonstrative evidence, the *Frye*²⁶ standard of scientific evidence²⁷ in light of the recent United States Supreme Court decision in *Daubert v. Merrell Dow Pharmaceuticals, Inc.*,²⁸ and the codified rules of evidence.

II. BACKGROUND: WHAT IS A.D.A.M.?

A. TECHNOLOGICAL ASPECTS

A.D.A.M. is a custom software²⁹ program used in medical schools throughout the United States to teach concepts in anatomy.³⁰ A.D.A.M. uses high-resolution graphics and color animation to show views of the human body from every conceivable angle. Such in-depth visual information helps to increase understandings about proposed medical treatments and procedures.³¹

25. For the purposes of this article the acronym "A.D.A.M." will refer to evidence generated by the program. Trial lawyers that use the program say that they have yet to collectively bring the software and hardware into the courtroom and have an expert manipulate the program while instructing the jury. *See supra* note 24 (identifying trial lawyers using A.D.A.M.). They explain that A.D.A.M. is primarily used to generate still-exhibits for trial. *Id.* In fact, A.D.A.M. has the capacity to create "libraries" for trial. *See supra* note 21. However, the trial lawyers remark that the thought of physically bringing the program into the courtroom has not been discounted as a possible trial strategy. *Id.*

26. *Frye v. United States*, 293 F. 1013 (D.C. Cir. 1923).

27. For the discussion of the *Frye* standard of scientific evidence, *see infra* notes 82-87 and accompanying text.

28. *Daubert v. Merrell Dow Pharmaceuticals, Inc.*, 113 S. Ct. 2786 (1993). For a discussion of the *Daubert* decision and its effect upon *Frye*, *see infra* notes 132-138 and accompanying text.

29. "Custom software" refers to the procurement or in-house development of software that is tailor-made for a specific organization. 1 RICHARD L. BERNACCHI ET AL., BERNACCHI ON COMPUTER LAW §8.01, at 8-1. *See also* 1 RICHARD RAYSMAN & PETER BROWN, COMPUTER LAW: DRAFTING AND NEGOTIATING FORMS AND AGREEMENTS §§1.04[2]-[3], at 1-11, 1-12 (differentiating between custom software and customized software). "Customized software" is "packaged off-the-shelf" software that is modified to meet the specific needs of the user. *Id.* Alternatively, custom software is created specifically for the needs of the user. *Id.*

30. In fact, A.D.A.M. was brought to Dartmouth Medical School by Former Surgeon General and professor, C. Everett Koop. Therese DiPippa, *What a Cut Up!*, INFORMATIONWEEK, May 17, 1993, at 68. Currently, every medical student at Dartmouth uses a cadaver to study anatomy. *Id.* However, Dr. Koop predicts that in five years, "A.D.A.M. will become the primary reference, and students may only have token experience with a cadaver. *Id.*

31. Interview with Dr. Isaac Martin Thapedi, Neurosurgeon, in Chicago, Ill. (Mar. 1, 1994).

A.D.A.M. and its female counter-part E.V.E.,³² are quite different from the familiar renditions of medical illustrators who rely heavily on their imagination.³³ A.D.A.M. and E.V.E. are computer-generated images produced by using the laws of physics governing light and its reflection to determine what an object would look like to the human eye.³⁴

Developed by Atlanta-based A.D.A.M. Software, Inc.,³⁵ A.D.A.M. is the creation of Gregory Swayne, and a team of professionals including artists, scientists, anatomists and physicians.³⁶ A.D.A.M.'s thousands of medical illustrations are stored on computer compact discs ("CD"),³⁷ resembling the CD used for musical recordings. Computer CD's are advantageous because one can hold as much information as about 1,500 floppy discs, the equivalent of about 250,000 printed pages of text.³⁸

Utilizing a mouse,³⁹ the A.D.A.M. user can "point and click" to reveal the various anatomical parts of the human body. In addition, A.D.A.M. can simulate various traumas to the body. For example, burns can be placed onto any part of the body in either first, second or third-degree severity.⁴⁰ A.D.A.M. also contains detailed animated simulations of standard surgical procedures, which allow the viewer to see what a

32. E.V.E. is an acronym for Electronic Viewing Environment. See *supra* note 21.

33. Telephone Interview with Dino Juarez, Medical Illustrator, Nat'l College of Chiropractic, Lombard, Ill. (April 5, 1994). A.D.A.M. was created by medical illustrators who invested thousands of hours to create the thousands of detailed, precise drawings that make up the product. Paul Bernstein, *The Ultimate Tool for Personal Injury Litigation: A.D.A.M.*, ILL. LEGAL TIMES, March, 1994, at 11. A.D.A.M. blends these superbly rendered, precise illustrations into a multimedia platform of interactivity. *Id.*

34. See *infra* notes 45-47 and accompanying text (discussing Queens College physics professor, Arthur Paskins' development of computer-generated evidence for a Florida personal injury case). In fact, the user can depict A.D.A.M. or E.V.E. in five different nationalities including: African-American, Hispanic, Asian, Caucasian, and Native American. A.D.A.M. SOFTWARE, INC., Legal Video, (1993) (video on file with the author). Additionally, anterior, posterior, medial and lateral views of the human body may be demonstrated or viewed with the assistance of A.D.A.M. *Id.*

35. 1899 Powers Ferry Road, Suite 460, Marietta, GA 30067. (404) 980-0888 or (800) 755-ADAM.

36. MIAMI HERALD, *supra* note 18.

37. A compact disc is "[a] 4.75 inch or 12 cm optical disk, standardized, used for storing audio or data in a digitized format." See Fox, *supra* note 20, at 102.

38. See Michael J. Prounis, *The Perfect Match: Law Office Automation and CD-Rom*, LAW PRACTICE MANAGEMENT, November/December 1990, at 25.

In order to access information stored on a computer CD, the user must have a CD-ROM (compact disc read-only memory) drive. *Id.* The computer CD's cannot be changed or edited once they have been produced. *Id.* "CD-ROM's can interface with most computers now used by law firms, whether they are microcomputers or minicomputers. *Id.*

39. A "mouse" is defined as "a computer input device that is used by rolling it around on your desk and pressing one or more buttons." DICTIONARY OF COMPUTER TERMS 216 (3rd. ed. 1992).

40. Dennis Rodkin, *Medical Illustration Comes Alive*, A.B.A. J., October 1993, at 51 (specifically discussing the technological aspects and potential uses of A.D.A.M.).

surgeon would see during the course of the procedure.⁴¹ A.D.A.M. users can navigate throughout the body, from the conspicuous exterior to the microscopic interior, peeling away layer after layer to reach a desired anatomical destination.

B. POTENTIAL USES

In the 1990's, courtrooms have observed the commencement of the computer age.⁴² Trial lawyers have begun to incorporate computer-generated evidence into their trial strategies by taking advantage of its power to illustrate.⁴³ A.D.A.M., for example, takes its viewers "beyond passive observation of two-dimensional, computer-generated displays" to the next realm of interactive, three-dimensional simulations.⁴⁴

Additionally, in a 1989 Florida personal injury case, a computer simulation of an accident persuaded a jury to award seven million dollars to the plaintiff.⁴⁵ The jury failed to accept the defendant's claim that the plaintiff lost control of her car.⁴⁶ Instead, the computer simulation of the incident demonstrated that the defendant's vehicle collided with the rear of the plaintiff's car, thereby causing the accident.⁴⁷ Moreover, in litigation arising from the Delta 191 crash at Dallas/Forth Worth International Airport,⁴⁸ the defendant utilized computer simulations as exhibits

41. A.D.A.M. SOFTWARE, INC., Training Video, (1993) (video on file with the author). See also Bernstein, *supra* note 33, at 11 (acknowledging that practicing physicians find A.D.A.M. "useful to demonstrate to patients and their families exactly what medical surgeries are all about.")

42. James W. Dabney, *Animation is Invading Courtrooms*, N.Y.L.J., Apr. 6, 1993, at 4.

43. For a discussion of the uses of computer-generated evidence at trial, see *infra* notes 45-50 and accompanying text.

44. Laureen Belleville, *SIGGRAPH '91 Preview*, COMPUTER GRAPHICS WORLD, July 1991, at 124, 125.

45. *Computer Simulation Sways Jury*, CHI. TRIB., June 25, 1989, §1, at 8 (discussing Jill Grant's personal injury claim against a Lakeland, Fla. based grocery chain, Publix Super Markets).

46. *Id.*

47. *Id.* The plaintiff's evidence included a computer-generated video simulation illustrating that the defendant's truck rear-ended the plaintiff's car and propelled it into the path of an 18-wheeler. *Id.* The 18-wheeler subsequently broadsided the plaintiff's vehicle. *Id.* The plaintiff's attorney noted that "[i]t was the first time that a computerized reconstruction of an accident was used as evidence in a personal-injury case in Florida" *Id.* Unfortunately, the court's opinion remained unpublished without notice of appeal pursuant to Fed. R. App. P. 3. The field of accident reconstruction, sometimes called "accidentology," dates back to at least 1931. See *Fishman v. Silva*, 2 P.2d 473 (Cal. Ct. App. 1931) (where a non-eyewitness tow truck driver attempted to testify to cause of accident).

48. *In re Air Crash at Dallas/Forth Worth Airport* on Aug. 2, 1985, 720 F. Supp. 1258 (N.D. Tex. 1989). The estates of two cockpit crew members sued the United States on the basis that the air traffic controllers and the National Weather Service failed to warn the airplane's crew of an impending 44-knot wind shear. *Id.* at 1286. The court found the defendant, the United States, not liable, holding that any acts or omissions by the air traf-

in court to recreate the aircraft's flight displaying heading, acceleration, pitch, and roll.⁴⁹ The defendant's three-dimensional simulation provided the jury with the opportunity to assess many factors while having "an eerie feeling of being there, of seeing and hearing what the crew experienced."⁵⁰ These examples of prior litigious computer simulations provide a glimpse into the controversial and contested events surrounding innovative forms of demonstrative evidence.

