1999

Seeing is believing; or is it? An emperical study of computer simulations as evidence.

Robert B. Bennett
Butler University, rbennett@butler.edu

Jordan H. Leibman

Richard Fetter
Butler University, rfetter@butler.edu

SEEING IS BELIEVING; OR IS IT? AN EMPIRICAL STUDY OF COMPUTER SIMULATIONS AS EVIDENCE

Robert B. Bennett, Jr.[*]
Jordan H. Leibman[**]
Richard E. Fetter[***]

> *Relying on the old adage, "seeing is believing," we conclude that the jury may give undue weight to an animated reconstruction of the accident. . . . It would be an inordinately difficult task for the plaintiff to counter, by cross-examination or otherwise, the impression that a computerized depiction of the accident is necessarily more accurate than an oral description of how the accident occurred. Because the expert's conclusion would be graphically depicted in a moving and animated form, the viewing of the computer simulation might more readily lead the jury to accept the data and premises underlying the defendant's expert's opinion . . . than it might if the jury were forced to evaluate the expert's opinion in the light of the testimony of all of the witnesses, as generally occurs in such cases.*[1]

INTRODUCTION

Proponents tout the use of computer simulations and animations in trials as demonstrative evidence of a persuasive and winning technique, a virtual "silver bullet" guaranteeing success because of their dramatic impact upon jurors.[2] The deductive

---

* Associate Professor of Business Law, Butler University.
** Professor of Business Law, Indiana University-Indianapolis.
*** Associate Professor of Marketing, Butler University.

1. Racz v. R.T. Merryman Trucking, Inc., No. CIV.A.92-3404, 1994 WL 124857, at *5 (E.D. Pa. Apr. 4, 1994).

2. *See, e.g.*, Carlo D'Angelo, *The Snoop Doggy Dogg Trial: A Look at How Computer Animation Will Impact Litigation in the Next Century*, 32 U.S.F. L. REV. 561, 585 (1998) ("Given its highly persuasive tendencies, computer animation is likely to become the single most powerful evidentiary tool utilized by trial lawyers in the next century."); Robert J. Bingle, *Winning the Verdict with Videos and Virtual Reality*, NAT'L L.J., June 15, 1998, at B7; Thomas Brown, *Animations Add a New Dimension; Visual Evidence; Computer Animation Becomes a Sophisticated Evidence Tool*, MICH. LAW. WKLY., May 27, 1991, at 19 ("When computer-aided evidentiary tools are produced by experienced demonstrative evidence firms, they have been shown to increase jurors' retention of

reasoning supporting such a position is flawless. Our society is fascinated, even obsessed, with modern technology, particularly computers which project an aura of objectivity.[3] Americans are also accustomed to receiving information from video sources.[4] Social science research also supports the proposition that we assimilate and remember more information that we see, or see and hear, than what we hear alone.[5] It follows that the use of computer animations or simulations as demonstrative evidence for jurors presents an unparalleled opportunity—or danger—depending on one's point of view. The perceived power of animations and simulations to sway jurors has made their admissibility extremely controversial among both courts[6] and commentators.[7]

---

important information and shorten the duration of trials."); Catherine DiDomenico, *Animation Gets a Jury's Attention and Illustrates Key Points of Case*, N.Y. L.J., Nov. 5, 1996, at 5 ("Computer animation is a flexible litigation tool that offers tremendous advantages over traditional charts and graphs.").

One author noted:

> As for the future, [Computer-Generated Re-enactments ("CGR")] will appear more and more in courtrooms. One reason will be that CGRs will cost less in the future as computational power in general goes down in price and as more CGR designers enter the business. Another reason will be that more lawyers will begin to realize the power of CGRs to induce settlements and win trials.

Barry Sullivan, Comment, *Computer-Generated Re-Enactments as Evidence in Accident Cases*, 3 HIGH TECH. L.J. 193, 239 (1989). Another commentator discussed the power of photo-realistic animation. He stated:

> During a trial, a photo-realistic animation is a memorable and attention-getting event. Jurors can be expected to watch and to pay much closer attention to a computer-generated animation than to all but the most dramatic of testimonial evidence. While computer animation in the courtroom is gaining more acceptance, few lawyers realize the potential power of this tool—until they come up against it themselves.

Derek Danois, *Computer Animation Helps Win Cases; By Visualizing Complex Evidence, Juror Comprehension Rises*, LEGAL INTELLIGENCER, July 17, 1995, at S8.

3. Over 41 million personal computers were sold in the United States in 1994 and 1995 alone. *See* U.S. BUREAU OF THE CENSUS, STATISTICAL ABSTRACT OF THE UNITED STATES: 1998, at 759 (1998). It is certainly not coincidental that Bill Gates, the founder of the software giant Microsoft, is generally credited with being the world's richest man. *See, e.g., Alt.Culture* (visited Feb. 23, 1999) <http://www.altculture.com/.index/aentries/g/gates_bill.html>; Pat O'Neil, *Stockbook—Weekly Newsletter* (Aug. 12, 1996) <http://stockbook.com/stockbook/archives/issue201.cfm>; *Technopolitics Transcripts* (Blackwell Corp. radio broadcast transcript, July 3, 1998) <http://technopolitics.com/scripts/tp07-03-98.htm>.

4. Sales of television sets accounted for almost $9 billion in the United States in 1996 alone. *See* U.S. BUREAU OF THE CENSUS, *supra* note 3, at 760. In 1996 the average hours of television viewing per person, per year, reached a record of 1567 hours, together with a record 49 hours of home video, compared with an average of 161 hours reading daily newspapers, 83 hours reading magazines, and 99 hours reading books. *See id.* at 572.

5. *See infra* text accompanying notes 15-16.

6. *See, e.g.*, Perma Research & Dev. v. Singer Co., 542 F.2d 111, 121-26 (2d Cir. 1976) (Van Graafeiland, J., dissenting); Racz v. R.T. Merryman Truck-

However, jury decision-making is a complex social task in which a number of strangers deliberate and decide the outcome of an often lengthy and confusing trial. The evidence marshalled by proponents to support the efficacy of computer simulations in swaying jury decisions is largely anecdotal. To determine whether the criticisms of computer simulations could be supported by empirical evidence, we performed a laboratory experiment to study the effects of one such simulation on a series of mock, civil jury, comparative fault verdicts.[8] We will provide a brief background on computer animations and simulations and the controversy surrounding them. Then we will describe the empirical research project and its results.

I. BACKGROUND

The apocalyptic aura surrounding the year 2000 software problem has made it clear that computers have changed the face of American society. It was inevitable that their influence would extend to affect litigation.[9] Computers are being used for document

---

ing, Inc., No. CIV.A.92-3404, 1994 WL 124857, at *5 (E.D. Pa. Apr. 4, 1994); Bledsoe v. Salt River Valley Water Users' Ass'n, 880 P.2d 689, 691-93 (Ariz. Ct. App. 1994); Pino v. Gauthier, 633 So. 2d 638, 652 (La. Ct. App. 1993); Commercial Union Ins. Co. v. Boston Edison Co., 591 N.E.2d 165, 167-69 (Mass. 1992); Richardson v. State Highway & Transp. Comm'n, 863 S.W.2d 876, 881-82 (Mo. 1993) (en banc); Bray v. Bi-State Dev. Corp., 949 S.W.2d 93, 97-100 (Mo. Ct. App. 1997); Kudlacek v. Fiat S.p.A., 509 N.W.2d 603, 617-18 (Neb. 1994); Deffinbaugh v. Ohio Turnpike Comm'n., 588 N.E.2d 189, 193-94 (Ohio Ct. App. 1990); Brown v. Boise-Cascade Corp., 946 P.2d 324, 342 (Or. Ct. App. 1997); Steinhart v. St. Paul Fire & Cas. Ins., No. 96-2656, 1997 WL 697788, at *4 (Wis. Ct. App. Nov. 11, 1997) (per curiam) (unpublished table decision).

7. *See, e.g.*, Richard C. Jennings, *Evidence Survey*, 72 DENV. U. L. REV. 703, 715-20 (1995) (stating that video animation may have a "dramatic power" over the trier of fact); Adam T. Berkoff, Comment, *Computer Simulations in Litigation: Are Television Generation Jurors Being Misled?*, 77 MARQ. L. REV. 829, 845-54 (1994) (suggesting the possible abuses, misunderstandings, and disadvantages to using computer simulations); Sullivan, *supra* note 2, at 239 ("[Computer-Generated Re-enactments] constitute an interesting form of evidence. Numerous adjectives could apply to them: educational, informative, innovative, dangerous, misleading, and prejudicial. Such a disparate nature counsels caution for courts determining the admissibility of a CGR."); Declan O'Flaherty, *Computer-Generated Displays in the Courtroom: For Better or Worse?*, 4 WEB J. CURRENT LEGAL ISSUES 1, § 3 (Sept. 30, 1996) <http://webjcli.ncl.ac.uk/1996/issue4/oflah4.html> (discussing the potential misuse of computer generated displays).

8. For background on development of the empirical research project, see Robert B. Bennett, Jr. et al., *The Empirical Legal Research Initiative: An Interim Report to the Academy*, 14 J. LEGAL STUD. EDUC. 237 (1996).

9. *See, e.g.*, Frederic I. Lederer, *Technology Comes to the Courtroom, and . . .*, 43 EMORY L.J. 1095 (1994) (discussing computer-based technology and how it might be used in the courtroom); Evelyn D. Kousoubris, Comment, *Computer Animation: Creativity in the Courtroom*, 14 TEMP. ENVTL. L. & TECH. J. 257 (1995) (examining computer animation and its future role in modern litigation).

production and management,[10] and increasingly to produce evidence to be shown to the jury in the form of computer "animations" and "simulations."[11] Although there may not be a bright line distinction between the two, the term "computer animations" generally refers to artistic renderings or images, which the program alters to give the effect of movement,[12] whereas "computer simulations" generally involve the input, calculation, and manipulation of rules of physics, such as the effects of acceleration, gravity, friction, atmospheric pressure, water flow, etc.[13] In other words, the emphasis in "computer animations" is illustration, while "computer simulations" involve both computation and illustration.[14]

Computer animations and simulations seem to offer a persuasive tool for the litigator in educating or indoctrinating a jury. Social science research shows that people tend to assimilate and remember more information that they see, or see and hear, than they hear alone. For example, one study found that after three hours, subjects retained 70% of information they were told, 72% of information they were shown, and 85% of information that they were told and shown.[15] The disparities became more marked after seventy-two hours; subjects retained 10% of the material that they were told, 20% of the material that they were shown, and 65% of the material that they were told and shown.[16] Jurors are also accustomed to information presented in a video format.[17]

---

10. *See generally* Mario Borelli, Note, *The Computer As Advocate: An Approach to Computer-Generated Displays in the Courtroom*, 71 IND. L.J. 439 (1996) (examining computer displays as both evidence and arguments).

11. *See id.* at 451.

12. *See* Pierce v. State, 718 So. 2d 806, 808 (Fla. Dist. Ct. App. 1997).

13. *See* Borelli, *supra* note 10, at 450-52.

14. *See Pierce*, 718 So. 2d at 809; Berkoff, *supra* note 7, at 830-31; Borelli, *supra* note 10, at 450-52.

15. *See* Berkoff, *supra* note 7, at 845.

16. *See id.*; *see also* Borelli, *supra* note 10, at 453 (citing similar statistics); Jane A. Kalinski, Note, *Jurors at the Movies, Day-in-the-Life Videos As Effective Evidentiary Tool or Unfairly Prejudicial Device?*, 27 SUFFOLK U. L. REV. 789, 792-93 (1993) (same); Bingle, *supra* note 2, at B7 (same).

17. *See supra* note 4 and accompanying text; *see also* Berkoff, *supra* note 7, at 829-30 (discussing the effects of computer generated simulations on jurors).

