

# Notes

## Computer Simulations: How They Can Be Used at Trial and the Arguments for Admissibility

### I. INTRODUCTION

As litigation has become more complex, attorneys are constantly seeking new techniques to prove their cases. As a result, many litigators are turning to new forms of evidence to help explain and dramatize the evidence they must rely upon to persuade the judge or jury. One type of evidence considered to have great promise for this purpose is the computer simulation. In a computer simulation, data which is representative of actual events is manipulated by the computer to produce an animated simulation capable of display in the courtroom.<sup>1</sup>

The evidence is generally introduced for the purpose of simplifying potentially technical areas.<sup>2</sup> Thus, it may prove to be particularly useful in mid-air collision cases, wake turbulence cases, weather-related cases, automobile accident litigation, and admiralty cases.<sup>3</sup> These types of cases are particularly well-suited for the use of computer simulation techniques because they contain issues of movement and perspective. The computer simulation can supply the element of motion, thereby enabling visualization by the jury. Two simulation techniques can be utilized for different purposes depending upon the needs of the attorney: computer-generated reconstructions and computer-generated visualizations.<sup>4</sup> The reconstruction can demonstrate the movement of many objects in a three-dimensional world, while computer-generated visualizations present a three-dimensional scene.<sup>5</sup> This Note will consider the potential uses of computer simulations, with a brief discussion of the technical aspect of producing a simulation. The main focus of the Note, however, will be a practical consideration of the admissibility problems an attorney may face upon introduction of evidence utilizing such techniques. Further, the Note will focus on potential arguments the attorney may advance in order to lay a proper foundation for the introduction of the computer simulation under common law principles of demonstrative evidence, the *Frye* stand-

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<sup>1</sup>Schaeffer v. General Motors Corp., 372 Mass. 171, 177, 360 N.E.2d 1062, 1066-67 (1977).

<sup>2</sup>Dombroff, *Demonstrative Evidence*, TRIAL, July 1982, at 52.

<sup>3</sup>*Id.*

<sup>4</sup>*Id.*

<sup>5</sup>*Id.*

ard of general acceptance,<sup>6</sup> and the relevance/balancing test of the Federal Rules of Evidence.<sup>7</sup>

## II. BACKGROUND INFORMATION ON LITIGATION USES AND SIMULATION PREPARATION

Several reported cases where parties have sought to present computer simulation evidence are illustrative of the potential uses at trial.<sup>8</sup> Although computer simulations are probably best suited for accident reconstruction in tort litigation, simulations have also been used to demonstrate the perfectibility of a product, to reconstruct an accident in a criminal trial, to demonstrate the ability of a product to function as it was intended, and to calculate the fair market value of land in an eminent domain proceeding.<sup>9</sup>

In *Perma Research and Development v. Singer Co.*,<sup>10</sup> Perma had assigned a patent to Singer to perfect, manufacture, and market an anti-skid device. Perma brought an action for Singer's breach of contractual obligation to use its best efforts to perform those functions. Singer's defense was an abandonment of contract claiming the device was not perfectible. Perma was permitted to present expert testimony based on computer simulations indicating that the anti-skid device was perfectible. As a result, Perma was awarded nearly seven million dollars in damages.<sup>11</sup>

In *People v. McHugh*,<sup>12</sup> defense counsel presented a computer reenactment of a car accident which resulted in the death of four teenagers. The experts closely examined the accident scene and the police reports to determine where the wreckage was found, where the car hit the wall, and finally, where McHugh and the four bodies were found. Then, the experts applied the laws of physics to the observed data. They found that the observed data did not correspond to the prosecution's version of the accident, which surmised that McHugh, apparently drunk at the wheel, lost control of his Mustang at eighty miles per hour and slammed into the wall. Instead, they concluded that the only way the accident could have happened was if the car, going forty-five miles per hour, slid off the rain-slick roadway, hit an uncovered manhole, and slammed into the wall. The experts determined that if the manhole had not been

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<sup>6</sup>*Frye v. United States*, 293 F. 1013 (D.C. Cir. 1923).

<sup>7</sup>FED. R. EVID. 403.

<sup>8</sup>*United States v. 1,606.00 Acres of Land, Etc.*, 698 F.2d 402 (10th Cir. 1983); *Perma Research and Dev. v. Singer Co.*, 542 F.2d 111 (2d Cir.), *cert. denied*, 429 U.S. 987 (1976); *Holland v. Dick Youngberg Chevrolet*, 348 N.W.2d 770 (Minn. App. 1984); *People v. McHugh*, 124 Misc. 2d 559, 476 N.Y.S.2d 721 (N.Y. Sup. Ct. 1984).