Currently, an inclination to accept what one sees and hears as an accurate depiction of reality exists.⁵¹ Imagine following expert testimony in a medical malpractice suit explaining the standard of care required for a surgical procedure.⁵² With the assistance of A.D.A.M., the expert would take the trier of fact on a guided tour of the operation by demonstrating the medically acceptable procedures and precautions. Instead of being bombarded with discipline-specific cryptic and scientific terms, the trier of fact would see the actual procedure involved in the litigation along with any alternative processes espoused by the expert. The trier of fact could then compare the processes to determine whether

fic controllers were not the proximate cause of the crash. *Id.* at 1290. The court concluded that the crew "possessed substantially all of the weather information potentially available from the government sources." *Id.* The court continued "[a]ny failure of the air traffic controllers to warn a pilot of the presence of a storm in his path cannot be regarded as a continuing proximate cause after the pilot himself discovered its presence, appreciated the danger and decided to fly." *Id.* (quoting *Black v. United States*, 441 F.2d 741, 745 (5th Cir. 1971), *cert. denied*, 404 U.S. 913 (1971)).

49. Paul Marcotte, *Animated Evidence: Delta 191 Crash Re-Created Through Computer Simulations at Trial*, A.B.A. J., Dec. 1989, at 52, 54. To present its defense, the United States relied on a laser disc player along with a lap-top computer and custom-made software. *Id.* "By using the laptop computer, a witness could display on the television monitors facing the judge and lawyers any image on the disc almost instantly — also freeze-action animation without distortion." *Id.*

50. *Id.* "While computer animation has become more common in litigation during the past 10 years, the Justice Department's presentation at the Delta 191 trial marked a new milestone in terms of length, sophistication and technology used." *Id.* at 53.

51. See generally 1 MCCORMICK ON EVIDENCE §206, at 903-07 (John W. Strong ed., 4th ed. 1992). There is a widespread tendency to accept what one views, as representative of the truth. *Id.* However, that is not always the case, for their exist studies indicating the unreliability of eyewitness testimony. *Id.*

52. Classically, liability for negligence is predicated upon the unintentional breach of a duty owed by a defendant to a plaintiff which proximately causes injury to the plaintiff. W. PAGE KEETON ET AL., PROSSER AND KEETON ON THE LAW OF TORTS §44, at 280 (5th ed. 1984). "Today, over 200,000,000 American receive their health care from some 320,000 doctors, 100,000 dentists, 700,000 nurses and 7,200 hospitals." 1 STEVEN E. PEGALIS & HARVEY F. WACHSMAN, AMERICAN LAW OF MEDICAL MALPRACTICE §1:2, at 3. Accordingly, these health care providers owe a legal duty to these patients, the breach of which will result in civil liability for proximately caused personal injuries. *Id.* Law suits predicated upon such a breach are collectively characterized as medical malpractice suits. *Id.*

there was a deviation or transgression from the standard of care.⁵³ Thus, A.D.A.M. provides a forceful demonstrative tool than can be useful in persuading the trier of fact that an event happened in a particular manner.⁵⁴ Additionally, the use of A.D.A.M. to animate or simulate the anatomical effects of an accident or event may reveal new perspectives on causation which the trial lawyer may not have previously considered.⁵⁵ Therefore, the images conveyed through A.D.A.M. can create a memorable case with enduring impressions on the trier's mind.

C. STANDARD THEORIES OF ADMISSIBILITY

Specialized knowledge often forms the basis of opinion testimony by expert witnesses.⁵⁶ However, the trial court may exercise broad discretion in determining the admissibility of data upon which an expert bases an opinion.⁵⁷ This judicial discretion serves as a threshold test before the specialized knowledge is submitted to the trier of fact as evidence.⁵⁸ Once admitted, the trier of fact must scrutinize the evidence and weigh it in relation to the remaining facts presented at trial.⁵⁹

53. The transgression or deviation from the standard of care leads to liability in a medical malpractice action. See *KEETON et. al, supra* note 52. There is a significant distinction between the duty of a physician to use his best judgment and the duty of the physician to conform to "the standard of care measured by the knowledge and ability of the average physician or specialist in good standing in the community where he practices." *Spadaccini v. Dolan*, 407 N.Y.S.2d 840 (N.Y. App. Div. 1978). See *supra* notes 30-31 and *infra* notes 64-68 and accompanying text (describing the use of A.D.A.M. as a teaching device in the medical profession).

54. See *supra* notes 40-41 and accompanying text (describing the technological capabilities and uses of A.D.A.M.).

55. See *supra* notes 48-50 and accompanying text (denying relief based on problems with causation).

56. See *FED. R. EVID.* 702 (acknowledging the admissibility of scientific or other specialized knowledge by expert testimony in the form of an opinion); see also 56 *F.R.D.* 183, 282 advisory committee's note (1973) (articulating "[a]n intelligent evaluation of the facts is often difficult or impossible without the application of some scientific, technical, or other specialized knowledge. The most common source of this knowledge is the expert witness, although there are other techniques for supplying it.").

57. See, e.g., *Spring Co. v. Edgar*, 99 U.S. 645, 657 (1878) (establishing the well-settled principle that a trial judge has broad discretion in ruling upon the admissibility of expert testimony). Additionally, questions regarding the admissibility of expert testimony shall be determined by the court subject to the introduction of sufficiently relevant evidence. *FED. R. EVID.* 104(a)-(b).

58. See McCormick, *Scientific Evidence: Defining a New Approach to Admissibility*, 67 *IOWA L. REV.* 879, 882 (1982) (asserting that admission of scientific evidence must satisfy threshold requirement of scientific community acceptance in addition to relevancy and helpfulness standards).

59. *McCORMICK ON EVIDENCE* §203, at 364 (4th ed. 1992) (discussing relative weight assigned by jury after admission by trial judge); see also *FED R. EVID.* 104(e) (explaining that preliminary questions of admissibility do not apply to relative weight or credibility).

Generally, when confronted with scientific techniques about which they have limited knowledge, courts have scrutinized the innovative techniques primarily on their degree of reliability.⁶⁰ However, this standard of reliability is much higher than the standard used for traditional observational testimony.⁶¹ Courts have employed this heightened level of scrutiny when ruling on the admissibility of many scientific techniques,⁶² including computer animations.⁶³ Accordingly, the query as to whether A.D.A.M. is a reliable scientific technique is affirmatively answered by the large number of medical schools in the United States⁶⁴ that utilize A.D.A.M. to teach students about the human body.⁶⁵ For

60. See e.g., *United States v. Gwaltney*, 790 F.2d 1378, 1382 (9th Cir. 1986) (holding that the immunobead assay test for anti-sperm antibodies is sufficiently reliable and, therefore, admissible); accord *United States v. Maivia*, 728 F. Supp. 1471, 1474 (D. Haw. 1990) (finding spectrographic voice identification evidence admissible).

61. Compare FED. R. EVID. 401, 403 (defining "relevant evidence" as evidence proving a fact more or less probable and allowing exclusion of evidence for prejudice, jury misdirection, undue delay, needless presentation, or issue confusion) with FED. R. EVID. 702 (allowing expert testimony if it "will assist trier of fact to understand the evidence or to determine a fact at issue . . .") and *Frye v. United States*, 293 F. 1013, 1014 (D.C. Cir. 1923) (requiring degree of general acceptance in scientific community for admission of novel scientific evidence). See MCCORMICK ON EVIDENCE, *supra* note 59, §§184-85, at 338-341, §203, at 362-364 (discussing requirement of relevancy and admissibility for scientific evidence).

62. See *State v. Downie*, 569 A.2d 242 (N.J. 1990) (considering the admissibility of breathalyzer test results); see also *People v. Adamson*, 165 P.2d 3, 12 (Cal. 1946) (regarding the admissibility of fingerprinting identification), *aff'd*, 332 U.S. 46 (1947); *United States v. Williams*, 583 F.2d 1194, 1197-99 (2d Cir. 1978) (concerning the admissibility of sound spectrography), *cert. denied*, 439 U.S. 1117 (1979). See generally Laurel Beeler et. al., *DNA Identification Tests and the Courts*, 63 WASH. L. REV. 903, 930-54 (1988) (discussing judicial acceptance of deoxyribonucleic acid (DNA) tests); accord Gina Kolata, *Some Scientists Doubt the Value of "Genetic Fingerprint" Evidence*, N.Y. TIMES, Jan. 29, 1990, at A-1 (discussing findings of some scientists doubting value of DNA fingerprinting). In the first two dozen cases in which DNA evidence was introduced, the opposing attorneys did not even challenge the evidence because "[t]hey felt scientifically illiterate and unable to even perceive of questions Everyone just sort of lay down and died." *Id.* However, attorneys have challenged its reliability in the courtroom in recent cases. *Id.*

63. See Robert D. Brain & Daniel J. Broderick, *The Derivative Relevance of Demonstrative Evidence: Charting its Proper Evidentiary Status*, 25 U.C. DAVIS L. REV. 957 (1992) (discussing admissibility of computer simulations and computer animations).

64. Physicians and medical students are not the sole users of A.D.A.M. Pre-Medical and Pre-Dental students at St. Mary's College in Moraga, California also use A.D.A.M. to "visualize structures from different perspectives, providing them with a whole body image such that they could locate and identify structures regardless of the visual approach" *Life Before Med School: A Revealing Study*, T.H.E. JOURNAL, May 1993, at S6.