Several commentators have discussed the advantages of presenting information in video format. Fred Cate and Newton Minow found:

> New technologies offer hope as well. Computers and interactive video, by appealing to jurors visually, can stimulate their interest, improve their understanding, and increase their ability to retain and recall evidence that has been presented during trial. Complex facts and points of law can be explained more clearly and effectively . . . . These technological innovations, while raising their own important issues, bode well for increasing the clarity of courtroom communications.

Fred H. Cate & Newton N. Minow, *Communicating with Juries*, 68 IND. L.J. 1101, 1118 (1993). Other authors have noted:

Computer animations and simulations offer advantages over other media, allowing the presentation of a scene from varied perspectives so that the audience can see objects or events from different vantage points.[18] The events can be shown in slow and fast motion or using stop action to focus on or highlight elements of a scene.[19] The presenter may also modify parameters or assumptions for analysis,[20] and motions can be changed to illustrate interactions in a complex relationship. The presenters can eliminate extraneous background or details that may be unrelated to what happened.[21]

These advantages have made computer animations and simulations both attractive and controversial. Litigants believe computer-generated displays will bolster their arguments, making them memorable and convincing to jurors. They are persuaded that computer-generated displays are as effective as demonstrative evi-

---

> Our society is in the electronic age, and has been for several decades. Perhaps the most useful electronic tool available to the trial lawyer is the videotape machine . . . . The videotape is itself far superior to reading a sterile transcript of a sworn statement when the witness cannot or will not appear at trial.

Thomas A. Heffernan, *Effective Use of Demonstrative Evidence—"Seeing is Believing"*, 10 AM. J. TRIAL ADVOC. 109, 112 (1987). Author Jane Kalinski notes:

> Additionally, jurors are extremely familiar with the method of presentation of a day-in-the-life video. "The average juror possesses a highly-developed cinematic sensibility, albeit unconscious, which derives from years, usually decades, of movie-going and television-watching." The early use of television as a source of entertainment naturally segued into the widespread use of television as a means of conveying information. Jurors are accustomed to receiving much of their information from television. Moreover, television increases juror interest and understanding by presenting information in a more engaging fashion than oral testimony. Because they trust and understand television as a medium, jurors also perceive day-in-the-life videos as a particularly credible evidentiary tool.

Kalinski, *supra* note 16, at 798-99 (footnote and citation ommitted). Others have expressed their agreement by stating that:

> [a]s a visual aid, the micro-computer can be influential in litigation because people generally appreciate and remember pictures better than they do words. With a computer simulation model, the trial lawyer can present events dynamically to ensure that the jury and the court will perceive them in the way an expert has described them . . . . In this age of television, the impact on the jury of a computer simulation on a television-like monitor cannot be overlooked. Computer simulations, like television, effectively package a point of view through a dynamic, visual presentation.

C. Caverhill Schaefer et al., *Computer Simulations in Court*, TRIAL, July 1987, at 69, 69-70.

18. *See* Schaefer et al., *supra* note 17, at 72.

19. *See id.*

20. *See id.*; Berkoff, *supra* note 7, at 849.

21. *See* Schaefer et al., *supra* note 17, at 72-73; David Weinberg, *"Seeing Is Believing" When You Uses [sic] Scientific Animation,* MICH. L. WKLY., Dec. 6, 1993, at 5B.

dence.[22] In fact, courts are beginning to struggle with issues raised by dueling simulations.[23] Critics[24] and courts[25] are concerned that

---

22. For a discussion of proponents' claims regarding computer simulations as a winning technique, see *supra* note 2 and accompanying text. *See also* Berkoff, *supra* note 7, at 836 ("[Computer simulations] were originally viewed with trepidation, but are now seen as benign tools. This view may be a bit too trusting.").

23. *See, e.g.*, People v. Hood, 62 Cal. Rptr. 2d 137, 139 (Ct. App. 1997) (admitting as evidence computer simulations introduced by both the prosecution and the defense); John Butler, *Tell Your Story to the Jury Through Computer Animations*, MICH. LAW. WKLY., Mar. 13, 1995, at 3 (discussing a case in which the judge admitted animation for demonstrative purposes).

24. For example one commentator states:

> A highly persuasive computer animated exhibit certainly could confuse or mislead a jury. After all, the powerful demonstrative images portrayed in a computer animated piece might influence jurors to believe that those images are an actual account of the event and not merely one party's interpretation of the facts. A trial judge's cautionary instructions may not be sufficient to offset jurors' tendency to believe what they see, even when it is contradicted by the real evidence offered at trial.

D'Angelo, *supra* note 2, at 570. Sullivan agrees with these concerns.

> Furthermore, a good [Computer-Generated Re-enactment] can reenact an accident with an almost eerie reality. However wrong that reality may be, the danger exists that a jury will accept it unquestioningly. The reasons for this danger stem from the high quality of a CGR's images, the fact that a computer generated a R's [Reenactment] images, and the fact the CGR appeared on a "TV." This problem would seem to loom particularly large when the opposition does not offer their own CGR in rebuttal.

Sullivan, *supra* note 2, at 195.

25. *See, e.g.*, Hinkle v. City of Clarksburg, 81 F.3d 416, 424-25 (4th Cir. 1996) (recognizing "the unique problems presented by the introduction of videotapes purporting to recreate events at the focus of a trial" but "fail[ing] to see a practical distinction . . . between a real-life recreation and one generated through computer animation" and stating that "both can be a particularly powerful recreation of the events"); Perma Research & Dev. v. Singer Co., 542 F.2d 111, 121-26 (2d Cir. 1976) (Van Graafeiland, J., dissenting) ("As courts are drawn willy-nilly into the magic world of computerization, it is of utmost importance that appropriate standards be set for the introduction of computerized evidence."); Van Houten-Maynard v. ANR Pipeline Co., No. 89C0377, 1995 WL 317056, at *12 (N.D. Ill. May 23, 1995) (noting that "this type of evidence can be highly influential upon a jury, well beyond its reliability and materiality," and that "computer animation evidence . . . may well have an undue detrimental effect on other more reliable and trustworthy direct-type evidence"); Bledsoe v. Salt River Valley Water Users' Ass'n, 880 P.2d 689, 691-93 (Ariz. Ct. App. 1994) (setting minimum foundational requirements for computer simulations); Pino v. Gauthier, 633 So. 2d 638, 652 (La. Ct. App. 1993) (affirming the trial court's rejection of computer simulations as unduly prejudicial, and holding that "[t]he factors favoring admission are substantially outweighed by the factors against admission. . . . It was proper to avoid the impact of the jury viewing the specially created tape, containing only favorable outcomes"); Sommervold v. Grevlos, 518 N.W.2d 733, 737 (S.D. 1994) ("The impact of video reenactment is substantial. When people see something on television, they think it is real even when it is not.").

jurors give them undue weight, that the assumptions underlying the displays are not readily apparent to jurors, and that the television generation is particularly susceptible to being misled. In light of these concerns, courts have been struggling to develop and refine standards for the admissibility of simulations.[26] Although it may be premature to say that a consensus has developed, particularly since trial courts are generally given wide discretion in this area,[27] courts seem to be drawing a line between computer animations and computer simulations,[28] taking a more permissive stance to admission of the former.[29] With respect to computer simulations, courts seem to be imposing the more rigorous standards for admissibility of scientific evidence mandated by *Frye v. United States*[30] or *Daubert v.*

---

26. A comprehensive discussion of admissibility of computer simulations is beyond the scope of this paper. For such a discussion, see, for example, Jennings, *supra* note 7, at 715-20, Berkoff, *supra* note 7, at 833-45, Borelli, *supra* note 10, at 440-49, Elaine M. Chaney, Note, *Computer Simulations: How They Can Be Used at Trial and the Arguments for Admissibility*, 19 IND. L. REV. 735, 741-56 (1986), Sullivan, *supra* note 2, at 201-39, and Brien J. Wholey, *Admissibility of Computer Simulation Evidence in New York Courts*, N.Y.L.J., Jan. 15, 1991, at 1.

27. *See, e.g.*, *Hinkle*, 81 F.3d at 424-25 (4th Cir. 1996); Strock v. Southern Farm Bureau Cas. Ins. Co., No. 92-2357, 1993 WL 279069, at *1 (4th Cir. July 12, 1993) (per curiam).

28. *See, e.g.*, Robinson v. Missouri Pac. R.R. Co., 16 F.3d 1083, 1087 (10th Cir. 1994); *Hood*, 62 Cal. Rptr. 2d at 139-40; Pierce v. State, 718 So. 2d 806, 808-10 (Fla. Dist. Ct. App. 1997); Constans v. Choctaw Transp., Inc., 712 So. 2d 885, 900-01 (La. Ct. App. 1997); Steinhart v. St. Paul Fire & Cas. Ins. Co., No. 96-2656, 1997 WL 697788, at *4 (Wis. Ct. App. Nov. 11, 1997) (per curiam) (unpublished table decision).

29. *See, e.g.*, *Robinson*, 16 F.3d at 1087-88; *Hood*, 62 Cal. Rptr. 2d at 139-40; *Pierce*, 718 So. 2d at 808-09; Ladeburg v. Ray, 508 N.W.2d 694, 696 (Iowa 1993); *Constans*, 712 So. 2d at 900-01; *Steinhart*, 1997 WL 697788, at *4.

At least one commentator questions different standards for animations and simulations. *See* I. Neel Chatterjee, *Admitting Computer Animations: More Caution and New Approach Are Needed*, 62 DEF. COUNS. J. 36 (1995).

30. 293 F. 1013 (D.C. Cir. 1923). *Frye* mandates that expert testimony must be deduced from scientific principles that "must be sufficiently established to have gained general acceptance in the particular field in which it belongs." *Id.* at 1014; *see also* Starr v. Campos, 655 P.2d 794, 797 (Ariz. Ct. App. 1982) (applying the *Frye* standard to admissibility of computer simulations); Commercial Union Ins. Co. v. Boston Edison Co., 591 N.E.2d 165, 168 (Mass. 1992) (same). The Massachusetts Supreme Court stated:

> [W]e treat computer-generated models or simulations like other scientific tests, and condition admissibility on a sufficient showing that: (1) the computer is functioning properly; (2) the input and underlying equations are sufficiently complete and accurate (and disclosed to the opposing party, so that they may challenge them); and (3) the program is generally accepted by the appropriate community of scientists.

Id.; *see also* Bray v. Bi-State Dev. Co., 949 S.W.2d 93, 97 (Mo. Ct. App. 1997) (citing *Commercial Union* with approval); Kudlacek v. Fiat S.p.A., 509 N.W.2d 603, 617 (Neb. 1994) (same).

Merrell Dow Pharmaceuticals, Inc.,[31] their progeny,[32] or alternative standards designed to shield jurors from undue influence.[33]

The assumption underlying the position of commentators and courts, regardless of their position on the merits of computer animations or computer simulations, is that the use of computer-generated displays affects jury decision-making.[34] These assumptions ignore the reality that computer simulations are often brief pieces of evidence that are directed at critical issues, but often as

---

31. 509 U.S. 579 (1993).

32. Several cases apply the *Daubert* standard to admissibility of computer simulations. *See, e.g., Robinson*, 16 F.3d at 1088-89; Livingston v. Isuzu Motors, Ltd., 910 F. Supp. 1473, 1495 (D. Mont. 1995). *See generally* G. Michael Fenner, *The* Daubert *Handbook: The Case, Its Essential Dilemma, and Its Progeny*, 29 CREIGHTON L. REV. 939 (1996) (providing a comprehensive list of federal cases following *Daubert*).

33. *See, e.g.*, Bledsoe v. Salt River Valley Water Users' Ass'n, 880 P.2d 689, 692 (Ariz. Ct. App. 1994) (requiring the proponent of computer simulation evidence to satisfy the "foundational requirements for other demonstrative evidence"); Richardson v. State Highway & Transp. Comm'n, 863 S.W.2d 876, 882 (Mo. 1993) (en banc) (affirming the trial court's rejection of computer simulation, and holding that it was a proper exercise of the court's discretion, since the simulation was not timely shown to the other side and was based on "variables" which the opposing party was unable to test by cross-examination).