<sup>9</sup>*See infra* notes 10-20 and accompanying text.

<sup>10</sup>542 F.2d 111 (2d Cir.), *cert. denied*, 429 U.S. 987 (1976).

<sup>11</sup>*Id.* at 113.

<sup>12</sup>124 Misc. 2d 559, 476 N.Y.S.2d 721 (N.Y. Sup. Ct. 1984).

left uncovered, the accident could have been avoided.<sup>13</sup> The simulation was introduced into evidence and the jury acquitted McHugh of four counts of manslaughter.<sup>14</sup>

The Minnesota Court of Appeals allowed the introduction of a computer simulation in *Holland v. Dick Youngberg Chevrolet*.<sup>15</sup> The case concerned a revocation of acceptance of a contract, based on inadequate power of a truck to haul a full load. The appellant car dealership offered the simulation to show that its truck could haul 50,000 pounds at highway speed.<sup>16</sup> Despite the fact that the evidence was admitted, the jury concluded that the truck lacked power and that this lack of power was a substantial impairment that interfered with the purpose for which the truck was purchased.<sup>17</sup> Consequently, Holland was permitted to revoke his acceptance.<sup>18</sup>

Another use of simulation at trial was demonstrated in *United States v. 1,606.00 Acres of Land, Etc.*<sup>19</sup> The United States brought an eminent domain action to subordinate all oil, gas, and other mineral rights on certain tracts of land to the right of the United States to flood the tracts as necessary for construction or operation of a reservoir. In order to aid in the determination of fair market value, the royalty owners presented an expert who gave extensive testimony based on computer simulations of the various present worths of the royalty interests under five wells depending upon certain price conditions for the products.<sup>20</sup>

Further, simulation techniques are frequently used to reconstruct accidents.<sup>21</sup> Post-accident data such as the friction co-efficient of the pavement and the length of the skid marks are programmed into the computer.<sup>22</sup> "By trial and error, the computer . . . then determine[s] what impact speed would yield a reconstruction most consistent with this physical evidence."<sup>23</sup> The computer program assigns to the variables values that most closely correspond with the observed data.<sup>24</sup>

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<sup>13</sup>Harper, *Computer Evidence Is Coming*, A.B.A. J., Nov. 1984, at 80, 84.

<sup>14</sup>*McHugh*, 124 Misc. 2d at 560, 476 N.Y.S.2d at 723.

<sup>15</sup>348 N.W.2d 770 (Minn. App. 1984).

<sup>16</sup>*Id.* at 774.

<sup>17</sup>*Id.* at 775.

<sup>18</sup>*Id.* at 776.

<sup>19</sup>698 F.2d 402 (10th Cir. 1983).

<sup>20</sup>*Id.* at 403-04.

<sup>21</sup>Dombroff, *supra* note 2.

<sup>22</sup>*See Schaeffer v. General Motors Corp.*, 372 Mass. 171, 177, 360 N.E.2d 1062, 1066-67 (1977).

<sup>23</sup>*Id.* at 177, 360 N.E.2d at 1067.

<sup>24</sup>*See, e.g., Starr v. Campos*, 134 Ariz. 254, 655 P.2d 794 (1982) (scientific evidence may be admitted if it is derived from principles and procedures that have achieved general acceptance — widespread use is without significant objection from the relevant scientific community); *Schaeffer v. General Motors Corp.*, 372 Mass. 171, 360 N.E.2d 1062 (1977) (before simulation results can be admitted, the judge must conduct a hearing in the absence of the jury to determine if the evidence meets the prescribed standards for admissibility).

A final reported case involving computer simulations is *McDonnell Douglas Corp. v. United States*.<sup>25</sup> McDonnell Douglas introduced computer simulations to demonstrate a reduction to practice of a missile for which they sought a patent. A reduction to practice for purposes of patentability is accomplished when the inventor's conception is embodied in such a form as to render it capable of practical and successful use.<sup>26</sup> The court found the computer simulations inadequate to prove a reduction to practice because subsequent physical testing had revealed significant flaws in design.<sup>27</sup> However, the court did not rule out the possible future use of computer simulations to demonstrate a reduction to practice absent subsequent contrary physical tests. The above examples provide a sample of potential uses of computer simulations at trial, but they are by no means conclusive or exhaustive.<sup>28</sup>

Aviation accidents, for example, are well suited for the use of computer simulations because they "involve the analysis of the movements of many objects in a three-dimensional world with critical events occurring at known times."<sup>29</sup> Additionally, reconstruction of mid-air collisions is illustrative of the general process used for all types of simulation construction. The first step is a computation of the flight paths of the aircraft.<sup>30</sup> Known data is programmed into the computer to calculate either location or velocity, heading and rate of climb or descent.<sup>31</sup> The computer is also programmed with the mathematical formulas necessary to determine the bank angle and turn radius from the known variables.<sup>32</sup>

The flight paths are then superimposed on a map of the collision area with a symbol by each aircraft to indicate the time at which the

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<sup>25</sup>670 F.2d 156 (Ct. Cl. 1982).