65. See *Gross Anatomy and the Missing Link*, T.H.E. JOURNAL, May 1993, at S4 (identifying Brown University as a user of A.D.A.M. for its medical students.) See e.g., *One New Medium, Well Done*, T.H.E. JOURNAL, May 1993, at S8 (acknowledging the use of A.D.A.M. at Emory University); *Coming Soon to a Big Screen Near You*, T.H.E. JOURNAL, May 1993, at S9 (revealing the use of A.D.A.M. at the University of Texas at Galveston). Accord DiPippa, *supra* note 30, at 68 (recognizing Dartmouth Medical School as a user of A.D.A.M.). Additionally, A.D.A.M. Software, Inc. indicates that "100 of the 126" medical

example, the James A. Haley Veterans Hospital⁶⁶ was among the first educational institutions in the country to use A.D.A.M. to depict muscles, bones, tendons, nerves and arteries in the human body.⁶⁷ In fact, former Surgeon General C. Everett Koop predicts that A.D.A.M. will soon replace cadavers in the study of human anatomy.⁶⁸

Although reliable, evidence generated by A.D.A.M. must first be admissible. To gain admissibility, all evidence, including A.D.A.M., must pass a relevancy test.⁶⁹ Evidence is relevant if it has a tendency to make the existence of a fact at issue more or less probable than without evidence.⁷⁰ As a result, courts will generally admit specialized knowledge into evidence as long as its probative value is not substantially outweighed by prejudice, does not confuse the issues, and does not consume excessive time.⁷¹

Unfortunately, no reported decisions specifically addressing the admissibility of evidence generated by A.D.A.M. exist. However, *Perma Research and Dev. v. Singer Co.*,⁷² was the first important decision considering the use and admissibility of computer simulations. In

schools in the United States currently use A.D.A.M. in "some shape, form, or fashion." Telephone Interview with Mark S. Wilbanks, Marketing Support Representative, A.D.A.M. Software, Inc. (Mar. 28, 1994).

66. Veteran's Hospital in Tampa, Fla.

67. *Computer Cadaver Helps Teach Surgery*, MIAMI HERALD, May 31, 1992, at 7B.

In England in the 1820's, an active trade arose in fresh cadavers to supply the great needs of medical and anatomy schools. R. SCOTT, *THE BODY AS PROPERTY* 5 (1981). Because the need was so great, the sale of just one fully grown cadaver brought up to four guineas, eleven times the average weekly wage. *Id.* at 8. "Resurrectionists" obtained these cadavers from local cemeteries and secreted them to the purchasing schools in the dead of the night. *Id.* Although the trespass and exhumation involved in obtaining these cadavers were crimes, the theft and sale of a cadaver was not considered criminal. *Id.* at 7. One historian noted that a medical student could attend the funeral of a relative on Monday and find the body on the dissecting table by Tuesday or Wednesday, regardless of how eminent the deceased was. *Id.* at 6.

68. See *supra* note 30 and accompanying text (discussing former United States Surgeon General, C. Everett Koop's use of A.D.A.M. at Dartmouth Medical School).

69. See MCCORMICK ON EVIDENCE, *supra* note 51, §§184-85, at 540-48 (exploring relevancy requirements). Rule 401 of the Federal Rules of Evidence defines relevant evidence as data both materially related to the issue(s) at hand and having probative value. FED. R. EVID. 401

70. See FED. R. EVID. 402 (concluding non-relevant evidence is inadmissible). See also FED. R. EVID. 401 (defining relevant evidence).

71. See Victor J. Gold, *Federal Rule of Evidence 403: Observations on the Nature of Unfairly Prejudicial Evidence*, 58 WASH. L. REV. 497, 497-98 (1982) (analyzing application of rule 403). Rule 403 provides "[a]lthough relevant, evidence may be excluded if its probative value is substantially outweighed by the danger of unfair prejudice, confusion of the issues, or misleading the jury, or by considerations of undue delay, waste of time, or needless presentation of cumulative evidence." FED. R. EVID. 403.

72. *Perma Research and Dev. v. Singer*, 542 F.2d 111 (2d Cir. 1976), *cert. denied*, 429 U.S. 987 (1976).

Perma, the Court of Appeals for the Second Circuit upheld the trial court's admission of expert testimony based on computer simulations, notwithstanding the defendant's objections.⁷³ Regrettably, the court did not specifically discuss the reasoning utilized for the admission of evidence based on the computer simulations.⁷⁴ Nevertheless, the evidence was admitted and Perma Research and Development recovered almost seven million dollars,⁷⁵ a recovery based almost exclusively on expert testimony. Thus, judicial discretion appears to control the admission of computer-generated data.

To determine the admissibility of A.D.A.M. as evidence, a trial judge will undoubtedly have several concerns; first, there is a concern of the validity of the underlying scientific principles of A.D.A.M.;⁷⁶ second, the validity of the technique used in demonstrating A.D.A.M.;⁷⁷ finally, whether the person applying A.D.A.M. has the necessary skills to apply and interpret its results.⁷⁸

These three inquiries provide the framework from which the trial judge must determine the appropriate standard for evaluating A.D.A.M.'s admissibility.⁷⁹ Consequently, three possible standards face the trial judge for determining the admissibility of A.D.A.M. The trial judge may be guided by: (1) the common law approach to demonstrative evidence, (2) the *Frye* standard of general acceptance in the relevant scientific community, or (3) the relevancy/balancing test promulgated by the Federal Rules of Evidence.⁸⁰ Under the common law approach to demonstrative evidence, the test inquires as to whether the demonstrative object is relevant to some issue in the case, and whether the object is actually explanatory of something that is important for the jury to understand.⁸¹ The second possible standard is the "general acceptance

73. *Id.* at 115. The defendant argued that the plaintiff's refusal to provide it with the underlying data and theorems of the simulations, impaired its ability to adequately cross-examine the plaintiff's expert witness. *Id.* The majority disagreed holding that the defendant "had not shown that it did not have an adequate basis on which to cross-examine plaintiff's experts." *Id.*

74. The court's standard of admissibility was most likely based on the defendant's ability to properly prepare for cross-examination.

75. *Perma Research and Dev.*, *supra* note 72 at 113.

76. Frederick B. Lacey, *Scientific Evidence*, 24 JURIMETRICS J. 254, 255 (1984).

77. *Id.*

78. *Id.*

79. *Id.*

80. See generally, Lacey, *supra* note 76 (discussing both the *Frye* standard and the relevancy/balancing test).

81. *Smith v. Ohio Oil Co.*, 134 N.E.2d 526, 530 (Ill. App. Ct. 1956). In *Smith*, the plaintiff suffered pelvic injuries when his truck was run into by a truck of the defendant company, driven by the defendant employee. *Id.* at 527-28. At trial, the court allowed plaintiff's expert witness to use a model human skeleton during the expert's testimony. *Id.* at 531. The defendants objected to this use, arguing that the model was unnecessary to an

test" promulgated by the United States Court of Appeals for the District of Columbia Circuit in *Frye v. United States*.⁸² In *Frye*, the defendant appealed a conviction of second degree murder based on the trial court's failure to admit certain scientific evidence that tended to exonerate him.⁸³ The defendant claimed that the trial court erred in refusing to admit expert testimony regarding the results of a systolic blood pressure deception test (a predecessor of the modern polygraph).⁸⁴ The court of appeals affirmed the trial court's exclusion of the test based on a determination that the test was still experimental, and therefore, of unconfirmed reliability.⁸⁵ The court concluded that scientific evidence may be admitted, but the key to its admissibility is the general acceptance of the technique in the relevant community.⁸⁶ Courts measure the general acceptance required in *Frye* by looking at expert evaluations of the technique including case law, law review articles, medical textbooks, medical findings, and established guidelines on testing procedures.⁸⁷

Alternatively, the United States Supreme Court in *Daubert v. Merrell Dow Pharmaceuticals*⁸⁸ recently held that the Federal Rules of Evidence superseded *Frye*.⁸⁹ Nonetheless, several jurisdictions have responded to *Daubert* by systematically distinguishing it, thus avoiding conflicts in their respective standards of admissibility for scientific evidence.⁹⁰

understanding of the issues, was gruesome, and tended only to arouse emotion rather than explain anything. *Id.* The appellate court affirmed the trial court's decision holding that the model was "relevant, legitimate and helpful, and contained nothing emotional or dramatic in character." *Id.* at 531.

82. *Frye v. United States*, 293 F. 1013 (D.C. Cir. 1923).

83. *Id.*

84. *Id.*

85. *Id.* at 1014.

86. *Id.*

87. See *Moore v. McNamara*, 513 A.2d 660, 665-69 (Conn. 1986) (evaluating general acceptance of blood testing techniques); *Cobey v. State*, 559 A.2d 391, 392-98 (Md. Ct. Spec. App. 1989) (probing general acceptance of DNA fingerprinting).

88. *Daubert*, 113 S. Ct. at 2786.

89. See generally *Daubert v. Merrell Dow Pharmaceuticals*, 113 S. Ct. 2786 (1993) (holding that *Frye* "should not be applied in federal trials").