The *Richardson* court stated:

> The Commission poses the issue as a landmark test on the admissibility of computer simulations as evidence in Missouri. In fact, the rules are clear on the admissibility of experimental evidence. Experimental evidence is admissible only if the experiment is made under substantially similar conditions to those at the time of the accident, although the conditions need not be identical.

Id.; *see also* Deffinbaugh v. Ohio Turnpike Comm'n, 588 N.E.2d 189, 193 (Ohio Ct. App. 1990) (holding that admissibility is within the discretion of the trial judge upon a determination that the evidence is relevant and will assist the trier of fact to understand the issues); Sommervold v. Grevlos, 518 N.W.2d 733, 738 (S.D. 1994). The *Sommervold* court explained:

> SDCL 19-17-1(9) requires the proponent of computer generated evidence to describe the system and show that the program produced an accurate result. Then the animation must be relevant, probative and nearly identical. The animation must fairly and accurately reflect the oral testimony of the witness and be an aid to the jury in understanding the issues.

Id. (citations omitted).

34. *See, e.g., Robinson*, 16 F.3d at 1088 ("Video animation adds a new and powerful evidentiary tool to the trial scene . . . . Because of its dramatic power, trial judges should carefully and meticulously examine proposed animation evidence for proper foundation, relevancy and the potential for undue prejudice."); Racz v. R.T. Merryman Trucking, Inc., No. CIV.A.92-3404, 1994 WL 124857, at *5 (E.D. Pa. Apr. 4, 1994) ("Relying upon the old adage, 'seeing is believing,' we conclude that the jury may give undue weight to an animated reconstruction of the accident.").

Commentators are even more dogmatic. *See, e.g.*, Berkoff, *supra* note 7, at 845 ("Whether or not one sees such an impact as beneficial or detrimental to the judicial process, one cannot argue that computer simulations do leave a substantial imprint on the minds of jurors.").

only a small part of a lengthy and complex trial.[35] However, the evidence marshalled by proponents to support the efficacy of computer simulations in swaying jury decisions is based on deductive reasoning, largely anecdotal,[36] and even redundant.[37] The effect of computer simulations or animations on jury decision-making has not been empirically tested. The authors have attempted to develop such an empirical test.

---

35. In *Pierce v. State*, 718 So. 2d 806 (Fla. Dist. Ct. App. 1997), for example, the court noted that the computer animation at issue constituted approximately six minutes of an eleven-day trial. *Id.* at 810. Alan Gahtan reports that "a typical animation is about 10-15 seconds in length." Alan Gahtan, *Computer Technology Invades Litigation Practice* (Nov. 6, 1995) <http://www.gahtan.com/alan/articles/ctechlit.htm>; *see also* Marie G. Wilson et al., *Information Competition and Vividness Effects in On-Line Judgements*, 44 ORGANIZATIONAL BEHAV. & HUM. DECISION PROCESSES 132, 138 (1989) ("[R]eal world information-processing settings often are considerably more 'noisy' than psychological experiments.").

36. *See, e.g.,* Berkoff, *supra* note 7, at 845-49 (citing the use of computer animations in a gas explosion case, a Delta Airline crash case, and a negligence case, and concluding: "[t]hese cases demonstrate that computer simulations are extremely powerful tools, which weigh heavily in the decision processes of a jury"); Danois, *supra* note 2, at S8 (citing the use of a simulation in a high profile Florida hit-and-run case); Weinberg, *supra* note 21, at 5B (citing successful use of computer animation in two intellectual property cases); O'Flaherty, *supra* note 7, § 5 (citing the use of computer animation in a gas explosion case, a Florida personal injury case, and a criminal case, and concluding: "[a] brief look at a number of the cases in which computer-generated displays were utilized demonstrates the powerful and persuasive effect the technology can have on those who view it").

For a discussion of the danger of relying on anecdotal evidence, see David A. Hyman, *Lies, Damned Lies and Narrative*, 73 IND. L.J. 797, 835 (1998), who states "Unfortunately, 'even writers who are not ideologically motivated don't let the complexities of actual events stand in the way of a good story'—and those who are ideologically motivated are considerably less scrupulous. . . . In short, as noted previously, '[t]he plural of anecdote is not *data*.'"

37. *Compare* Berkoff, *supra* note 7, at 846-47, *with* O'Flaherty, *supra* note 7, § 5 (both citing as an example the same gas explosion case); *compare* David J. Richter, *3D Animation: Almost As Good As an Eyewitness*, N.Y.L.J., Oct. 28, 1996, at S3, *with* Mary Wisniewski Holden, *Computer Animation Helps Lawyers Draw Lines in Court*, CHICAGO LAW., Nov. 1996, at 61 (both citing as an example the same architect malpractice case).

II. THE EFFECT OF AN ANIMATED COMPUTER SIMULATION ON VERDICTS: AN EMPIRICAL LABORATORY EXPERIMENT[38]

A. *Overview*

The authors concluded that field research into the effects of computer simulations and animations was not feasible. Actual cases differ too much on their facts, on the quality of physical evidence, on the personalities and abilities of attorneys, and on the appeal and credibility of witnesses. On the other hand, the question appeared testable using laboratory methods of social psychology.[39]

---

38. The authors gratefully acknowledge the invaluable assistance of the following in carrying out this empirical investigation:

FUNDING SUPPORT: The Academy of Legal Studies in Business (ALSB); the J.I. Holcomb Res. Inst.; the Ind. U. Purdue U. in Indianapolis (IUPUI) Res. Fellowship Program; and the AMOCO Found. Multidisciplinary Res. Grant Program. We especially wish to acknowledge the initiative of Professor O. Lee Reed, who, as ALSB President, proposed the award of a seed money grant for empirical research, without which this project could not have commenced.

VOLUNTEER ACTORS AND DIRECTORS FOR THE TRIAL SIMULATIONS: Michael Maitzen, Mary Chappell, Joan Leibman, Christopher Dull, and Thomas Weinland; Professors Robert Hall, Charles Luckenbill, Richard Magjuka, Roger Schmenner, and Jerrold Stern.

ALSB FACULTY MEMBERS WHO ADMINISTERED ITERATIONS OF THE TRIAL SIMULATIONS IN WHICH THEIR STUDENTS PARTICIPATED AS MOCK JURORS: Professors Caryn Beck-Dudley, Utah St. U.; Robert B. Bennett, Jr., Butler U.; Don Boren, Bowling Green U.; Jay Erstling, U. of St. Thomas; Laura Ginger, Ind. U. (Bloomington); Jordan Leibman, Ind. U. (Indianapolis); Nim Razook, U. of Okla.; Eric Richards, Ind. U. (Bloomington); Ellen Rubert, College of Lake County; Robert Van Der Velde, Auburn U. (Montgomery); Nancy Wainwright, Eastern Wash. U.; Dexter R. Woods, Jr., Ohio Northern U.; and Floyd Woodward, Ind. U. (Indianapolis).

39. The empirical work that has been done on jury decision-making is concentrated in the social science literature. For three surveys of this literature, its contributions, and limitations, see Kathleen Carrese Gerbasi et al., *Justice Needs a New Blindfold: A Review of Mock Jury Research*, 84 PSYCHOL. BULL. 323 (1977), Nancy Pennington & Reid Hastie, *Juror Decision-Making Models: The Generalization Gap*, 89 PSYCHOL. BULL. 246 (1981), and Nancy Pennington & Reid Hastie, *Practical Implications of Psychological Research on Juror and Jury Decision Making*, 16 PERSONALITY & SOC. PSYCHOL. BULL. 90 (1990) [hereinafter Pennington & Hastie, *Practical Implications*].

Others have also addressed the topic of jury decision-making. *See, e.g.*, REID HASTIE ET AL., INSIDE THE JURY (1983); Franklin J. Boster et al., *An Information-Processing Model of Jury Decision Making*, 18 COMM. RES. 524 (1991). Most of this work has focused on the criminal jury process. *See, e.g.*, Mark Costanzo & Sally Costanzo, *Jury Decision Making in the Capital Penalty Phase*, 16 LAW & HUM. BEHAV. 185 (1992); Richard L. Wiener et al., *Comprehensibility of Approved Jury Instructions in Capital Murder Cases*, 80 J. APPLIED PSYCHOL. 455 (1995).

Much of the empirical work published to date studies the effects of personal attributes of jurors, race, and socio-economic background, or deliberation style on jury decisions. *See, e.g.*, Jeffery R. Boyll, *Psychological, Cognitive, Personality and Interpersonal Factors in Jury Verdicts*, 15 LAW & PSYCH. REV. 163 (1991); Jane Goodman et al., *Money, Sex, and Death: Gender Bias in Wrongful*

The authors scripted, produced, and videotaped two versions of a simulated, personal injury trial[40] conducted under pure comparative fault rules.[41] In the Baseline ("Base") version, the plaintiff's expert witness presents a critical piece of evidence to the jury using an animated computer simulation; in the Variant version, the same expert presents his conclusions using only oral testimony and traditional graphics.[42]

We recruited groups of mock juror subjects to view each of the versions. After viewing the trial tape and receiving instructions, the groups were randomly assigned to six- or seven-person juries. The juries retired to separate rooms and deliberated for up to two hours, rendering verdicts on forms calling for answers to special interrogatories. The first interrogatory asked for the total amount of damages without regard to any contributory negligence. The second interrogatory asked the percentage of negligence attributable to each of three parties, two defendants and the plaintiff. The third interrogatory asked the amount of damages attributable to each party, to be calculated, by the jury, by multiplying each party's percentage of fault by the total amount of damages suffered by the

---

Death Damage Awards, 25 LAW & SOC'Y REV. 263 (1991). Relatively few works, however, consider the effects of differences in legal rules on jury decisions. *But see* Irwin A. Horowitz, *Jury Nullification: The Impact of Judicial Instructions, Arguments, and Challenges on Jury Decision Making*, 12 LAW & HUM. BEHAV. 439 (1988) (presenting a study discussing the effects of legal rules on jury decisions); Ronald J. Matlon et al., *Factors Affecting Jury Decision-Making*, 12 SOC. ACTION & L. 41, 41 (1985) ("It is somewhat surprising that relatively little empirical research has been devoted to comparing the impact of extralegal factors to the various essential content-oriented (legal) aspects of the trial itself on the decisions of the juries."). *See generally* Darryl K. Brown, *Plain Meaning, Practical Reason and Culpability: Toward a Theory of Jury Interpretation of Criminal Statutes*, 96 MICH. L. REV. 1199 (1998) (discussing how juries apply criminal statutes); Nancy J. King, *Postconviction Review of Jury Discrimination: Measuring the Effects of Juror Race on Jury Decisions*, 92 MICH. L. REV. 63 (1993) (discussing the effect of jury discrimination on jury decisions); Barbara F. Reskin & Christy A. Visher, *The Impacts of Evidence and Extralegal Factors in Jurors' Decisions*, 20 L. & SOC'Y REV. 423 (1986) (finding that extra legal factors influenced jurors most in cases in which the state presented little hard evidence).

40. The transcripts of the two simulation versions of *McKey v. Torino Pizza Co.*, including instructions, verdict forms, and exhibits are on file with the authors at their institutional addresses.

41. The law in Indiana actually provides for a version of modified comparative fault. For a complete description of Indiana's law and the implications for juries and tort reform, see Jordan H. Leibman et al., *Blindfolding Comparative Fault Juries on the Percentage of Negligence: Should Indiana Follow the Lead of Illinois?* 41 RES GESTAE 24 (1998). For a discussion on the alternatives to comparative fault, see Jordan H. Leibman et al., *The Effect of Lifting the Blindfold From Civil Juries Charged with Apportioning Damages in Modified Comparative Fault Cases: An Empirical Study of the Alternatives*, 35 AM. BUS. L.J. 349 (1998).