<sup>26</sup>BLACK'S LAW DICTIONARY 1150 (5th ed. 1979).

<sup>27</sup>*McDonnell Douglas Corp.*, 670 F.2d at 161.

<sup>28</sup>Interview with Michael Pape, engineer, Wolf Technical Services, Inc., Indianapolis, Ind. (September 13, 1985). Mr. Pape discussed several simulations prepared by that company for purposes of litigation. One case concerned negligence on the part of a city in piling snow next to a guardrail. The driver of a Jeep lost control of his vehicle on a slippery street, ran into the piled-up snow, and was launched onto the street below an overpass, suffering severe injuries. By collecting post-accident data, the engineers were able to reconstruct the accident and to demonstrate that if the snow had not been present, the Jeep would have skidded along the guardrail and returned to the roadway thereby greatly reducing the injuries of the driver. The simulation serves the important function of demonstrating the "what if" possibilities of an accident, by providing for recreation under different circumstances.

The engineers at Wolf Technical Services were also able to use a computer simulation to determine the murder weapon in a beating case. Working in conjunction with doctors, the engineers established a pattern of the blows and thereby positively determined that the murder weapon was a tennis shoe.

<sup>29</sup>Dombroff, *supra* note 2, at 52.

<sup>30</sup>*Id.*

<sup>31</sup>*Id.*

<sup>32</sup>*Id.*

aircraft occupied that position.<sup>33</sup> During trial, this figure can be used to explain time and distance factors relating to the accident. Further, it can be used with eyewitness testimony to explain the relative positions of the aircraft.

The next step in aircraft accident analysis is to prepare a cockpit field of view from each aircraft to determine whether any part of the aircraft structure obstructed the pilot's view of the other aircraft.<sup>34</sup> The computer can generate photographs that depict on a progressive basis what each pilot and the air traffic controller could see from his vantage point.<sup>35</sup> This figure may be used in conjunction with an expert pilot witness to determine which one of the pilots had the time to "see and avoid" the accident.<sup>36</sup>

Computer-generated graphic visualizations should be useful where questions of three-dimensional perspectives arise.<sup>37</sup> Assume you are representing a driver involved in a rear-end collision. There is a question of whether your client could see a road sign off to the side of the road in front of the first car.<sup>38</sup> The computer can make three-dimensional representations of the objects in interest, presenting the scene from any point of view, for example, your client's point of view.<sup>39</sup> After the program is complete, distances between the cars and the sign can be freely changed.<sup>40</sup> By assuming starting points and velocities for each car, a time sequence of pictures can be produced.<sup>41</sup>

### III. GENERAL OBSERVATIONS ON POTENTIAL ADMISSION STANDARDS FOR COMPUTER SIMULATIONS

There are few reported cases dealing specifically with the admissibility of computer simulations; however, *Perma Research and Development v. Singer Co.*<sup>42</sup> is an important decision which considered the admissibility and use of simulations. In *Perma*, the Court of Appeals for the Second Circuit upheld the trial court's admission of expert testimony based on computer simulations.<sup>43</sup> The testimony was offered to refute Singer's defense that the anti-skid device was not perfectible, and consequently

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<sup>33</sup>*Id.* at 53.

<sup>34</sup>*Id.*

<sup>35</sup>*Id.*

<sup>36</sup>*Id.*

<sup>37</sup>*Id.*

<sup>38</sup>*Id.* at 54.

<sup>39</sup>*Id.*

<sup>40</sup>*Id.*

<sup>41</sup>*Id.*

<sup>42</sup>542 F.2d 111 (2d Cir.), *cert. denied*, 429 U.S. 987 (1976).

<sup>43</sup>*Id.* at 115.