90. See *Jones v. Arkansas*, 862 S.W.2d 242 (Ark. 1993). In *Jones*, the defendant was convicted of murder. *Id.* The court concluded that *Daubert*, although correct, was not applicable because the requirement of general acceptance by the scientific community was not at issue in the case at bar. *Id.* at 245. Accord *Arizona v. Bible*, 858 P.2d 1152, 1181-83 (Ariz. 1993) (discussing the possibility of applying *Frye* and *Daubert* in DNA testing issues); *People v. Clark*, 857 P.2d 1099, 1142 (Cal. 1993) (refusing to address the effect of *Daubert*, if any, on the *Kelly/Frye* standard). The *Kelly/Frye* standard discussed by the *Clark* court is a principle based in California. In California, courts follow what is commonly referred to as the *Kelly/Frye* Rule. *People v. Luna*, 250 Cal. Rptr. 878, 882 (Cal. 1980) (noting that it is not necessary to establish that every device, more specifically a colposcope, used by a doctor fits the *Kelly/Frye* test). This rule evolved from *People v.*

Lastly, notwithstanding the adoption of *Daubert*, the trial judge may apply the relevancy/balancing approach suggested by the Federal Rules of Evidence. The rules provide that relevant evidence should be admitted if its probative value is not outweighed by prejudice, potential to mislead the jury, or excessive consumption of time.⁹¹

Collectively, each of the aforementioned standards provide cogent and logical arguments for the introduction and admissibility of A.D.A.M. in the courtroom.

III. ANALYSIS

A. METHODS FOR INTRODUCING A.D.A.M. AS EVIDENCE

Courtroom evidence is in the midst of a major evolution towards the routine use of computer graphics to persuade the trier of fact.⁹² This current trend may stem from the American Bar Association's heightened awareness of the trier's plight. After conducting a recent study on jury comprehension, the Bar found that the trier of fact is often confused, frustrated, bored, or overwhelmed by technical issues or complex fact patterns.⁹³ As a remedy for this malaise, experts predict that computer-generated evidence will soon become standard tools in civil trials because it can assist the trier of fact in a manner that oral testimony alone cannot equal.⁹⁴

While A.D.A.M.'s ability to persuade can be substantiated, the hurdle remains as to how it will gain admittance in the courtroom. If A.D.A.M. is found unduly persuasive or one-sided, the balancing test of Rule 403⁹⁵ may effectively exclude A.D.A.M. as either unfairly prejudicial, misleading or confusing.

Kelly, 549 P.2d 1240 (Cal. 1976), in which the California Supreme Court reversed a lower court ruling that voice print analysis had attained sufficient scientific approval to merit admitting an expert's testimony. The *Kelly* court adopted the *Frye* test for determining the reliability of a new scientific technique. *Id.* at 1244. Although it acknowledged the existence of a misleading aura of certainty which usually accompanies a new scientific process. *Id.* at 1245. While reliability is usually established by expert testimony, the court found that scientific and legal articles may be considered by a court in determining the reliability of a new scientific method. *Id.* at 1247. Thus, the court in *Kelly* clearly established that California follows the *Frye* standard while imposing some additional requirements. The *Kelly/Frye* rule has since evolved as the dominant approach to the admission of scientific evidence in California courts. Paul Gianelli, *The Admissibility of Novel Scientific Evidence: Frye v. United States, A Half Century Later*, 80 COLUM. L. REV. 1197, 1204-1223 (1980).

91. FED. R. EVID. 401-403.

92. Roy Krieger, *Now Showing at a Courtroom Near You: Sophisticated Computer Graphics Come of Age — And Evidence Will Never be the Same*, A.B.A. J., Dec. 1992, at 92.

93. *Id.*

94. Jim Meyer, *In and Out of Court*, A.B.A. J., June 1992, at 105.

95. FED. R. EVID. 403. See *supra* note 71 and accompanying text.

To avoid this result, potential objections deserve consideration. As with any form of demonstrative or scientific evidence, there is always the risk that the trier of fact may accord undue weight to the evidence on the mistaken belief that such evidence is infallible by its nature.⁹⁶ Accordingly, there are primarily three available avenues for admitting A.D.A.M. in the courtroom: as demonstrative evidence, under the *Frye* standard of scientific evidence, and under the codified rules of evidence.⁹⁷

1. A.D.A.M. as Demonstrative Evidence

Circumstantial, testimonial, real and demonstrative are four forms of evidence through which the trier of fact may acquire knowledge at trial.⁹⁸ Demonstrative evidence is offered for the primary purpose of illustration and clarification.⁹⁹

Accordingly, demonstrative evidence is the primary means by which A.D.A.M. will be presented at trial.¹⁰⁰ Although A.D.A.M. cannot portray the actual event, it may be helpful in explaining, illustrating, and visualizing the incident at issue.¹⁰¹ As a visual creation, A.D.A.M. is not

96. GRAHAM C. LILLY, AN INTRODUCTION TO THE LAW OF EVIDENCE §12.4, at 495 (2d ed. 1987) (when the trier is a jury, "its likely inclination [is] to find all 'matters of science' accurate and reliable."). However, Alice Oliver-Parrott, Chief Judge of the Texas First Court of Appeals, is one who questions computer depictions based only on expert testimony. Jane B. Baird, *All About: Forensic Animation; New From the Computer: 'Cartoons' for the Courtroom*, N.Y. TIMES, Sept. 6, 1992, at 5. "Whatever is put into computers still is put in by human beings and has the possibility of human error," she said. *Id.* "Unless you can satisfy me that this is what happened, I think the computer gives it more emphasis than it deserves." *Id.*

97. Roy Krieger, *Getting it Admitted*, A.B.A. J., Dec. 1992, at 96. For a discussion of A.D.A.M. as demonstrative evidence, see *infra* notes 98-122; for its use as scientific evidence, see *infra* notes 123-139; for admissibility under the federal rules, see *infra* notes 140-154.

98. Douglas M. Moore, *Basic Practice Guide For Demonstrative, Experimental and Scientific Evidence*, 50 INS. COUNSL. J. 279, 279 (1983).

99. *Pilkington v. Hendricks County Rural Elec. Membership Corp.*, 460 N.E.2d 1000, 1010 (Ind. Ct. App. 1984).

100. MARK A. DOMBROFF, DOMBROFF ON DEMONSTRATIVE EVIDENCE [hereinafter DEMONSTRATIVE EVIDENCE] §2.27, at 50 (1983), states that demonstrative evidence:

[is] used to inform the trier of fact of scenes, places, objects and other pertinent data relative to the issues in the litigation which, for numerous reasons, cannot be described with as much force and effect without the use of those aids.

The use of diagrams and other visual aids is justified on the grounds that they represent a pictorial reproduction or communication of the senses which may be used in place of descriptive testimony, or simply to supplement such testimony.

101. For an explanation of what types of cases are best suited for demonstrative evidence, see DEMONSTRATIVE EVIDENCE, *supra* note 100, §§1.4-1.10, at 5-11; 2 MCCORMICK, *supra* note 51, §212, at 3 ("Since 'seeing is believing,' and demonstrative evidence applies directly to the senses of the trier of fact, it is today universally felt that this kind of evi-

real, substantive evidence,¹⁰² and sometimes depending on the jurisdiction, it will not be placed into evidence in the traditional manner.¹⁰³ Therefore, before demonstrative evidence can be presented at trial, it must first meet certain prerequisites.¹⁰⁴ The trial lawyer must first demonstrate the underlying foundational requirements of relevancy, materiality, and competency of the object.¹⁰⁵

Relevancy of evidence is established where the fact offered tends to prove a matter in controversy.¹⁰⁶ Consequently, presentation of demonstrative evidence under the federal rules requires that it be relevant.¹⁰⁷ However, even if relevant, evidence may be excluded by the court's discretionary power if the evidence is either unfairly prejudicial, confusing, misleading, distracting, cumulative or a waste of time.¹⁰⁸

dence possesses an immediacy and reality which endow it with particularly persuasive effect.")

102. For an example, in a medical malpractice case, the actual catheter that was allegedly improperly placed in the patient is construed as real evidence. Alternatively, a videotape reenactment of the actual catheterization, would be construed as demonstrative evidence.

103. See 2 MCCORMICK, *supra* note 101, §212, at 4 ("while oral testimony is easily incorporated into a paper record for purposes of appellate review, demonstrative evidence will sometimes be insusceptible to similar preservation and transmission.") Once the foundation for evidence is established, the item is then formally placed into evidence. GRAHAM C. LILLY, AN INTRODUCTION TO THE LAW OF EVIDENCE §13.2, at 516 (2d ed. 1987). This invariably is the practice with original evidence, but some jurisdictions do not require that demonstrative evidence be introduced into the record." *Id.* The jury, therefore, often does not have access to demonstrative evidence during its deliberations. *Id.* Consequently, this double-standard hinders appellate review since the record is incomplete. *Id.*

104. ASHLEY S. LIPSON, ART OF ADVOCACY; DEMONSTRATIVE EVIDENCE, §2.06[2][b] (1991) (setting the three basic standards of admissibility as relevancy, materiality, and competency).

105. *Id.* at 2-26. Although the guidelines overseeing the admissibility of demonstrative evidence must be followed, the trial lawyer must not fail to adhere to the basic requirements for the admissibility of all evidence. *Id.* Consequently, to admit demonstrative, and all other types of evidence, the following prerequisites must be met:

- 1) The evidence must be relevant, meaning that it must tend to make the existence of any fact that is of consequence to the determination of the action more probable or less probable than it could be without such evidence; (2) The evidence must be material, meaning that it must relate to an issue which is in some manner determinative to the outcome of the litigation; and (3) The evidence must be competent, meaning that it must not run afoul of any principles that might exclude it for statutory or policy reasons (i.e., where the evidence is unduly prejudicial or inflammatory).

Id. at 2-26-2-27.