42. For a more complete description of the Base and Variant differences, see *infra* Part II.B.5.a-b.

plaintiff. The sum of the percentages of fault for the three parties had to equal 100%.

Following each jury's deliberations, each juror completed an exit survey which included statements to which the individual jurors indicated levels of agreement on a five-point scale ranging from strongly agree (1) to strongly disagree (5). The survey asked an additional seven demographic questions and several open-ended questions about factors influencing the juror's personal decision and that of his or her jury panel.

The verdict data from the Base and Variant juries was tabulated and analyzed. Descriptive statistics (means, medians, and standard deviations) were calculated and the two versions compared. The statistical tests were performed to determine whether the differences between the Base and Variant measures of central tendency were significant.

B. *The Simulated Trial Scenario*

To ensure realism, we sought testimony and physical evidence from an actual trial.[43] We sought a comparative fault case that turned primarily on issues of fact rather than law (which lawyers and lay persons would likely agree was typical); one in which credible evidence could be adduced at trial upon which reasonable jurors could differ regarding the relative fault of the parties; and one in which there were multiple defendants so the option of shifting fault among the defendants by the jury could be studied. After a lengthy search, we discovered an Indiana motor vehicle accident case that met all of these requirements.[44] In discussing the case, the Indiana Court of Appeals said: "Nearly every fact related to the accident is vigorously disputed." Moreover, the plaintiff's attorney was convinced from post-trial jury interviews that the computer simulations were a determinative piece of evidence in the case. We captioned the simulation produced from the underlying trial: *McKey v. Torino Pizza Co.*

The simulation describes events that occurred at 7:00 A.M. on an early November day in rural southern Indiana. Dawn McKey, an attractive and popular sixteen-year-old cheerleader on her way to school, pulled out from County Road 1040 onto the preferred State Road 38 ("S.R. 38"), and collided with a truck called a

---

43. An actual case would also provide a real-world benchmark verdict with which the experimental verdicts could be compared.

44. In exchange for the use of the physical evidence in possession of the plaintiff's attorney, including the computer simulations that are the subject of this Article, we agreed to protect the privacy of the parties by withholding all names, the exact locations of the relevant incidents, and the name of the case. In this Article, we refer to the actual case upon which the simulation was based as the "underlying case," and have changed all names to preserve the confidentiality of the participants.

"stepvan," driven by an employee of Torino Pizza Co. ("Torino"). Torino is described as "a large national manufacturer of food products." Dawn suffered massive brain injuries in the collision, which left her with no memory of the accident and virtually no subsequent ability to remember events from day to day. The only other accident witness was Torino's truck driver, Will Drummond, who incurred superficial injuries that were not at issue in the case.[45]

The intersection is located in a valley between two low hills. Because the hills' sightlines in both directions were restricted for Dawn, the left turn across traffic onto S.R. 38 was dangerous. The State of Indiana had placed a 40 M.P.H. "advisory-speed" sign below the crest of the hill on S.R. 38, over which Will Drummond had just driven.[46] However, the speed *limit* along S.R. 38 was 55 M.P.H. throughout the area. The parties disputed the speed of the stepvan at the moment of collision, and whether conditions existed requiring the stepvan to slow down to 40 M.P.H. The plaintiff claimed Torino, through its driver, was negligent because the driver had approached the intersection at an unreasonable speed; he had failed to abide by warning signs; he was unable to control his vehicle to avoid the accident; and he had failed to maintain a proper lookout.

The plaintiff also sued the State of Indiana on the theory that it was well known that the intersection was highly dangerous, creating a duty for the State to do more than it had done to protect drivers attempting to make left turns onto S.R. 38. Although the reason is not disclosed to the jury, the State did not appear at trial, because the plaintiff and the State had entered into a "covenant not to execute."[47] Despite hearing no defense from it, the jury was permitted

45. These facts and those in the following paragraphs are essentially the same in the underlying case.

46. Advisory speed signs in Indiana are treated like other warning signs such as "yield," or "deer crossing." The statute requires drivers to take action in adherence to these warnings only when conditions indicate there is reason to do so.

47. In the underlying case, there was virtually no possibility for the plaintiff to recover damages from the State. Indiana law, at the time, provided that the Comparative Fault Act "does not apply . . . to tort claims against governmental entities." IND CODE § 34-4-33-8 (1986) (repealed 1998). With respect to the State, under section 34-4-33-8, contributory negligence was a complete defense. *Id.* Under the facts of *McKey*, some negligence on Dawn's part was conceded by the plaintiff. Presumably, the State was named as a party defendant to attract a portion of the fault that might otherwise be attributed to Dawn. Because Indiana is a modified comparative fault State, with 51% creating a bar to recovery, it was important for the plaintiff to make it as easy as possible for the jury to assign at least 50% to the defendants. The defense was probably ambivalent about this strategy because it could not be confident that Dawn would be found more than 50% responsible for her own injuries. The defense, therefore, may have welcomed the opportunity to lay-off part of the fault on another defendant. In any event, the jury knew none of this and had to assume the State would pay its share of any damages assessed against it.

to allocate a percentage of fault to the State. The trial simulation breaks down into the following fourteen segments.

1. Plaintiff's opening statement

The plaintiff's attorney tells the jury about Dawn, her family, her aspirations, her injuries, her suffering, and what she has lost as a result of the accident. He describes the plaintiff's theory of the case and gives reasons why the jury should allocate fault to the defendants. He treats the state's liability lightly, and he raises the dangerousness of the intersection primarily to show that Torino's agent, Will Drummond, had notice of it and failed to take it into account.

2. Defendant's opening statement

Torino's attorney pleads for the jury not to let sympathy for Dawn affect its consideration of the liability issues. He also asks them to accept that Will Drummond had no reason to go on high alert at the intersection, that his driving behavior was reasonable, and that his speed approaching Dawn's car could not really be ascertained, even by Will. As a result, he asks the jurors to attribute 100% of the fault to Dawn and the State.

3. Testimony of Carter Stumpf

The Lincoln County Sheriff's Captain, Carter Stumpf, is shown photographs of the road and the 40 M.P.H. advisory sign and testifies to the well-known dangerousness of the intersection. Stumpf is shown color photographs of the wreckage with which he describes the scene at the site shortly after the accident. The photographs reveal no skid marks. His accident report describes dry pavement, daylight, and Dawn's failure to yield the right of way.

4. Testimony of Will Drummond

Torino's truck driver, Will Drummond, testifies about his experience driving grain trucks, the nature of his job as a delivery/route salesman for Torino, his suspension for tardy paper work, and his return to work the day of the accident. He asserts that Dawn's pull-out that day left him no opportunity to take evasive action. Drummond testifies that he doesn't remember seeing the 40 M.P.H. advisory and school bus signs. Further, he concedes that he was doing 55 M.P.H. to the crest of the hill and believes he had "eased off" the accelerator on the way down, but he can not remember his approach speed. He testifies that Dawn stopped at the stop sign located twenty-six feet from S.R. 38, then pulled out without stopping again from that position. Drummond maintains that he did brake before the collision.

5. *Testimony of Vincent Schneider*

The plaintiff's expert accident reconstructionist,[48] Vincent Schneider, describes his qualifications, his methods for reconstructing pre-accident rates of speed,[49] and his assumptions regarding the initial positions of the parties.[50] He testifies that the

---

48. One commentator describes the task of the accident reconstructionist as follows:

> Although no two accidents are perfectly identical, an expert accident reconstructionist attempts to determine the following details common to every accident: i) the physical factors involved in the accident; ii) the physical factors involved in the production of injuries; iii) the physical factors involved in avoiding the accident; and iv) the possible factors (physical or not) that might have mitigated or avoided injuries. The final result is a supportable set of conclusions that describe what happened, how injuries occurred, and whether anything could have been [d]one either before or during the accident to avoid those injuries.

Sullivan, *supra* note 2, at 198 (footnotes ommitted).

49. Vincent Schneider's testimony, on the method of reconstructing pre-accident speeds, in pertinent part, is as follows:

> In this case the evidence was pretty clear. By determining the type and weight of the vehicles, the nature and condition of the road surface at the time of impact and the distance the vehicles moved after the impact, we can determine quite accurately how fast the pizza truck was moving at the instant it hit the Mustang. We can do this by using a principle of simple physics called coefficient of friction. By measuring the length of the scroll marks, which show the distance the vehicles slid along the pavement after impact, and knowing the amount of frictional resistance such a pavement, when dry, would offer to these sliding vehicles, we can calculate the initial velocity of the truck when the vehicles came together. In this case, the marks left by the tires of both vehicles show that they were in a locked-wheel, sideways skid. As you can see from the table marked Plaintiff's Exhibit 14, the appropriate coefficient of friction to use under those conditions is .70. [Schneider indicates by pointing to the line on the chart for traveled dry road when vehicles were traveling in excess of 30 M.P.H.] If, for example, the accident had occurred under snow conditions, the tables we engineers use for this purpose would call for a coefficient half that large. [Schneider indicates the chart line for snow packed roads.] Based on all this, my analysis shows that the pizza truck was traveling 50 M.P.H. at the moment of impact. We took great pains to verify the characteristics of the vehicles and the road surface, and we ran many tests to check the data.

For a discussion of two common methods of estimating speed in accident reconstruction cases, see Lawrence F. Mazer et al., *Expert Testimony Regarding the Speed of a Vehicle: The Status of North Carolina Law and the State of the Art*, 16 CAMPBELL L. REV. 191, 199-203 (1994).

50. Among the assumptions that Schneider included in the simulation is the assumption that Dawn started her turn from a position flush with S.R. 38, an assumption that was newly contradicted by Will Drummond's testimony. Schneider argues that his assumption is more favorable to the defendant because it would require the plaintiff less time to cross the lane of traffic from this position rather than from the stop sign which was 26 feet back from the road.

distance the vehicles traveled after the collision on a dry pavement indicates an impact speed of 50 M.P.H.

a. Base. In the Base version of the simulated trial tape, Schneider supports his testimony by introducing seven animated computer simulations of the accident. These simulations demonstrated graphically that, if Drummond had obeyed the advisory speed sign of 40 M.P.H., there would have been a clean miss of sixty-two feet. These computer simulations were developed for, and used in, the underlying trial. Schneider narrates the animated simulations as they appear on the videotape:

i. Simulation 1: Shows an overhead view of the accident scene with the Torino truck proceeding westbound at 55 M.P.H. and then slowing to 50 M.P.H. as the driver reacts to the Mustang pulling out. This simulation represents Schneider's conclusion of how the accident actually occurred.

ii. Simulation 2: Shows the same view in slow motion.[51]

iii. Simulation 3: Shows the same events as simulation 1 from the perspective of the driver.[52]

iv. Simulation 4: Shows the overhead view again with the truck proceeding at a steady 40 M.P.H., and illustrates a clean miss by sixty-one to sixty-two feet.[53]

v. Simulation 5: The action is the same as simulation 4, but the action is stopped at 3.45 seconds to emphasize the space existing between the two vehicles at that point in time.[54]

vi. Simulations 6 and 7: Repeat simulations 4 and 5, only the truck is moving at a steady 45 M.P.H. There is no impact, but the miss is much closer than at 40 M.P.H.

b. Variant. In the Variant version of the simulated trial tape, Schneider's testimony is substantially the same, but the jury is shown no animated computer simulations. Instead Schneider

---

51. As already indicated, the ability to highlight the elements of the scene using slow motion and stop action is one of the perceived benefits of simulations and its persuasive effects on jurors. *See supra* text accompanying note 19.

52. As previously indicated, the ability to shift perspectives and to show a scene from different vantage points is a frequently cited benefit to computer-generated displays. *See supra* text accompanying note 18.

53. The ability to change parameters and assumptions, particularly in events with complex relationships to each other, as already indicated, is a distinct advantage of computer simulations. *See supra* text accompanying note 20.