Singer was not in breach of contract for failing to use its best efforts to develop, perfect, and market the device.<sup>44</sup>

Singer objected to the introduction of the testimony on the ground that it had not been given the underlying data and computer programs prior to trial and consequently did not have an adequate basis for cross-examination.<sup>45</sup> In upholding the admission of the evidence and affirming the trial court, the appellate court said:

While it might have been better practice for opposing counsel to arrange for the delivery of all details of the underlying data and theorems employed in these simulations in advance of trial to both avoid unnecessarily belabored discussion of highly technical, tangential issues at trial, Fed. R. Civ. P. 26(b)(4)(A), and protect truly prop[r]ietary aspects of the programs . . . . The trial judge did not abuse his discretion in allowing the experts to testify as to this particular basis for their ultimate conclusion that the Perma device was indeed perfectible.<sup>46</sup>

The court did not specifically discuss the process under which it provided for the admission of the evidence based on the simulations. Nevertheless, the evidence was admitted and Perma recovered seven million dollars,<sup>47</sup> a recovery based almost exclusively on expert testimony.

In determining an admission process for computer simulations, a trial judge will undoubtedly have several concerns. As Frederick B. Lacey, a United States district court judge, said:

Three questions face a judge who must decide whether scientific evidence is admissible at trial. First, is the underlying scientific principle valid? . . . The second inquiry is: Is the technique applying the scientific principle valid? . . . Finally, assuming that a valid technique does exist, the judge must ask: Was the technique applied properly on this particular occasion; that is, does the person applying the technique have the necessary skills to apply and to interpret the results of the technique?<sup>48</sup>

Within the framework of these three questions, the trial judge must determine the appropriate standard for evaluating the scientific principle and the technique applying it.<sup>49</sup> Three possible standards face the trial judge: a common law approach to demonstrative evidence, the *Frye* standard of general acceptance in the relevant scientific community, and

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<sup>44</sup>*Id.*

<sup>45</sup>*Id.*

<sup>46</sup>*Id.*

<sup>47</sup>*Id.* at 113.

<sup>48</sup>Lacey, *Scientific Evidence*, 24 JURIMETRICS J. 254, 255 (1984).

<sup>49</sup>*Id.*

a relevancy/balancing test.<sup>50</sup> Each standard is different in terms of its operation and the considerations each requires for admission.

Under a common law approach to demonstrative evidence, the test for admissibility is two-fold: is the object relevant to some issue in the case and is it actually explanatory of something that is important for the jury to understand?<sup>51</sup> The second possible admission standard, the *Frye* standard of general acceptance in the relevant scientific community, was promulgated by the United States Court of Appeals for the District of Columbia Circuit in 1923.<sup>52</sup> Finally, the judge may apply the relevancy/balancing approach suggested by the Federal Rules of Evidence, whereby relevant evidence is admissible provided its probative value is not outweighed by prejudice, potential to mislead the jury, or consumption of time.<sup>53</sup> Within each of these standards there is a logical argument for the admissibility of computer simulations. As Dean McCormick wrote, "[t]he manifest destiny of evidence law is a progressive lowering of the barriers of truth."<sup>54</sup>

#### IV. ADMISSIBILITY ARGUMENT UNDER EACH OF THE PROPOSED ADMISSION STANDARDS ON LITIGATION USES AND SIMULATION PREPARATION

##### A. *The Common Law Principles of Demonstrative Evidence*

In *People v. McHugh*,<sup>55</sup> a case involving the introduction of a computer reenactment of a car accident, the New York Supreme Court stated:

The evidence sought to be introduced here is more akin to a chart or diagram than a scientific device. Whether a diagram is hand drawn or mechanically drawn by means of a computer is of no importance . . . . A computer is not a gimmick and the court should not be shy about its use, when proper. Computers are simply mechanical tools — receiving information and acting on instructions at lightning speed. When the results are useful, they should be accepted, when confusing, they should be rejected. What is important is that the presentation be relevant to a possible defense, that it fairly and accurately reflect the oral

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<sup>50</sup>See generally *People v. McHugh*, 124 Misc. 2d 559, 476 N.Y.S.2d 721 (N.Y. Sup. Ct. 1984) (admitting a computer simulation as demonstrative evidence); Lacey, *supra* note 48 (discussing the *Frye* standard and the relevancy/balancing test).

<sup>51</sup>*Smith v. Ohio Oil Co.*, 10 Ill. App. 2d 67, 71, 134 N.E.2d 526, 530 (1956).

<sup>52</sup>*Frye v. United States*, 293 F. 1013 (D.C. Cir. 1923).

<sup>53</sup>FED. R. EVID. 401-403.

<sup>54</sup>MCCORMICK, HANDBOOK OF THE LAW OF EVIDENCE 165 (1st ed. 1954).

<sup>55</sup>124 Misc. 2d 559, 476 N.Y.S.2d 721 (N.Y. Sup. Ct. 1984).

testimony offered and that it be an aid to the jury's understanding of the issue.<sup>56</sup>

Thus, a computer simulation was held to be admissible in *McHugh* on the theory that it was more similar to demonstrative evidence resulting from a scientific principle than to real evidence.