106. *Id.* at 2-28 (quoting *Bullard v. Barnes*, 468 N.E.2d 1228, 1235 (Ill. 1984)). When the trier of fact is a jury, "its likely inclination [is] to find all 'matters of science' accurate and reliable." LILLY, *supra* note 96, at 516.

107. FED. R. EVID. 401 (making the proposition to which it is directed more or less probable than without the evidence).

108. FED. R. EVID. 403. After a court has considered the various factors, such as relevancy, materiality, and prejudicial effect, it will likely allow the demonstrative evidence to

Materiality of the object is the second factor the trial lawyer must address. For evidence to be material, it must not only be relevant, but it must also relate to a material issue.¹⁰⁹ Lastly, the trial lawyer must demonstrate the competency of the object. The test for competence involves an invasive search for negatives.¹¹⁰ "When evidence is described as being competent, it means that there is an absence of any legal reason why the evidence should be barred."¹¹¹

Hence, demonstrative evidence is very powerful because it permits the trier of fact to make personal perceptions instead of relying on the reported impressions of testimony.¹¹² Unfortunately, this same power often evokes objections of prejudice; opponents argue that the capacity of the evidence to inspire emotions, such as sympathy and repugnance, outweighs its probative value for the issues in litigation.¹¹³ Even if the demonstrative evidence is void of emotion or unlikely to elicit such responses, it may be objected to as "misleading" since it tends to "convey an impression of objective reality to the trier."¹¹⁴

The underlying foundation for demonstrative evidence seeks to establish that the computer-generated display "is sufficiently reliable to aid in the determination of truth."¹¹⁵ The admission of demonstrative evidence is particularly susceptible to claims of being prejudicial or misleading. Therefore, A.D.A.M. must be prepared to meet the strictest standards possible with the most airtight foundation that can be constructed.¹¹⁶

In addition to relevance, materiality and competence, the trial lawyer must identify or authenticate the demonstrative evidence before it can be admitted into evidence.¹¹⁷ Authentication is the process that identifies a given piece of evidence, links it to the controversy, and provides an appropriate basis for admission.¹¹⁸ Therefore, to authenticate

be admitted into evidence. The admissibility of the demonstrative evidence and the weighing of the factors are customarily perceived to be within the trial court's sound discretion. 2 MCCORMICK, *supra* note 51, §2133, at 10-13.

109. LIPSON, *supra* note 104, at §2.06[2][b]. Materiality concepts suggest that something more than mere relevance must be shown. *Id.*

110. *Id.*

111. *Id.*

112. 2 MCCORMICK, *supra* note 51, §206, at 3.

113. *Id.* See *supra* notes 3-10 for discussions of the use of demonstrative evidence in medical malpractice and personal injury cases.

114. 2 MCCORMICK, *supra* note 51, §212, at 3.

115. Kathylynn G. Fadely, *Use of Computer-Generated Visual Evidence in Aviation Litigation: Interactive Video Comes to Court*, 55 J. AIR L. & COM. 839, 857 (1990). For a detailed discussion of the foundational requirements and difficulties, see *Id.* at 882-87.

116. See DEMONSTRATIVE EVIDENCE *supra* note 100, §1.16 at 15.

117. LIPSON, *supra* note 104, at §2.06[2][b].

118. *Id.*

A.D.A.M., the trial lawyer must show it to be a fair and comprehensive portrayal of what it purports to depict,¹¹⁹ while also conforming precisely to the underlying foundational requirements.¹²⁰

Essentially, A.D.A.M. should be admitted once a proper foundation has been laid.¹²¹ Although it lies within the court's discretion as to what constitutes an adequate or proper foundation, many courts employ a standard of substantial similarity.¹²² Consequently, A.D.A.M.'s use in medical schools in conjunction with cadavers demonstrates the similarities between A.D.A.M.'s illustrations and a human cadaver. Thus, A.D.A.M. should be admitted as demonstrative evidence.

2. *A.D.A.M. as Scientific Evidence and Frye*

A.D.A.M. may also be admitted as scientific evidence,¹²³ which includes proof based on mathematical or scientific principles.¹²⁴ As scientific evidence, A.D.A.M. becomes substantive evidence and is no longer demonstrative. *Frye*¹²⁵ established the standard for the admissibility of any new technology. *Frye* measures whether a new technology is "sufficiently established to have gained general acceptance in the particular

119. LILLY, *supra* note 103, §13.2, at 516. To avoid the lengthy authentication process at trial, it may be resolved at a pre-trial conference or through stipulation. *Id.* §13.3, at 520.

120. Krieger, *Getting It Admitted*, *supra* note 97, at 96. See also LeMaster, *supra* note 4 (admitting photographs because they were accurate, material, relevant and correctly portrayed the extent of the plaintiff's injuries in a personal injury case).

121. LIPSON, *supra* note 104, at §2.06[2][b].

122. See *McQueen v. Goldey*, 484 N.E.2d 712 (Ohio. Ct. App. 1984) (allowing an experiment that reconstructed an automobile accident in a personal injury case where the car's headlight's, the lighting conditions, and the road conditions were substantially the same as when the accident occurred).

Additionally, a computer re-enactment of an automobile accident was admitted into evidence as demonstrative evidence in *People v. McHugh*, 476 N.Y.S.2d 721 (N.Y. Sup. Ct. 1984). The court found:

[E]very new development is eligible for a first day in court. A computer is not a gimmick and the court should not be shy about its use, when proper. Computers are simply mechanical tools receiving information and acting on instructions at lighting speed. When the results are useful, they should be accepted, when confusing, they should be rejected. What is important is that the presentation be relevant to a possible defense [or claim], that it fairly and accurately reflect the oral testimony offered and that it be an aid to the jury's understanding of the issue.

Id. a 722-23.

123. Timothy Harper, *Computer Evidence is Coming*, A.B.A. J., Nov. 1984, at 80, 83.

124. LILLY, *supra* note 96, §12.4, at 493. Scientific evidence is usually introduced by an expert witness, who interprets and deciphers the results, and sometimes discusses the underlying principles to manifest its reliability. *Id.*

125. See *Frye*, *supra* notes 82-89 and accompanying text (refusing to admit the systolic blood pressure deception test as evidence because it was not established as a scientifically accepted procedure).

field to which it belongs."¹²⁶

As a demanding yet ambiguous test, the *Frye* test requires more than expert testimony as support; the scientific evidence must be generally accepted by a particular scientific community. It is, therefore, apparent that *Frye* suggests a two-part analysis. First, the court must "identify the field in which the underlying principle falls. . . ." ¹²⁷ Second, the court must then "determine whether the principle has been generally accepted by members of the identified field."¹²⁸ Hence, the *Frye* test has encountered strong criticism for its vague terms, particularly "general acceptance" and "sufficiently established."¹²⁹

Modern civil cases tend to limit or alter this standard by whether the evidence's probative value is substantially outweighed by its propensity to mislead the jury or entangle the court in a time-consuming dispute about scientific reliability.¹³⁰ Even in states that implement the

126. *Id.* at 1014.

127. Lacey, *supra* note 76, at 265.

128. *Id.*

129. The test enumerated in *Frye* has been criticized as being too conservative and restrictive. Fredric I. Lederer, *Resolving the Frye Dilemma—A Reliability Approach*, 26 JURIMETRICS J. 240 (1986). Others have criticized *Frye* as being "amorphous" and having created confusion. Lacey, *supra* note 76, at 267. *Frye* has been labeled as "[a]n antiquated basis for admissibility used in early cases [which] includes consideration of computer-generated evidence as novel scientific evidence. This basis for admissibility is very limited in use and this analysis will arise only in certain state court jurisdictions." Fadely, *supra* note 115, at 871. Consequently, Federal District Court of New Jersey Judge Frederick B. Lacey commended the states of New York, Utah, and Iowa for rejecting the holding of *Frye* by stating: "Why should we not accept the challenge and declare that we have confidence in our juries, correlative of course with broad pretrial discovery of experts and furnishing of full reports pretrial?" Harper, *supra* note 123, at 84.

130. LILLY, *supra* note 96, §12.4, at 495. This modern trend is noted in *State v. Catanese*, 368 So.2d 975 (La. 1979), and *State v. Walstad*, 351 N.W.2d 469 (Wis. 1984). *Contra* *Starr v. Campos*, 655 P.2d 794 (Ariz. Ct. App. 1982) (*Frye* standard is applicable to computer accident reconstruction). In *Starr*, the Court of Appeals of Arizona was not convinced that the trial court had used the appropriate standard for determining admissibility. *Id.* at 797. Scientific evidence is only to be admitted in Arizona if it is derived from principles and procedures that have achieved general acceptance in their respective scientific fields. *State v. Mena*, 624 P.2d 1274, 1279 (1982). According to the *Starr* court under this standard, "it is not sufficient that any one expert relies upon the technique in question or that the technique is 'widely used,' unless that widespread use is without significant objection from the relevant scientific community." *Starr*, 655 P.2d at 797. As a result, the court established the guidelines that would control subsequent offerings of this type of evidence:

[T]he court is directed to apply the *Frye* standard and determine specifically, in the absence of the jury, whether the procedure used to obtain that evidence is generally accepted among scientists in relevant fields, including accident reconstruction and automotive engineering. In making this determination the court may take judicial notice of the ability of a properly programmed computer to perform mathematical computation and of the general acceptance of the underlying principle of the method, the law of conservation of linear momentum. It will only be necessary to determine whether those of sufficient training and experience to judge are in

two-step approach, the consensus is that "*Frye* jurisdictions will always lag behind the advances of science while they wait for novel scientific techniques to gain 'general acceptance.'"¹³¹

Faced with similar arguments, the United States Supreme Court in *Daubert v. Merrell Dow Pharmaceuticals*,¹³² held that *Frye* was superseded by rule 702 of the Federal Rules of Evidence ("FRE 702")¹³³ where there is no requirement of general acceptance in the scientific community.¹³⁴ FRE 702 governs expert testimony in federal trials.¹³⁵ However, under federal law, if a witness qualifies as an expert, the court may not play censor,¹³⁶ as the merits and demerits of a particular scientific approach are simply matters for the jury to sort out.¹³⁷ In *Daubert*, expert testimony was critical to a determination of whether the drug Bendectin was the cause of birth defects. However, the expert testimony was excluded, not because it would not assist the jury, but on the erroneous conclusion that it lacked "general acceptance" by the scientific community.

general agreement that the program properly applies that principle (and others it may involve) to automobile collisions.