54. This is another illustration of the use of stop action in collision simulation. *See supra* text accompanying note 19.

shows an aerial photograph of the intersection and a road profile chart and describes the results of calculations based on alternative assumptions.[55] His description of his qualifications, methods, assumptions, and conclusions is unchanged. Schneider concludes his testimony by assigning 100% of the fault of the accident to Torino's driver.

6. Testimony of Neil Sundstrom

The plaintiff's expert authority on truck-driving safety, Neil Sundstrom, testifies that Drummond's safety training was woefully deficient, but that no training requirement laws were violated by Torino. He testifies that a trained driver would have immediately slowed and covered his brakes as soon as he saw Dawn's car moving toward S.R. 38 from the stop sign.

7. Testimony of Penny McKey

Penny McKey, the mother of the plaintiff, testifies about the horrendous burdens the family has suffered because of Dawn's slow and painful physical rehabilitation and her permanent mental impairments, seizures, and anti-social personality disorders.

8. Testimony of Carla Trammell

The plaintiff's expert clinical neuropsychologist, Carla Trammell, summarizes Dawn's post-accident medical history, and describes her current and permanent loss of mental function. Trammell also operates Indiana's only rehabilitation facility for these

---

55. The testimony of Schneider is revised in pertinent part as follows:

> Jackson: You have testified that you assumed that Mr. Drummond crested the hill at 55 M.P.H. and continued down at that speed. You also testified that your scientific analysis of the accident site yielded an impact speed of 50 M.P.H. In your expert testimony, does this scenario reflect accurately the events as you believe they actually happened?
>
> Schneider: Yes, I believe it does.
>
> ....
>
> Jackson: Mr. Schneider, have you considered alternative scenarios in which Mr. Drummond proceeded differently than he apparently did?
>
> Schneider: Yes. In the first alternative we have the truck slowing down to 40 M.P.H. at the warning sign and staying at that speed thereafter. At 40 [M.P.H.] there is no collision and [a] miss is not even close; I calculated about 62 feet of clearance. In the second alternative, we have the truck moving at a steady 45 M.P.H. Again there is a miss, but closer, of course. In the third alternative, Mr. Drummond is moving initially at 55 [M.P.H.] but when he sees the Mustang pull out he removes his foot *completely* from the accelerator. In this scenario there is a complete miss.

types of injuries and discusses the expense of a rehabilitation program for Dawn.

9. Testimony of Arnold Eagleton

The plaintiff's expert economist, Arnold Eagleton, projects Dawn's range of economic damages for lost income based on her probable work-life expectancy and for the costs she will incur for lifetime residential care for her full life expectancy. To these he adds medical and rehabilitation costs. Following Eagleton's testimony, the plaintiff rests.

10. Testimony of Stanton Kramer

Defendant's expert accident reconstructionist, Stanton Kramer, testifies that his "momentum analysis" of the physical evidence yields an impact speed of 30 to 35 M.P.H. He opines that there was no time, even at that speed, for Drummond to react. He testifies that only a very cautious driver would have reacted to Dawn's moving from the stop sign. Following Kramer's testimony, the defense rests.

11. Plaintiff's first closing argument

Plaintiff's attorney reviews his theory of the case and how the testimony from the plaintiff's witnesses' supports it. He admits some fault on Dawn's part, but argues that Torino and the State were more responsible for the collision. With respect to damages, plaintiff's attorney recapitulates the figures of the economist. He adds a range of non-economic damages including pain and suffering that Dawn will incur over her life expectancy.

12. Defendant's closing argument

The defendant's attorney reminds the jury not to be swayed by sympathy. He attacks the plaintiff's accident reconstruction, which assumed that Dawn stopped once at the edge of S.R. 38. He emphasizes Drummond's good driving record and argues that Drummond had no reason to be rushed or distracted by his job or his suspension. He focuses the jury's attention on Dawn's failure to look left again before she turned left. He emphasizes that S.R. 38 is a preferred road to County Road 1040. In the Base version, he misrepresents the amount of a miss shown on the animated simulation at 40 M.P.H. as two rather than sixty-two feet. In both cases, he attacks the assumptions of the plaintiff's economist, suggesting that Dawn might not have been headed for college, nor is she certain to be permanently unemployable, or need lifetime residential care.

13. Plaintiff's final closing argument

In this rebuttal argument, plaintiff's attorney explains to the jury that the assumptions about Dawn's stopping point do not affect

Dawn's case; either assumption leads to a "clean miss" if Drummond had just slowed down or braked. In the Base version, he denies the defense attorney's two-foot-miss assertion. He emphasizes that, despite having the right of way, a driver on the preferred road is negligent if he or she fails to react to conflicting traffic moving from a dead stop in the direction of S.R. 38. He derides Torino's failure to call experts to rebut plaintiff's damages experts, and demands that the jury accept plaintiff's uncontested evidence. Additionally, he attacks the big company mentality that denies having made mistakes when they cost the company money. Finally, he concludes with an emotional description of Dawn's loss.

14. Jury instructions

Judge Barton reads aloud twenty-two instructions taken from the underlying case, copies of which each juror has been given. The jurors are to read the instructions silently along with the judge and are permitted to bring them into the deliberation rooms. Several instructions, taken from Indiana pattern instructions, define "comparative fault," "negligence," "agent of the defendant," "preponderance of the evidence," "burden of proof," "proximate cause," "ordinary care," and "sole proximate cause." Judge Barton reads the relevant Indiana statutes, sets out the various common law duties, and instructs the jury how both are to be applied. He lists possible items of damages and informs the jury that Dawn's life expectancy is 63.7 years. He also explains the nature of expert opinion and tells the jury it must render a unanimous verdict.

The trial of the underlying case took thirteen days and generated 4000 pages of trial transcript. The *McKey* simulation, however, runs about four hours. In *McKey*, the number of witnesses was reduced, rebuttal evidence was incorporated into direct and cross-examination, long medical depositions were summarized and integrated into one witness's testimony, and all motions, objections, and sidebars were deleted. Despite the simplification and compression, we believe that all significant factual issues were preserved.

a. Study #1.

i. Subjects. Mock jurors were 525 students recruited from several colleges across the Midwest.[56] Most of the students were sophomores or juniors enrolled in their institutions' business programs. They volunteered for the *McKey* exercise in conjunction with

56. All jurors were "jury-eligible" with respect to age. These student juries were no doubt younger than those typically encountered in the "real world," but they were older on average than might be surmised from their sophomore/junior status.

their introductory business law course.[57] As a group, they had little or no exposure to comparative fault principles. Of the 525 mock jurors, 296 saw the Base case in which Schneider (an expert witness for the plaintiff) supplemented his testimony with a series of computer simulations. The other 229 mock jurors saw the Variant set of tapes in which Schneider's testimony did not include the computer simulations. Instead, the Variant form was composed of Schneider's oral testimony supplemented with a set of pictures, charts, and an aerial photograph of the accident scene.[58]

ii. Manipulating the independent variable. Our independent variable (the computer simulation) was manipulated via Vincent Schneider's testimony.[59] In the Base version of the simulation, Schneider's testimony included the seven animated computer simulations of the accident. In the Variant version of our study, Schneider's content delivery remained essentially unchanged from the Base version, but the juries did not see the computer simulations. Instead, the juries saw an aerial photograph of the highway intersection, along with Schneider's verbal descriptions and analysis.[60]

iii. Hypotheses (H) and experimental results (ER) based on the verdict data. In the experimental framework that we have described, the Variant juries may draw conclusions that differ from the Base juries in several ways. Relative to the Base juries, the Variant juries may: (1) allocate a different percentage of fault to both defendants combined (i.e., Torino and the State of Indiana); (2) allocate a different percentage of fault to Torino, the defendant company; (3) allocate a different percentage of fault to the State of Indiana; (4) allocate a different percentage of fault to Dawn McKey, the plaintiff; (5) award a different dollar award to Dawn Mckey; and/or (6) award a different total damage award.

Inspection of Table 1 (Base case) and Table 2 (Variant case) indicates that forty-five juries[61] who participated saw the Base case and thirty-eight juries[62] who participated in the study saw the Variant version of the simulation. Tables 1 and 2 also present basic descriptive statistics (i.e., mean, median, and standard deviation).

We developed a set of six hypotheses predicting how each dependent variable-of-interest would be influenced by Schneider's

57. For a description of the use of the empirical research project within the classroom setting, see Robert B. Bennett, Jr. et al., *Using a Jury Simulation As a Classroom Exercise*, 15 J. LEGAL STUD. EDUC. 191 (1997).

58. For a script of Schneider's testimony, see *supra* note 55.

59. Recall that Schneider served as the plaintiff's expert accident reconstruction witness. *See supra* Part II.B.5.

60. *See supra* Part II.B.5.b.

61. Table 1, col. 1.

62. Table 2, col. 1.

computer simulation. Subsequent to each of the following hypotheses, we provide the experimental results and brief explanations of the experimental outcomes.

Our rationale across all six hypotheses is based on the premise that, given the complexity of the case, a visual tool such as the computer simulation should help jurors conclude that, if Will Drummond had slowed down, he could have avoided the accident. Moreover, there was a road sign warning him to take heed. If the computer simulation was effective, as we have posited, those juries who saw the computer simulation should be inclined to apportion a greater percentage of fault to Will Drummond and possibly higher dollar damages.

H_1: Those juries who saw the computer simulations will allocate a greater percentage of fault to the combined defendants (i.e., Torino plus the State of Indiana), compared to the juries who did not see the computer simulations.

ER_1: The empirical evidence reported in Tables 1 and 2 does not support our first hypothesis. Variant juries allocated 37.3% of the fault to the defendants combined.[63] Our sample of Base juries allocated 36.2% of the fault to the defendants combined.[64] We conducted a difference of means test (t-test for small samples)[65] to assess whether the observed difference (i.e., 37.3% versus 36.2%) was statistically significant. We concluded that Schneider's computer simulations did not cause juries to apportion more fault to the defendants combined. The observed t-value was only t=0.18 (d.f.=79), yielding an observed p-value of p=0.43, considerably larger than our 0.05 critical p-value. Based on the evidence, it appears that juries apportion about one-third of the accident's blame to the combined defendants, regardless of whether they saw Schneider's computer simulations.

H_2: Juries who saw the computer simulation will apportion a greater percentage of fault to Torino, compared to those juries who did not see the computer simulations.

ER_2: The empirical evidence reported in Tables 1 and 2 does not support our second hypothesis. Variant juries allocated 21.2% of

63. *See id.* col. 6.

64. *See* Table 1, col. 6.

65. This test (two-sample difference of means test) is appropriate when one wishes to compare two observed sample means to statistically assess whether two different samples came from populations having equal means. *See* DONALD L. HARNETT, STATISTICAL METHODS 376-78 (3d ed. 1982). In this instance we used the t-distribution and the corresponding t-test difference of means, because we operate under the assumption that the population variances are not known. Inasmuch as we used the sample variances, the t-test is appropriate. For a more thorough discussion of this test, see *id.* at 345-88, and UMA SEKARAN, RESEARCH METHODS FOR BUSINESS: A SKILL BUILDING APPROACH 249-50 (2d ed. 1992).

the fault to Torino,[66] compared to 17.2% by the Base sample.[67] A difference of means test yielded a t-value of only t=0.99 and a p-value of p=0.16, well above our critical p-value of 0.05. The observed differences from our samples of jurors are not statistically significant. Therefore, our study suggests that Schneider's computer simulation did not cause jurors to apportion more blame to Torino. Regardless of whether juries saw the computer simulations, they tend to apportion a small amount of blame to Torino, finding the pizza company only about one-fifth to blame for the accident.

H_3: Juries who saw the computer simulations will apportion a greater percentage of fault to the State of Indiana, compared to those juries who did not see the computer simulations.[68]

ER_3: The empirical evidence does not support our hypothesis. Those juries who did not see the computer simulations apportioned 16.1% of the blame to the State,[69] while those juries who saw the simulations apportioned 19.0% responsibility to the State.[70] Our difference of means test yielded a t-value of only t=0.78 and an observed p-value of p=0.44. Regardless of whether juries saw Schneider's computer simulations, they tended to apportion a very small amount of blame to the State, finding the State less than one-fifth at fault in the accident.