Id. at 797-798.

131. Lacey, *supra* note 76, at 265.

132. *Daubert v. Merrell Dow Pharmaceuticals*, 113 S. Ct. 2786 (1993). *Daubert* is a civil case in which the plaintiffs allege that limb reduction birth defects were caused by Bendectin, a product of the defendant. *Id.* at 2791. The District Court dismissed the claims by summary judgment, finding that the plaintiffs' expert testimony failed to meet the applicable "general acceptance" standard within the scientific community. *Daubert v. Merrell Dow Pharmaceuticals, Inc.*, 727 F. Supp. 570, 572 (S.D. Cal. 1989). The United States Court of Appeals for the Ninth Circuit affirmed on the strength of *Frye*. *Daubert v. Merrell Dow Pharmaceuticals Inc.*, 951 F.2d 1128, 1129-1130 (9th Cir. 1991). The court held that a scientific technique is inadmissible unless, it is "generally accepted" as reliable in the relevant scientific community. *Id.*

133. The Court in *Daubert* specified FRE 702 as the rule superseding *Frye*. *Daubert v. Merrell Dow Pharmaceuticals, Inc.*, 113 S.Ct. 2786, 2794 (1993). FRE 702 states that: "[i]f scientific, technical, or other specialized knowledge will assist the trier of fact to understand the evidence or to determine a fact in issue, a witness qualified as an expert by knowledge, skill, experience, training, or education, may testify thereto in the form of an opinion. FED. R. EVID. 702.

134. *Daubert, supra* note 88, at 2794.

135. See FED. R. EVID. 702 *supra* note 133 and accompanying text.

136. *People v. Leahy*, 22 Cal. Rptr.2d 322, 324 (Cal. Ct. App. 1993). *Leahy* is a consolidated appeal of two defendants' arrested and convicted of driving under the influence of alcohol ("DUI"). *Id.* at 324. Upon arrest, both defendants' were administered and subsequently failed the horizontal gaze nystagmus ("HGN") test indicating the defendants' respective levels of intoxication. *Id.* In both prosecutions the arresting officers were permitted to testify, over continuing objections, concerning the HGN test and the defendants' intoxication. *Id.* The higher court held that the trial courts erred in permitting the officers to testify concerning the HGN test because there was insufficient foundation proving general acceptance of the HGN in the scientific community. *Id.* at 328.

137. *Id.*

Nonetheless, some jurisdictions have avoided applying *Daubert* and remain followers of *Frye*.¹³⁸ On the other hand, in those jurisdictions that have abandoned *Frye* and adopted *Daubert* and the Federal Rules of Evidence, the courts apply a relevancy/balancing test to admit relevant scientific evidence.¹³⁹

3. Relevancy/Balancing Test—The Federal Rules of Evidence

Courts that have applied the relevancy/balancing test have held that “[i]f the evidence has substantial probative value and is relevant to the issue and does not endanger defendant’s rights, or prejudice the jury, nor mislead the proper administration of justice, then it should be admitted as any other evidence.”¹⁴⁰ The advantages of the relevancy/balancing test are that it (1) allows the admission of relevant scientific evidence, (2) subjects the proponent to cross-examination and refutation, and (3) allows the jury to attach whatever weight it deems fit.¹⁴¹

138. See *supra* notes 89-90 and accompanying text.

139. See e.g., *United States v. Williams*, 583 F.2d 1194 (2d Cir. 1978), *cert. denied*, 439 U.S. 1117 (1979) (stating “the probativeness, materiality, and reliability of the evidence, on the one side, and any tendency to mislead, prejudice, or confuse the jury on the other, must be the focal points of inquiry”). In *Williams*, the United States Court of Appeals for the Second Circuit rejected *Frye* and promulgated a new balancing test for all scientific evidence by applying the Federal Rules of Evidence. *Id.* The defendant was convicted of selling narcotics. *Id.* at 1195-96. The defendant challenged the trial court’s decision to allow the results of a spectrograph as evidence of the defendant’s identification. *Id.* at 1196. After analyzing the findings from the spectrograph under the Federal Rules, the court of appeals affirmed the trial court’s admission of the evidence. *Id.* at 1200. The court was persuaded by the existence of and conformation with standards of testing and reliability of the results. *Id.* at 1198-1200 (finding voice spectrography to be reliable when properly supported by a qualified expert and demonstrated reliability). The enunciated balancing test combines the expert testimony guideline of Rule 702 that allows expert testimony if a proper foundation is laid and its probative value is shown with the requirement of Rule 401 that mandates a showing of relevancy. See FED. R. EVID. 401 and 402. *Accord* *People v. Daniels*, 422 N.Y.S.2d 832, 837 (N.Y. Sup. Ct. 1979) (abandoning *Frye*, “[t]o require general acceptance would in essence mandate absolute infallibility.”)

140. *Id.*

141. See *United States v. Stifel*, 433 F.2d 431 (6th Cir. 1970), *cert. denied*, 401 U.S. 994 (1971). *Stifel* “is a strange and disturbing case.” *Id.* at 431. The defendant was indicted and convicted for murder. *Id.* At trial, the evidence supported the inference that the defendant mailed the victim a package (via the United States Mail) containing a bomb. *Id.* Subsequently, the bomb exploded killing the victim as he opened the package at his home. *Id.* The prosecution attempted to establish that materials from the bomb were available to the defendant at his place of employment. *Id.* at 434. The trial court allowed over the defendant’s objection, expert testimony regarding a relatively new process, “neutron activation analysis.” *Id.* at 435. The neutron activation analysis determined the bomb debris “[was] of the same type and same manufacture” of that available to the defendant at his place of business. *Id.* at 436. The court of appeals affirmed the admissibility of the neutron activation analysis, relying in part on its reliability as a scientific evidence. *Id.* at 440.

In general, the trier of fact may have difficulty ascertaining the elements of a case without the assistance of an expert witness because of the highly technical and scientific facets of medical malpractice cases.¹⁴² Thus, if A.D.A.M. is denied admissibility under the above-listed methods,¹⁴³ it may slip in on the coattail of an expert witness under the federal rules.¹⁴⁴ Therefore, when an expert is used as an aid¹⁴⁵ to the trier of fact, A.D.A.M. may be admitted in conjunction with the expert's testimony,¹⁴⁶ although it is inadmissible on its own.¹⁴⁷ The expert may then utilize the A.D.A.M. demonstration to express conclusions or to illustrate the foundation for his opinion.¹⁴⁸ Consequently, A.D.A.M.'s underlying data need not be disclosed prior to trial since it can be examined on cross-examination.¹⁴⁹ Nonetheless, the newness of A.D.A.M. may make it susceptible to challenges, hence its contents should be disclosed prior to trial. By coupling A.D.A.M. with expert testimony, the general distrust of computers held by some people may be effectively overcome since it will not appear so abstract.¹⁵⁰ Likewise, even though the A.D.A.M. demonstration involves an ultimate issue to be decided by the trier of fact,¹⁵¹

142. See *supra* notes 4, 7, 10, 14-16 and accompanying text (discussing the intricacies of medical malpractice cases).

143. See *supra* notes 123-154 and accompanying text (discussing the admissibility and use of A.D.A.M. as both demonstrative evidence and scientific evidence).

144. "An intelligent evaluation of facts is often difficult or impossible without the application of some scientific, technical, or other specialized knowledge. The most common source of this knowledge is the expert witness, although there are other techniques for supplying it." FED. R. EVID. 702 advisory committee's note. See also *supra* note 91.

145. FED. R. EVID. 702. "The test is one of helpfulness." LILLY, *supra* note 103, §12.1, at 484.

146. FED. R. EVID. 702. Although demonstrative evidence is accepted by all jurisdictions in connection with an expert's testimony, the unanimity ceases "concerning the precise evidentiary status of articles used for this purpose." 2 MCCORMICK, *supra* note 51, §213, at 10. See also *id.* §213, at 11 n.8.

147. "Proponent's ultimate authority for overcoming objections to the introduction of a simulation is the Federal Rules of Evidence, Rule 703, which, under proper circumstances, allows an expert witness to testify in reliance on data that is in itself inadmissible. . . ." Ronald L. Johnston, *A Guide for the Proponent and Opponent of Computer-Based Evidence*, 1 COMPUTER/L.J. 667, 695 (1979). As long as the facts and data are "of a type reasonably relied upon by experts in the particular field," admissibility is not an issue. FED. R. EVID. 703.

148. Krieger, *Getting It Admitted*, *supra* note 97, at 96. (stating that computer simulations developed specifically for trial have been combined with the testimony of an expert).

149. FED. R. EVID. 705 which states: "[t]he expert may testify in terms of opinion or inference and give reasons therefore without first testifying to the underlying facts or data, unless the court requires otherwise. The expert may in any event be required to disclose the underlying facts or data on cross-examination."

150. See DEMONSTRATIVE EVIDENCE, *supra* note 100, §9.13 at 202-03.

151. FED. R. EVID. 704(a) which states in part: "testimony in the form of an opinion or inference otherwise admissible is not objectionable because it embraces an ultimate issue to be decided by the trier of fact."

it is insulated from objections seeking exclusion solely on that justification.¹⁵² "Computer graphics thus may conclusively depict an ultimate issue in dispute."¹⁵³ As A.D.A.M.'s acceptance in the medical community continues to expand,¹⁵⁴ it appears likely that A.D.A.M. will be admissible as a clarification of an expert's testimony.

B. POTENTIAL ARGUMENTS TO GAIN ADMITTANCE

A.D.A.M. is a potentially effective visual tool that may be used during trial to persuade the trier of fact.¹⁵⁵ Regardless of A.D.A.M.'s use as demonstrative evidence, scientific evidence, or in conjunction with an expert's testimony under the federal rules, certain conditions must be satisfied. Even though computer simulations have already been used extensively in airplane litigation,¹⁵⁶ the fact remains that since simulations and reproductions have a great potential for fabrication or distortion,¹⁵⁷ precautions must be taken to safeguard the process. Since computer simulations can transform hearsay and data errors into a deceptive neat package, courts and practitioners must exercise additional care with computer-generated evidence.¹⁵⁸ Thus, testimony as to the methods utilized in creating the simulation must document its integrity. However, since there are so few cases on the admissibility of computer-generated materials, no firm evidentiary rules can be given for the foundation necessary to assure its admissibility.¹⁵⁹ To overcome this ambiguity, a proper and exhaustive foundation becomes critical to the admissibility of A.D.A.M.¹⁶⁰

152. Krieger, *Getting It Admitted*, *supra* note 97, at 96.

153. *Id.*

154. *See supra* notes 64-68 and accompanying text.

155. However, "[a]ccuracy of reproduction usually is important when pictorial evidence is presented to the trier. It always is required that the proponent of photographic evidence establish that the pertinent parts of the picture are a reasonably accurate representation of the subject pictured." LILLY, *supra* note 96, §13.3, at 519. *See also LeMaster*, *supra* note 4.

156. *See In re Air Crash at Dallas/Forth Worth*, *supra* notes 48-50 and accompanying text. *See also* *Haley v. Pan Am. World Airways*, 746 F.2d 311 (5th Cir. 1984) (admitting a videotaped simulation of the last moments of flight 759, before its crash in Louisiana on July 9, 1982, as evidence of pre-impact fear on behalf of the decedent), *reh'g denied*, 751 F.2d 1258 (5th Cir. 1984).

157. JOHN KAPLAN ET AL., *CASES AND MATERIALS ON EVIDENCE* 33 (6th ed. 1987).

158. Jerome J. Roberts, *A Practitioner's Primer on Computer-Generated Evidence*, 41 U. CHI. L. REV. 254, 256 (1974).

159. Fadely, *supra* note 115, at 882.

160. To lay a foundation for evidence, such as A.D.A.M. for use at trial, various factors should be considered: (1) A.D.A.M. should be made available to the adversary during pre-trial discovery to permit effective cross-examination or objections during trial; (2) the computer equipment must be established as reliable; (3) wide acceptance of A.D.A.M. must also be shown. *Id.* at 890.

The proper underlying foundation, as well as authentication and identification, must be laid through the use of appropriate witnesses, such as the technicians and computer programmers who created A.D.A.M.¹⁶¹ Therefore, the opposing side has the opportunity to cross-examine A.D.A.M. by questioning the programmers to determine the accuracy of its underlying data.¹⁶² Additionally, witnesses must be produced to verify the accuracy of the factual matter contained in A.D.A.M.¹⁶³ Preferably, an individual familiar with the event through first-hand knowledge, like a doctor, will testify along with various experts.

A.D.A.M. must also be precisely correlated to the issues and facts presented in the case.¹⁶⁴ Authentication of A.D.A.M. is governed by Rule 901(a) requiring that "the matter in question is what its proponent claims."¹⁶⁵ Consequently, A.D.A.M. may be authenticated under Rule 901(b)(9).¹⁶⁶ Some of the foundational requirements involve the validity and sufficiency of the underlying data, the processes by which the data was calculated, the methods for detecting and correcting errors, the security of the information in storage and retrieval, the relevancy of the final outcome, and the effectiveness and usability of the object.¹⁶⁷ Authentication of A.D.A.M. involves having a witness either identify A.D.A.M. or provide a brief explanation for the trier of fact to understand what is exhibited.¹⁶⁸

The first foundational requirement is that the underlying scientific principle of A.D.A.M.¹⁶⁹ must be substantiated; the factors explained by

161. DEMONSTRATIVE EVIDENCE, *supra* note 100, §1.16 at 15.

162. Roberts, *supra* note 158, at 260.

163. *Id.*

164. *Id.*

165. FED. R. EVID. 901(a) which states: "[t]he requirement of authentication or identification as a condition precedent to admissibility is satisfied by evidence sufficient to support a finding that the matter in question is what its proponent claims." Accordingly, "[a]uthentication and identification represent a special aspect of relevancy." FED. R. EVID. 901(a) Advisory Committee's Note.

166. "Evidence describing a process or system used to produce a result and showing that the process or system produces an accurate result." FED. R. EVID. 901(b)(9). With the advent and pervasiveness of computers, this clause may be extended to provide for "judicial notice of the accuracy of the process or system." FED. R. EVID. 901(b)(9) advisory committee's note.

167. DEMONSTRATIVE EVIDENCE, *supra* note 100, §9.12 at 201-02 (including a more detailed checklist). Some of the elements of a computer simulation that must be supported by expert testimony include the underlying theory, the underlying facts, the data base, the software program, and the processing by the computer hardware. Johnston, *supra* note 147, at 694-95.

168. LILLY, *supra* note 96, §13.2, at 515.

169. A.D.A.M., as a mathematical model, describes complex medical procedures and intricacies.

A.D.A.M. cannot vary "significantly . . . from those that existed at the time of the events in question."¹⁷⁰ Since A.D.A.M. is based on scientific principles involving a high number of changing variables, it is impossible to demonstrate such complex information without a computer.¹⁷¹ Therefore, expert testimony must lay the foundation as to the necessity and validity of the original scientific principle and its transformation by computer. Any changes or alterations in the original factors, even if conceded, must be divulged to opposing counsel and the court prior to trial.

The second foundational requirement is that the testimony depict a true and "fair representation" of the scene.¹⁷² The accuracy of A.D.A.M. in all pertinent respects is critical; it must not be misleading.¹⁷³ In dealing with visual images, the advocate of A.D.A.M. must demonstrate that it is a reasonably accurate representation of the subject pictured.¹⁷⁴ A witness can satisfy the requirement by simply testifying as to first-hand knowledge of the original scene and that A.D.A.M. accurately portrays it.¹⁷⁵ Objections are likely to be made at this point. For example, in *People v. McHugh*,¹⁷⁶ the objection that a computer simulation was not a fair and accurate depiction was raised.¹⁷⁷ In overruling the objection,¹⁷⁸ the court noted that the computer program must be turned over to opposing counsel during any voir dire on the evidence to prevent obstructing the trial.¹⁷⁹ Thus, an eyewitness, expert or person familiar with the

Models are used to simplify and describe a complicated situation: Mathematical models can be divided into two categories. The deterministic model assumes all relevant information concerning the problem is completely and surely known and the analysis is to search among all feasible alternatives and find the actual alternative which will provide the optimum solution. The probabilistic or statistical model assumes information concerning the problem is not completely known, but can be specified by probabilities and the analysis is to search for the strategy which will optimize the expected value of the outcomes. In either case, complicated mathematical techniques are often employed and are usually most effectively implemented on the computer. Both categories of models can be appropriately applied to evaluating specific types of situations in litigation.

Carol P. Eastin, *The Use of Models in Litigation: Concise or Contrived?*, 52 CHI-KENT L. REV. 610, 611 (1976) (footnotes omitted).

170. KAPLAN ET AL., *supra* note 157, at 33.

171. Michael Chi & Jafar Vossoughi, *Engineering Aspect of Automobile Accident Reconstruction Using Computer Simulation*, 30 J. FORENSIC SCI. 814, 820 (1985).

172. LILLY, *supra* note 96, §13.2, at 515; Krieger, *Getting It Admitted*, *supra* note 97, at 96.

173. LILLY, *supra* note 96, §13.2, at 515.

174. *Id.* §13.3, at 519.

175. *Id.* §13.3, at 519-20.

176. *See supra* note 122.

177. Harper, *supra* note 123, at 81.

178. *See supra* note 122.