H_4: Juries who saw the computer simulation will apportion a lower percentage of fault to Dawn McKey, the plaintiff in the case, compared to those juries who did not see the computer simulations.

ER_4: Base juries apportioned 63.8% of the fault to Dawn McKey.[71] Those juries who did not see the computer simulations (Variant juries) apportioned 62.7% of the blame to Dawn McKey.[72] To compare these two groups, we performed a difference of means t-test, which yielded a t-value of t=0.18 and an observed p-value of p=0.43. Based on the evidence provided from this study, it appears the computer simulations did not cause juries to apportion less blame to Dawn McKey. Regardless of whether juries saw the computer simulations, they found Dawn McKey to be about two-thirds responsible for the accident.

H_5: Dawn McKey, the plaintiff in the case, will receive a larger damage award (in dollars) by those juries who viewed Schneider's

66. *See* Table 2, col. 2.
67. *See* Table 1, col. 2.
68. This hypothesis was tested solely for analytical completeness. The animated computer simulation and the testimony of the accident reconstructionist focus on the fault of the corporate defendant, Torino. Therefore, intuitively the apportionment of fault to the State should not be affected by the simulation.
69. *See* Table 2, col. 4.
70. *See* Table 1, col. 4.
71. *See id.* col. 8.
72. *See* Table 2, col. 8.

computer simulations (Base case) than those juries who did not see the computer simulations (Variant case).

ER_5: It appears the computer simulations did not cause juries to award a larger damage award in dollars to Dawn McKey. Those juries who did not see the simulations awarded, on average, $1.69 million to Dawn,[73] while those who saw the simulations awarded $1.63 million to her.[74] Our difference of means test yielded an observed t-value of only t=0.15 and a p-value of p=0.44. Regardless of whether juries saw the computer simulations, they tended to award about $1.6 to 1.7 million to the plaintiff, Dawn McKey.

H_6: Those juries who saw Schneider's computer simulations will award a higher total damage award, compared to those juries who did not see the computer simulations.

ER_6: Once again, our experimental results do not support our hypothesis. The average total damage award by the Base juries was $3.64 million,[75] compared to $3.32 million for the Variant juries.[76] The observed t-value was only t=0.58, yielding an observed p-value of p=0.28 (t-test difference of means). Thus, it appears that juries tended to award about $3.5 million in damages, regardless of whether they viewed Schneider's computer simulations.

iv. Summing up the experimental results to Study #1. Contrary to our expectations, this study provides strong empirical evidence that the computer simulations were ineffective in causing juries to apportion more or less responsibility to any of the parties. In the current study, regardless of whether juries saw the computer simulations, they tended to apportion about one-third of the fault to the combined defendants and two-thirds of the fault to the plaintiff, Dawn McKey. We also found that dollar damages were invariant across both samples, with the amount of total damages being in the $3.3 to 3.6 million range.

We examined the exit surveys of those jurors who had seen Schneider's computer simulations to see how jurors felt about them. Included in the exit survey were two questions that inquired whether the computer simulations had influenced individuals' apportionment of fault and their entire jury panel's apportionment of fault.[77] Jurors were generally neutral as to the influence of the

73. *See id.* col. 7.
74. *See* Table 1, col. 7.
75. *See id.* col. 10.
76. *See* Table 2, col. 10.
77. The exit survey questions read as follows:

1. The animated computer simulation of the accident presented by Vincent Schneider influenced me to *increase* the percentage of fault I would attribute to the Torino Pizza Company.

2. The animated computer simulation of the accident presented by Vincent Schneider influenced *my jury panel* to *increase* the percentage of fault it attributed to the Torino Pizza Company.

computer simulations in apportionment of fault, with observed means of 3.10 ("influenced my individual apportionment of fault") and 3.35 ("influenced my jury panel's apportionment of fault") on a 5-point scale (1="strongly disagree"; 5="strongly agree").[78]

While it is informative to learn that jurors were generally ambivalent as to the effect of the computer simulations on their apportionments, we do not know why the computer simulations were generally ineffective. Our contrary findings may have resulted from several possibilities. First, it is possible that Schneider's computer simulations used in the current study were simply not high enough quality to influence those who saw them.[79] Second, computer simu-

78. The Base jurors were generally ambivalent as to the influence of the computer simulation on their verdicts. Only 38% of the respondents indicated they agreed or strongly agreed with the statement, "The animated computer simulation of the accident presented by Vincent Schneider influenced me to increase the percentage of fault I would attribute to Torino Pizza Company." Only 23% of those same respondents agreed or strongly agreed with the statement, "The animated computer simulation of the accident presented by Vincent Schneider influenced my jury panel to increase the percentage of fault it attributed to Torino Pizza Company."

The average score for the question, "The animated computer simulation of the accident presented by Vincent Schneider influenced me to increase the percentage of fault I would attribute to Torino Pizza Company" was 3.10 on a 5-point scale (1="strongly disagree"; 5="strongly agree"). The average score for the question, "The animated computer simulation of the accident presented by Vincent Schneider influenced my jury panel to increase the percentage of fault it attributed to Torino Pizza Company," was 3.35 on a 5-point scale (1="strongly disagree"; 5="strongly agree"). Thus, those who saw Schneider's computer simulations were generally ambivalent as to the degree of influence the simulations had on the allocation of fault to Torino.

79. Both groups (Base and Variant) felt the videotaped trial was fairly realistic. In response to the question, "The videotaped trial presentation was realistic," the average score by those in the Base group was 2.72 on a 5-point scale. The average score for the Variant jurors was 2.83. The 5-point scale was anchored at 1="strongly disagree" and 5="strongly agree." Thus, a score of about 2.80 was slightly better than mid-range on the 5-point scale. A difference of means test between the groups was statistically non-significant (t=0.38).

Regarding the statement, "The videotaped trial presentation was realistic," 55% of the Base respondents and 50% of the Variant respondents either "agreed" or "strongly agreed." Both groups (Base and Variant) felt their deliberations were conducted similarly to that of a real trial. In response to the question, "Our jury panel's deliberations were conducted as if this were a real trial," the average score by those in the Base group was 2.40 on a 5-point scale. The average score for the Variant jurors was 2.37. Thus, a score of about 2.40 was slightly better than mid-range on the 5-point scale. A difference of means test between the groups was statistically non-significant (t=1.10).

Of those in the Variant group 63% and of those in the Base group 62% either indicated they "agreed" or "strongly agreed" with the question, "Our jury panel's deliberations were conducted as if this were a real trial."

Evidence from the exit surveys suggests both groups felt their verdicts and damage apportionment were comparable to a real jury setting. In response to the question, "A real jury at a real trial would likely have reached approximately the same result as that reached by my jury panel," average responses lations may not influence juries. Our supposition that computer simulations would facilitate jurors' cognitive processing may simply be incorrect. Possibly we underrated jurors' abilities, or we may have over-estimated the attractiveness of computer simulations. The third plausible explanation may be that the computer simulations really influence jurors when they see them, but then subsequent testimony "blurs" the effects of the computer simulations.[80] That is, at the point in the trial where the Base jurors saw Schneider's computer simulations, while the Variant jurors only heard Schneider's testimony and saw the aerial photograph, maybe the experimental groups did actually differ. However, this was only about one-third of the way through the entire trial. The testimony and other activities subsequent to the introduction of the computer simulations may have diminished the effects of the computer simulations. A final possibility is that computer simulations may facilitate juror understanding, but the same understanding may be achieved by alternative means, particularly when issues lie within the range of jurors' experiences. Therefore, the simulations did not shift the results, because sufficient understanding was accomplished by conventional expert testimony alone.

Given these plausible explanations regarding why our experimental results were not as expected, we decided to conduct a second study to further investigate these possibilities.

b. Study #2. Study #2 was again comprised of two groups, a Base group and a Variant group. The Base jurors viewed the videotapes that included Schneider's presentation of the computer simulations as part of his expert witness testimony on behalf of the plaintiff.[81] The Variant jurors heard Schneider's testimony and saw an aerial photograph of the accident scene, but they did not see his computer simulations.[82]

The procedures for our second study essentially replicated those described for our initial study, with several substantive exceptions. First, the jurors did not hear any testimony or closing arguments

---

were 2.55 for Base jurors and 2.47 for Variant jurors (5-point scale). Thus, a score of about 2.50 was slightly better than mid-range on the 5-point scale. A difference of means test between the groups was statistically non-significant (t=0.98).

In reaching the the question, "A real jury at a real trial would likely have reached approximately the same result as that reached by my jury panel," 53% of the Base jurors and 63% of the Variant jurors either indicated they "agreed" or "strongly agreed."

80. *See supra* text accompanying note 35. The total running time of the seven computer simulations in *McKey v. Torino Pizza Co.*, is approximately two minutes of the simulation, which lasts for approximately four hours.

81. *See supra* Part II.B.5.a.

82. *See supra* Part II.B.5.b.

following Schneider's testimony.[83] After Schneider's testimony, jurors received the judge's instructions relative to apportionment of fault.[84] Second, rather than randomly assigning students to jury panels, we asked the students to individually deliberate. Third, since the jurors did not hear testimony about the extent of Dawn McKey's injuries or the anticipated costs of her care, we only asked them to apportion the percent of damages (across Torino, the State of Indiana, and Dawn McKey). We also did not ask them to decide on a total dollar damage award. Subsequent to Schneider's testimony and receiving the instructions from the judge, mock jurors individually apportioned fault, completed an apportionment of damages form, and responded to a set of exit survey questions (comparable to the exit survey administered to participants in Study #1[85]). Finally, we amended the exit survey form by adding an item that assessed whether jurors thought Schneider's computer simulations were high-quality.

i. Subjects. Our second study was comprised of 104 mock jurors. Forty-three of those jurors were assigned to the Base sample (i.e., they saw Schneider's testimony with the computer simulations), and sixty-one jurors did not see the computer simulations, but they did hear his testimony. We recruited our mock jurors for Study #2 in the same manner as we had done for Study #1 (i.e., primarily business students who were enrolled in an introductory law class).

ii. Manipulating the independent variable: "including the computer simulations in Schneider's testimony." As indicated in our introduction of Study #2, we manipulated our independent variable-of-interest (i.e., the computer simulations) by including it in the Base version and omitting it from the Variant version.

iii. Dependent variables (DV), hypotheses (H), and experimental results based on the verdict data: In Study #2 we were essentially interested in whether jurors felt Schneider's computer simulations were high quality and whether they influenced jurors' apportionment of damages across Torino, the State of Indiana, and Dawn McKey. The hypotheses that follow are generally predicated on the rationale that jurors who saw Schneider's computer simulation will apportion less fault to Dawn McKey and more fault to the defendants because the computer simulations provide rather clear evidence that if Will Drummond had slowed to an appropriate speed he would have avoided the collision.

83. In other words, both groups viewed the trial only through part five. *See supra* Part II.B.5.

84. Because the jurors in Study #2 had heard no testimony related to damages, all instructions related to determination of damages were omitted.

85. *See supra* notes 77-79 and accompanying text.

Table 3 (Base case) and Table 4 (Variant case) present the empirical results from Study #2 together with basic descriptive statistics (i.e., mean, median, and standard deviation).

Given our rationale for the experimental effect in Study #2 is the same as the rationale that we presented for Study #1, the first four hypotheses that we examine in Study #2 are essentially the same as those we presented in Study #1.

H_1: Those juries who saw the computer simulations will allocate a greater percentage of fault to the combined defendants (i.e., Torino and the State of Indiana), compared to the juries who did not see the computer simulations.