179. *Id.* *See also* United States v. Stifel, *supra* note 141, at 438 (affirming that neutron activation analysis had gained general acceptance in the particular field to which it belonged, and noted that "[e]very useful new development must have its first day in court.")

event or subject matter in question can lay the true and fair foundation as to the accuracy of A.D.A.M.¹⁸⁰

Additionally, although an exhibit is deemed admissible or useable in other ways, it may not be credible.¹⁸¹ Therefore, credibility of A.D.A.M. must be established. The existence or absence of credibility constitutes four areas: "the integrity of the input data, the integrity of the computer equipment and the program, the security of the data processing system and the security of the output."¹⁸² Accordingly, the original data, calculations, and hypotheses must be shown to be trustworthy.¹⁸³ Furthermore, the ability of A.D.A.M. to create three-dimensional objects that move in real time and which react to the users wishes, requires explanation via testimony describing how A.D.A.M. actually functions.¹⁸⁴ Laying the foundation also mandates that the final display be accurate.¹⁸⁵

Relevancy is the principal manner by which admissibility is established once the foundation is in place and credibility has been determined.¹⁸⁶ "[R]elevant evidence helps persuade the trier of the existence (or nonexistence) of some fact that is germane to the dispute between the parties."¹⁸⁷ It must be "logically probative of the proposition toward which it is directed."¹⁸⁸ A.D.A.M.'s ability to present a given scenario as coherent, powerful, and reliable should surmount the relevancy hurdle. The fact that A.D.A.M. is utilized in 100 of 126 United States medical schools is indicative of its relevancy in a medical malpractice or personal injury case.¹⁸⁹

180. See generally, LILLY, *supra* note 96, §13.2.

181. See James A. Sprowl, *Evaluating the Credibility of Computer-Generated Evidence*, 52 CHI-KENT L. REV. 547 (1976) (discussing the credibility of computer-generated documents). The Sprowl article deals primarily with accounting reports generated by a computer and the inherent possibilities for misinformation. *Id.*

182. William A. Fenwick, *How To Get Computer-Based Evidence Admitted*, USE OF COMPUTERS IN LITIGATION 329, 338. For a sample of control procedures to substantiate a system's integrity, see *id.* at 339.

183. Krieger, *Getting It Admitted*, *supra* note 97, at 96.

184. Sprowl, *supra* note 181, at 548. For a more detailed discussion of the factors involved in determining credibility, see *id.* at 557-62.

185. Krieger, *Getting It Admitted*, *supra* note 97, at 96.

186. Relevancy is covered by Federal Rules 401 through 403. To be relevant, evidence must "hav[e] any tendency to make the existence of any fact that is of consequence to the determination of the action more probable or less probable than it would be without the evidence." FED. R. EVID. 401. "Obviously, a recreation or simulation will not become relevant until the foundation testimony demonstrates that the proposed computer graphics illustrate crucial characteristics and factors present when the accident occurred or illustrate alternative theories of the expert proposing the testimony." Fadely, *supra* note 115, at 888 (footnotes omitted).

187. LILLY, *supra* note 96, §2.1, at 23.

188. *Id.* §2.1, at 24.

189. See *supra* note 65 and accompanying text.

Once deemed relevant, there may be an objection that evidence generated by A.D.A.M. will unfairly prejudice the opposing party.¹⁹⁰ The balancing test between probative value and unfair prejudice can be overcome by providing the adversary with the A.D.A.M. generated evidence during pre-trial discovery to prevent surprise and facilitate cross-examination;¹⁹¹ perhaps a motion in limine may be attainable.¹⁹² Since talented opposing counsel may use circumstantial evidence as a means of proof to buttress relevancy problems,¹⁹³ objections to A.D.A.M. will likely arise. Therefore, to survive opposition, the trial lawyer must show A.D.A.M. to be material, reliable, and of probative value.

Lastly, A.D.A.M. may also be admitted under the residual exception¹⁹⁴ to the hearsay rule.¹⁹⁵ Since an A.D.A.M. exhibit will plausibly be prepared solely for the trial, it may be admissible if the proponent can

190. FED. R. EVID. 403.

191. See, e.g., *People v. McHugh*, *supra* note 122 at 723 ("To eliminate delay at trial — during any voir dire on the evidence — the defendant's attorney is directed to turn over a copy of the computer program to the District Attorney.")

192. Motion in Limine derives from the Latin, "[on] or at the threshold." *Luce v. United States*, 469 U.S. 38, 40 n.2 (1984). A motion in limine is best defined as a "request for a ruling on the admissibility of certain evidence made at any time prior to the offer of that evidence at trial." Comment, *The Use of Motions in Limine in Civil Litigation*, ARIZ. ST. L.J. 443, 444 (1977). Authority for the Motion in Limine derives from Federal rule of Civil Procedure 16 and its state court counterparts, along with inherent judicial power over admissibility of evidence.

Prior to trial, a trial lawyer may have formed objections to certain evidence. Although the motion in limine is particularly well suited to evidence with potentially inflammatory characteristics outweighing whatever materiality it may possess, the motion may be used to obtain an advance ruling on any ground regarding matters at trial. *Id.* The disadvantage of the motion in limine is, if unsuccessful, it may educate the trial lawyers opponent about the Achilles heel of the moving parties case. *Id.* However, this disadvantage is virtually nonexistent in the context of sympathy, since the opposing counsel will be well aware of the use of sympathy and its effect upon the jury. Therefore, it is advisable to dispose of such evidentiary issues prior to trial by bringing a motion in limine for a ruling on the admissibility of certain evidence or the exclusion of adversary evidence. It is advisable to get a ruling in advance as opposed to having an adversary vociferously argue objections in the presence of the jury.

A motion in limine may also be useful prior to engaging in the production of A.D.A.M. generated evidence. In this instance, before incurring the expense of production, it may be advisable to have a court rule on, for example, the guidelines of A.D.A.M. generated evidence and thus, eliminate the risk of inadmissibility at trial. An alternative to a motion in limine is to enter into a stipulation with opposing counsel that will allow for the admission of the evidence for a limited purpose or if it is altered, to overcome specific objections.

193. "The variety of relevancy problems is coextensive with the ingenuity of counsel in using circumstantial evidence as a means of proof. An enormous number of cases fall in no set pattern, and this rule is designed as a guide for handling them." FED. R. EVID. 401 advisory committee's note.

194. FED. R. EVID. 803(24) (applicable regardless of whether or not the declarant is available as a witness); FED. R. EVID. 804(b)(5) (applicable only if declarant is unavailable as a witness).

demonstrate the reliability of the data.¹⁹⁶ Additionally, it may be admissible if the trial lawyer "can demonstrate that reasonable persons conducting serious affairs would rely" on A.D.A.M.¹⁹⁷

The most basic provisos for use of A.D.A.M. in a courtroom are that it must be open to discovery, it must appear on the list of exhibits, and above all, sufficient notice must be given to the opponent.¹⁹⁸ Perhaps the most promising aspect of A.D.A.M. is its ability to allow each side the opportunity to present its own version. Permitting each side to use A.D.A.M. obviates or lessens the threat of unfair prejudice, while at the same time leveling the playing field.

IV. CONCLUSION

As complex and technical trials become more and more customary, the appearance of and reliance on computers in the courtroom will gain acceptance.¹⁹⁹ Inevitably, courtrooms will have to adjust to accommodate this technology as "custom-made electronic evidence"²⁰⁰ becomes more prolific. Although the transformation may be gradual at first, the computer revolution of litigation is firmly in place and the process may accelerate in the near future.

The admissibility of A.D.A.M. issue relates to the fact that powerful new technologies do not simply change what human beings can do, but also change the way humans think, especially about themselves. Com-

195. FED. R. EVID. 802 ("[h]earsay is not admissible except as provided by these rules or by other rules prescribed by the Supreme Court pursuant to statutory authority or by Act of Congress.").

196. Fadely, *supra* note 115, at 868 (footnotes omitted). Since computers are now utilized to decipher existing data and to formulate hypotheses regarding the situation, "[t]he reliability of underlying data can be shown in order to qualify for admissibility as evidence under the residual exception to the hearsay rule. Even if this cannot be established, however, the opinions of the expert will be admissible upon a showing of proper foundation." *Id.*

197. *Id.*

198. See *Baugh v. Gulf Air Transp., Inc.*, 526 So.2d 1239 (La. Ct. App. 1988) (affirming the barring of a computer reconstruction from use at trial as a result of the plaintiff's failure to list it as an exhibit, among other reasons); *La. Land & Exploration Co. v. Wyo. Oil & Gas Conservation Comm'n*, 809 P.2d 775 (Wyo. 1991) (remanding matter for hearing since the petitioner was not afforded notice or sufficient time to prepare response and challenge to computer simulation).

199. Joseph F. Sullivan, *High-Tech Trials*, N.Y. TIMES, Jan. 14, 1992, at B5. In Federal District Court in Newark, New Jersey, Judge Alfred Wolin's courtroom was filled with computers for a complex patent infringement case involving Honeywell Inc. and Minolta Camera Company Ltd. *Id.* The computers stored between 6,000 and 8,000 diagrams, graphs, reports and extracts that could be used by both sides and were displayed on monitors. *Id.* Although the diagrams were two-dimensional, this application demonstrates the potential compatibility between computers and the courtroom.

200. *Id.*

paratively speaking, the use of the extraordinary functions of the computer to help depict what has been restricted to verbal description or artistic rendition, added with authenticity, should "provide a powerful tool for the courtroom."²⁰¹ In this respect, A.D.A.M. may become a particularly powerful thought transformer as A.D.A.M. models reality and helps us understand it. Moreover, one need only remember that the use of photographs and motion pictures has only recently gained acceptance, yet has quickly become commonplace.²⁰²

At any level, it is important to remember that it has been proven time and time again that jurors are more receptive to what they have both seen and heard. In fact, psychological tests show that after three days, a person of average intelligence will remember 65% of what they have both seen and heard as opposed to 10% of what was heard without visual evidence.²⁰³ Anything that can assist a trial lawyer in depicting a complicated event should be welcomed in the courtroom especially since improved communication is limited by one's audio-visual retention capacity. Thus, because of its effectiveness in reinforcing oral advocacy, A.D.A.M. will become a new standard tool in tort litigation.

ANDRÉ M. THAPEDI

201. DEMONSTRATIVE EVIDENCE, *supra* note 100, §9.13, at 203.

202. See *supra* note 4 and accompanying text.

203. Parker, *Applied Psychology in Trial Practices*, 7 DEFENSE L. J., 33 (1960).