ER_1: The empirical evidence reported in Tables 3 and 4 does not support our first hypothesis. In our Base case, jurors allocated 60.2% of the fault to the defendants combined.[86] Our sample of Variant jurors (those who did not see Schneider's computer simulations) allocated 57.25% of the fault to the defendants combined.[87] We conducted a difference of means test (t-test for small samples) to assess whether the observed difference (i.e., 60.2% versus 57.25%) was statistically significant. As a result of the difference of means test, we concluded the computer simulations did not cause juries to allocate more fault to the defendants combined. The observed t-value was only t=0.50 (d.f.=102), yielding an observed p-value of p=0.31, considerably larger than our 0.05 critical p-value. Based on the evidence, it appears that, individually, jurors apportioned about 60% of the accident's blame to the defendants, regardless of whether they saw Schneider's computer simulations.

H_2: Juries who saw the computer simulation will apportion a greater percentage of fault to Torino, compared to those juries who did not see the computer simulations.

ER_2: The empirical evidence reported in Tables 3 and 4 does not support our second hypothesis. In our Base sample, jurors allocated 43.2% of the fault to Torino,[88] compared to 39.1% in the Variant version.[89] A difference of means test yielded a t-value of only t=0.80 and a p-value of p=0.21, well above our critical p-value of 0.05. Therefore, our study suggests that Schneider's computer simulation did not cause jurors to apportion more blame to Torino. The observed difference from our samples of jurors is not statistically significant. Regardless of whether jurors saw Schneider's computer simulations, they allocated about 40 to 45% of the fault to Torino.

H_3: Juries who saw the computer simulations will apportion a greater percentage of fault to the State of Indiana, compared to those juries who did not see the computer simulations.

86. *See* Table 3, col. 4.
87. *See* Table 4, col. 4.
88. *See* Table 3, col. 2.
89. *See* Table 4, col. 2.

ER_3: The empirical evidence does not support our hypothesis. Those jurors who saw Schneider's computer simulations apportioned 17% of the blame to the State,[90] while those jurors who did not see the simulations apportioned 18.1% responsibility to the State.[91] Our difference of means test yielded a t-value of only t=0.31 and an observed p-value of p=0.38. Regardless of whether jurors saw Schneider's computer simulations, they tended to apportion a very small amount of blame to the State, finding the State less than 20% at fault in the accident.

H_4: Juries who saw the computer simulation will apportion a lower percentage of fault to Dawn McKey, the plaintiff in the case, compared to those juries who did not see the computer simulations.

ER_4: The jurors who saw the computer simulations apportioned 39.8% of the fault to Dawn McKey.[92] Those jurors who did not see the computer simulations apportioned 42.75% of the blame to Dawn McKey.[93] To compare these two groups, we performed a t-test difference of means test, which yielded a t-value of t=0.50 and an observed p-value of p=0.31. Based on the evidence provided from this study, it appears the computer simulation did not cause jurors to apportion less blame to Dawn McKey. Regardless of whether they saw the computer simulations, jurors found Dawn Mckey to be about 40% responsible for the accident.

H_5: Base jurors will indicate that they felt the computer simulations were a high-quality piece of evidence.

ER_5: The evidence obtained from our exit surveys supports this hypothesis. Those jurors who saw Schneider's computer simulations felt they were high quality pieces of evidence. The average score to the item, "The actual computer simulation was a high quality piece of evidence," was 2.04 on a 5-point scale. The scale was anchored at 1="strongly agree" and 5="strongly disagree". Thus, the closer a score is to 1, the left anchor, the more strongly respondents agree with the statement. A score statistically different from 3 (the midpoint on a 5-point scale) would provide strong evidence that jurors felt the computer simulations were high quality. We conducted a difference of means test, comparing our observed mean (2.04) to our hypothesized mean (3.0) and obtained a t-value of t=6.04 with a p-value of p=0.00. Given our observed mean was significantly better than the midpoint on the scale, we concluded that jurors felt Schneider's computer simulations were high-quality.[94]

90. *See* Table 3, col. 3.
91. *See* Table 4, col. 3.
92. *See* Table 3, col. 5.
93. *See* Table 4, col. 5.
94. This result is consistent with the authors' views of the computer simulation and the view of the jurors in the underlying trial.

iv. Summing up the experimental results to Study #2. Counter to our hypotheses, our results again suggest that the computer simulation did not significantly influence apportionment of damages between the defendants and the plaintiff in this case. We were somewhat surprised at the experimental results of Study #2 because: (1) we terminated the video in Study #2 immediately after Schneider's testimony, a point in the experimental procedure when the effect of the computer simulations should be at their maximum;[95] and (2) empirical evidence suggests that jurors felt the computer simulations were indeed high quality.

III. CONCLUSIONS AND RECOMMENDATIONS

As initially discussed, the extraordinary possibilities inherent in computer animations and computer simulations raised hopes—and fears—that juries would find computer-generated displays more persuasive or convincing than other forms of evidence.[96] These hopes and fears seem to be unwarranted, at least within the context of the empirical results of this study. In other words, computer-generated evidence is not a "silver bullet" which guarantees victory. Certainly there is still the possibility that such evidence could get lost in the "noise" of a long and complex trial; but, the results of our second study indicate that this is not a complete explanation.

Possible explanations may again come from social science research. Recall that the marked advantage of visually presented information or visually and orally presented information was in the retention of the information.[97] Therefore, it is possible that the computer simulation would stand out more, as compared to oral testimony only, following a more extended period of time between the testimony and jury deliberations.[98] However, with a jury composed of a number of individuals, the memory of the relevant evidence would arguably have to fade from the collective consciousness. If the evidence were significant to any one of the jurors, he or she would be in a position to remind the remainder.

95. It is noteworthy that jurors in Study #2 allocated considerably less fault to Dawn McKey and considerably more fault to Torino than did jurors in Study #1. Removing the defense evidence and the arguments may have had a major effect on the apportionment even if the computer simulations did not. This result would seem contrary to some earlier studies, which suggest that jurors tend to form their opinions very early in the trial. *See* Gerbasi et al., *supra* note 39, at 324-25. However, it is consistent with research, that suggests jury deliberation has a moderating effect on jury results. *See* Melissa A. Pigott & Linda A. Foley, *Social Influence in Jury Decision Making*, 18 TRIAL DIPL. J. 101, 102 (1995).

96. *See supra* Part I.

97. *See supra* text accompanying notes 15-16.

98. In both studies, the deliberations and/or determinations were made within hours of witnessing the testimony.

A more likely explanation, again borne out by social science research, is that jurors, both individually and collectively, construct a "story" from the evidence and remember the evidence that is consistent with the "story" and selectively ignore the remainder.[99] Therefore, the job of counsel and their expert witnesses is to build a persuasive story for the jurors. Once the story is built, any additional or more persuasive evidence merely becomes superfluous and does not alter the jurors' apportionment. In other words, if the expert witness can make his points in a "low tech" fashion, the high tech presentation is simply overkill.[100] Given the expense of producing quality simulations,[101] this may not be an insignificant consideration.

In the typical accident case, such as *McKey*, the essential facts are not beyond the scope of the average juror. Most jurors within the sample and within the jury pool of most jurisdictions were licensed, and even experienced, drivers. Therefore, the jurors will be able to grasp the facts and issues at hand as long as they are clearly laid out. Jurors can build their story without the wizardry of computer animation or simulation.[102] Arguably, if the issues in a case concerned matters outside the experience of ordinary jurors, computer-aided graphics would be much more helpful.[103] Further em-

---

99. For a detailed treatment of this notion, see Brown, *supra* note 39, at 1216-21, King, *supra* note 39, at 78, Nancy Pennington & Reid Hastie, *Evidence Evaluation in Complex Decision Making*, 51 J. PERSONALITY & SOC. PSYCHOL. 242, 243-54 (1986), and Pennington & Hastie, *Practical Implications*, *supra* note 39, at 93-98.

100. Without intending to minimize the difficulty of the task of the accident reconstructionist, accident reconstruction need not be a high technology venture. *See supra* notes 48-49. *See generally* RANDY W. KING & LARRY W. SPEARMAN, PUBLIC AGENCY TRAINING COUNCIL, ADVANCED APPLICATIONS IN TRAFFIC ACCIDENT INVESTIGATION, PHASE II-MODULE 1: MINIMUM SPEEDS FROM SKIDS (1993) (explaining how to determine coefficients of friction using a drag sled constructed from a tire filled with concrete).

101. *See* Berkoff, *supra* note 7, at 852 (citing costs of $1000 to $4000 per second for computer simulations); Gahtan, *supra* note 35 (citing average costs of $1000 per second for computer animations); *see also* Holden, *supra* note 37, at 61 (citing ranges for costs); Brown, *supra* note 2, at 19 ("The use of the tools is usually driven by the size of the case.").

102. In fact, one consultant on the project, Professor Laura Ginger of Indiana University (Bloomington), speculates that the more computer literate that jurors are, the less impressed that they may be with computer simulations.

Although Barry Sullivan argues a contrary position, he acknowledges the problem: "A [Computer Generated Re-enactment] is only as good as the underlying eyewitness testimony, physical data, and engineering assumptions that drive its images. In other words, the old computer maxim 'garbage in, garbage out,' applies to CGRs." Sullivan, *supra* note 2, at 195. The more sophisticated audience is acutely aware of this principle.

103. David J. Richter stated:

In general, the cases best suited to animations include the following:

- intellectual property/patent infringement;
- reconstruction of aviation or automobile accidents; and [sic]

pirical research is needed to test the effectiveness of simulations in that more complex context.

- medical malpractice;
- product liability;
- biomedical/biotechnology;
- complex commercial litigation.

> The common thread shared by these cases include[s] the complexity of the concepts involved and the difficulty in both witnessing and understanding the processes or events, for one reason or another.

Richter, *supra* note 37, at S5; *see also* Weinberg, *supra* note 21, at 5B (citing similar kinds of uses for simulations).

Appendix
Table 1 (Base Case, Saw Computer Simulations)
Study #1

Col. 1	Col. 2	Col. 3	Col. 4	Col. 5
Jury Panel	Fault Assessed to Torino	Damage Assessed to Torino	Fault Assessed to State	Damage Assessed to State
	Percent	Dollars	Percent	Dollars
1	12.0	240,000	8.0	160,000
2	34.0	899,314	0.0	0
3	0.0	0	66.0	2,970,000
4	40.0	1,400,000	20.0	700,000
5	0.0	0	5.0	173,643
6	35.0	2,100,000	0.0	0
7	5.0	92,500	35.0	647,500
8	30.0	802,050	30.0	802,050
9	5.0	272,200	5.0	272,200
10	20.0	450,000	50.0	1,125,000
11	23.0	1,369,644	23.0	1,369,644
12	10.0	336,960	20.0	673,920
13	30.0	1,357,572	40.0	1,810,096
14	15.0	267,974	15.0	267,974
15	15.0	828,786	35.0	1,933,834
16	15.0	375,000	10.0	250,000
17	0.0	0	0.0	0
18	30.0	1,830,000	40.0	2,440,000
19	0.0	0	10.0	122,010
20	0.0	0	10.0	174,485
21	5.0	11,005	10.0	22,010
22	20.0	600,000	5.0	150,000
23	10.0	600,000	40.0	2,400,000
24	30.0	1,290,000	10.0	430,000
25	50.0	2,993,760	15.0	898,128
26	55.0	3,300,000	5.0	300,000
27	0.0	0	0.0	0
28	5.0	360,000	5.0	360,000
29	10.0	22,010	20.0	44,020
30	15.0	900,000	35.0	2,100,000
31	15.0	155,087	15.0	155,087
32	0.0	0	10.0	452,524
33	0.0	0	10.0	344,637
34	0.0	0	0.0	0
35	10.0	280,354	25.0	700,885
36	10.0	100,000	25.0	250,000
37	0.0	0	20.0	689,274
38	25.0	717,400	0.0	0
39	55.0	3,685,000	35.0	2,345,000
40	10.0	735,982	50.0	3,679,908
41	0.0	0	40.0	2,400,000
42	30.0	1,800,000	40.0	2,400,000
43	10.0	9,410	0.0	0
44	40.0	3,600,000	20.0	1,800,000
45	50.0	1,737,870	0.0	0
Mean	17.2	789,331	19.0	840,307
Median	12.0	360,000	15.0	360,000
St. Dev.	0.164	1,015,269	0.166	977,664

Table 1 (Continued)
Study #1

Col. 6	Col. 7	Col. 8	Col. 9	Col. 10
Fault Assessed to Torino+State	Damage Assessed to Torino +State	Fault Assessed to Dawn	Damage Assessed to Dawn	Total Damages
Percent	Dollars	Percent	Dollars	Dollars
20.0	400,000	80.0	1,600,000	2,000,000
34.0	899,314	66.0	1,745,726	2,645,040
66.0	2,970,000	34.0	1,530,000	4,500,000
60.0	2,100,000	40.0	1,400,000	3,500,000
5.0	173,643	95.0	3,299,217	3,472,860
35.0	2,100,000	65.0	3,900,000	6,000,000
40.0	740,000	60.0	1,110,000	1,850,000
60.0	1,604,100	40.0	1,069,400	2,673,500
10.0	544,400	90.0	4,899,600	5,444,000
70.0	1,575,000	30.0	675,000	2,250,000
46.0	2,739,287	54.0	3,215,685	5,954,972
30.0	1,010,880	70.0	2,358,720	3,369,600
70.0	3,167,668	30.0	1,357,572	4,525,240
30.0	535,948	70.0	1,250,544	1,786,492
50.0	2,762,620	50.0	2,762,620	5,525,240
25.0	625,000	75.0	1,875,000	2,500,000
0.0	0	100.0	0	0
70.0	4,270,000	30.0	1,830,000	6,100,000
10.0	122,010	90.0	1,098,090	1,220,100
10.0	174,485	90.0	1,570,365	1,744,850
15.0	33,015	85.0	187,085	220,100
25.0	750,000	75.0	2,250,000	3,000,000
50.0	3,000,000	50.0	3,000,000	6,000,000
40.0	1,720,000	60.0	2,580,000	4,300,000
65.0	3,891,888	35.0	2,095,632	5,987,520
60.0	3,600,000	40.0	2,400,000	6,000,000
0.0	0	100.0	0	0
10.0	720,000	90.0	6,480,000	7,200,000
30.0	66,030	70.0	154,070	220,100
50.0	3,000,000	50.0	3,000,000	6,000,000
30.0	310,174	70.0	723,738	1,033,911
10.0	452,524	90.0	4,072,716	4,525,240
10.0	344,637	90.0	3,101,733	3,446,370
0.0	0	100.0	0	0
35.0	981,239	65.0	1,822,302	2,803,541
35.0	350,000	65.0	650,000	1,000,000
20.0	689,274	80.0	2,757,096	3,446,370
25.0	717,400	75.0	2,152,200	2,869,600
0.9	6,030,000	10.0	670000	6,700,000
60.0	4,415,889	40.0	2,943,926	7,359,815
40.0	2,400,000	60.0	3,600,000	6,000,000
70.0	4,200,000	30.0	1,800,000	6,000,000
10.0	9,410	90.0	84,690	94,100
60.0	5,400,000	40.0	3,600,000	9,000,000
50.0	1,737,870	50.0	1,737,870	3,475,740
36.2	**1,629,638**	**63.8**	**2,009,124**	**3,638,762**
35.0	**899,314**	**65.0**	**1,822,302**	**3,446,370**
0.234	**1,611,505**	**0.234**	**1,386,667**	**2,334,654**

Table 2 (Variant Case, Did Not See Computer Simulations)
Study #1

Col. 1	Col. 2	Col. 3	Col. 4	Col. 5
Jury Panel	Fault Assessed to Torino	Damage Assessed to Torino	Fault Assessed to State	Damage Assessed to State
	Percent	Dollars	Percent	Dollars
1	10.0	172,000	0.0	0
2	10.0	600,000	20.0	1,200,000
3	20.0	910,000	0.0	0
4	41.0	1,865,553	20.0	910,026
5	10.0	572,200	0.0	0
6	25.0	1,250,000	10.0	500,000
7	30.0	1,800,000	7.5	450,000
8	15.0	675,000	30.0	1,350,000
9	0.0	0	20.0	238,199
10	40.0	1,018,713	0.0	0
11	35.0	2,277,398	35.0	2,277,398
12	12.5	363,467	12.5	363,467
13				
14	0.0	0	35.0	70,525
15	45.0	4,050,000	45.0	4,050,000
16	0.0	0	0.0	0
17	0.0	0	0.0	0
18	70.0	4,168,480	30.0	1,786,492
19	10.0	22,010	10.0	22,010
20	70.0	5,151,871	10.0	735,982
21				
22	20.0	1,080,618	10.0	540,309
23	20.0	556,948	30.0	835,422
24	0.0	0	0.0	0
25	0.0	0	0.0	0
26	0.0	0	0.0	0
27	20.0	595,297	30.0	892,946
28	30.0	562,722	20.0	375,148
29	30.0	1,365,039	50.0	2,275,065
30	0.0	0	0.0	0
31	48.3	2,187,048	0.0	0
32	10.0	410,000	25.0	1,025,000
33	30.0	570,000	20.0	380,000
34	30.0	2,000,000	0.0	0
35	0.0	0	70.0	210,000
36	35.0	1,504,766	30.0	1,289,800
37	45.0	2,679,737	10.0	595,497
38	0.0	0	0.0	0
Mean	21.2	1,066,913	16.1	621,480
Median	20.0	583,749	10.0	369,307
Std. Dev.	19.6	1,295,220	17.2	870,408

Table 2 (Continued)
Study # 1

Col. 6	Col. 7	Col. 8	Col. 9	Col. 10
Fault Assessed to Torino+State	Damage Assessed to Torino+State	Fault Assessed to Dawn	Damage Assessed to Dawn	Total Damages
Percent	Dollars	Percent	Dollars	Dollars
10.0	172,000	90.0	1,548,000	1,720,000
30.0	1,800,000	70.0	4,200,000	6,000,000
20.0	910,000	80.0	3,640,000	4,550,000
61.0	2,775,579	39.0	1,774,551	4,550,130
10.0	572,200	90.0	5,149,800	5,722,000
35.0	1,750,000	65.0	3,250,000	5,000,000
37.5	2,250,000	62.5	3,750,000	6,000,000
45.0	2,025,000	55.0	2,475,000	4,500,000
20.0	238,199	80.0	952,795	1,190,994
40.0	1,018,713	60.0	1,528,069	2,546,782
70.0	4,554,796	30.0	1,952,056	6,506,852
25.0	726,934	75.0	2,180,801	2,907,735
35.0	70,525	65.0	130,975	201,500
90.0	8,100,000	10.0	900,000	9,000,000
0.0	0	100.0	220,000	220,000
0.0	0	100.0	0	0
100.0	5,954,972	0.0	0	5,954,972
20.0	44,020	80.0	176,080	220,100
80.0	5,887,852	20.0	1,471,963	7,359,815
30.0	1,620,928	70.0	3,782,164	5,403,092
50.0	1,392,370	50.0	1,392,370	2,784,740
0.0	0	100.0	0	0
0.0	0	100.0	0	0
0.0	0	100.0	0	0
50.0	1,488,243	50.0	1,488,243	2,976,486
50.0	937,870	50.0	937,870	1,875,740
80.0	3,640,104	20.0	910,026	4,550,130
0.0	0	100.0	0	0
48.3	2,187,048	51.7	2,338,192	4,525,240
35.0	1,435,000	65.0	2,665,000	4,100,000
50.0	950,000	50.0	950,000	1,900,000
30.0	2,000,000	70.0	4,666,666	6,666,666
70.0	210,000	30.0	90,000	300,000
65.0	2,794,566	35.0	1,504,766	4,299,332
55.0	3,275,235	45.0	2,679,737	5,954,972
0.0	0	100.0	0	0
37.3	1,688,393	62.7	1,630,698	3,319,091
35.0	1,205,541	65.0	1,480,103	3,538,243
28.0	1,935,249	28.0	1,490,228	2,600,216

Table 3 (Base Case, Saw Computer Simulations)
Study #2

Col. 1	Col. 2	Col. 3	Col. 4	Col. 5
Juror	Fault Assessed to Torino	Fault Assessed to State	Fault Assessed to Torino+State	Fault Assessed to Dawn
	Percent	Percent	Percent	Percent
1	60	30	90	10
2	80	20	100	0
3	60	5	65	35
4	50	10	60	40
5	75	5	80	20
6	50	10	60	40
7	35	0	35	65
8	10	5	15	85
9	60	15	75	25
10	25	15	40	60
11	45	10	55	45
12	15	15	30	70
13	50	40	90	10
14	40	40	80	20
15	85	5	90	10
16	70	30	100	0
17	0	0	0	100
18	0	20	20	80
19	35	30	65	35
20	20	5	25	75
21	20	60	80	20
22	78	20	98	2
23	70	10	80	20
24	20	0	20	80
25	10	10	20	80
26	80	0	80	20
27	55	10	65	35
28	50	20	70	30
29	50	10	60	40
30	20	30	50	50
31	45	20	65	35
32	85	15	100	0
33	10	30	40	60
34	0	20	20	80
35	90	10	100	0
36	35	10	45	55
37	30	0	30	70
38	10	5	15	85
39	100	0	100	0
40	50	0	50	50
41	10	70	80	20
42	45	10	55	45
43	30	60	90	10
Mean	43.2	17.0	60.2	39.8
Median	45.0	10.0	35.0	65.0
Std. Dev.	27.4	16.8	28.8	28.8

Table 4 (Variant Case, Did Not See Computer Simulations)
Study #2*

Col. 1	Col. 2	Col. 3	Col. 4	Col. 5
Juror	Fault Assessed to Torino	Fault Assessed to State	Fault Assessed to Torino+State	Fault Assessed to Dawn
	Percent	Percent	Percent	Percent
1	20	50	70	30
2	10	10	20	80
3	40	50	90	10
4	35	25	60	40
5	50	40	90	10
6	65	25	90	10
7	20	70	90	10
8	80	0	80	20
9	10	70	80	20
10	0	0	0	100
11	75	25	100	0
12	40	0	40	60
13	40	1	41	59
14	0	10	10	90
15	59	30	89	11
16	60	5	65	35
17	20	30	50	50
18	5	20	25	75
19	5	20	25	75
20	70	10	80	20
21	30	50	80	20
22	0	0	0	100
23	35	15	50	50
24	35	5	40	60
25	45	5	50	50
26	0	0	0	100
27	30	60	90	10
28	20	0	20	80
29	20	0	20	80
30	30	40	70	30
31	20	0	20	80
32	15	0	15	85
33	40	20	60	40
34	40	40	80	20
35	30	40	70	30
36	20	0	20	80
37	15	0	15	85
38	40	20	60	40
39	40	40	80	20
40	60	0	60	40

*This chart is continued on the next page.

Table 4 (Continued)
Study #2

Col. 1	Col. 2	Col. 3	Col. 4	Col. 5
Juror	Fault Assessed to Torino	Fault Assessed to State	Fault Assessed to Torino+State	Fault Assessed to Dawn
	Percent	Percent	Percent	Percent
41	10	10	20	80
42	20	20	40	60
43	75	25	100	0
44	40	10	50	50
45	30	0	30	70
46	40	0	40	60
47	70	0	70	30
48	90	0	90	10
49	40	50	90	10
50	40	0	40	60
51	80	10	90	10
52	75	5	80	20
53	75	15	90	10
54	30	50	80	20
55	50	40	90	10
56	40	0	40	60
57	32	3	35	65
58	85	15	100	0
59	75	5	80	20
60	80	12	92	8
61	40	10	50	50
Mean	39.11	18.13	57.25	42.75
Median	40	10	60	40
Std. Dev.	24.48	19.75	29.84	29.84