Demonstrative evidence has been defined as "[t]hat evidence addressed directly to the senses without intervention of testimony."<sup>57</sup> The probative value of this evidence centers on its ability to aid the jury in comprehending the testimony of a witness. "Demonstrative evidence is evidence offered for the purpose of illustration and clarification. The theory justifying admission of this type of evidence requires only that the item be sufficiently explanatory or illustrative of relevant testimony in the case to be of potential help to the trier of fact."<sup>58</sup>

Demonstrative evidence, thus, must be illustrative and explanatory of a relevant issue in the case to be admissible. The general standard for relevance is whether the evidence has a logical tendency to make the existence of any fact of consequence to the determination of the action more or less probable.<sup>59</sup> Most jurisdictions have readily admitted demonstrative evidence, provided the party who offered the evidence laid an adequate foundation for it.<sup>60</sup> The desirability of giving the jury the best possible understanding of the subject on which it is to pass seems to have outweighed the concern that such evidence will have a prejudicial effect.<sup>61</sup> Nonetheless, courts do require that a foundation be laid, and generally, it is within the discretion of the trial judge to determine what constitutes an adequate foundation.<sup>62</sup>

As a rule of thumb, the litigator seeking to introduce a computer simulation can utilize specific strategies to help ensure that the court will find an adequate foundation. Courts will likely consider the accuracy of the simulation with a test of whether the evidence is sufficient to

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<sup>56</sup>*Id.* at 560, 476 N.Y.S.2d at 722-23.

<sup>57</sup>BLACK'S LAW DICTIONARY 389 (5th ed. 1979).

<sup>58</sup>*Pilkington v. Hendricks County Rural Elec. Co.*, 460 N.E.2d 1000, 1010 (Ind. Ct. App. 1984) (quoting MCCORMICK, EVIDENCE § 212 (1972)). See generally *Slow Dev. Co. v. Coulter*, 88 Ariz. 122, 353 P.2d 890 (1960); *McKee v. Chase*, 73 Idaho 491, 253 P.2d 787 (1953); *Smith v. Ohio Oil Co.*, 10 Ill. App. 2d 67, 134 N.E.2d 526 (1956).

<sup>59</sup>See generally *Goff v. Continental Oil Co.*, 678 F.2d 593 (5th Cir. 1982); *United States v. Carter*, 522 F.2d 666 (D.C. Cir. 1975); *Papizzo v. O. Robertson Transp. Ltd.*, 401 F. Supp. 540 (E.D. Mich. 1975); *In re Marriage of Gray*, 422 N.E.2d 696 (Ind. Ct. App. 1981).

<sup>60</sup>Moore, *Basic Practice Guide for Demonstrative, Experimental, and Scientific Evidence*, 50 INS. COUNS. J. 279, 281 (1983).

<sup>61</sup>*Smith v. Ohio Oil Co.*, 10 Ill. App. 2d 67, 134 N.E.2d 526 (1956); see also *Stath v. Williams*, 174 Ind. App. 369, 367 N.E.2d 1120 (1977); Moore, *supra* note 60.

<sup>62</sup>Moore, *supra* note 60.

provide an adequate foundation assuring the accuracy of the process.<sup>63</sup> Consequently, the attorney can work toward laying a proper foundation by describing how the computer system operates and by showing that the evidence produced was accurate.<sup>64</sup> Utilization of a test program with known results would be extremely helpful in this regard.<sup>65</sup> Further, it is necessary to consider the flow of information into, through, and out of the computer system.<sup>66</sup> All steps in the processing and storage of information should be reviewed.<sup>67</sup> The litigator must demonstrate that the program provides for every contingency. He should show that, if the computer encounters data it does not know how to process, the data will be flagged instead of erroneously processed.<sup>68</sup> Finally, the simulation program should contain verification procedures and safeguards to eliminate potential sources of error at each step in the information flow.<sup>69</sup>

As a final measure to ensure admissibility, the computer simulation should be adopted by the expert witness as substantially correct in order to be formally introduced as part of the witness' testimony, in which it is incorporated by reference.<sup>70</sup> Another essential element preceding the introduction of demonstrative evidence is having the witness affirm that the illustrative evidence is a reasonable, accurate representation of his testimony.<sup>71</sup> Thus, if a litigator lays an adequate foundation and presents expert testimony adopting the evidence as accurate and reliable, a computer simulation should be admissible as demonstrative evidence.

### B. *The Frye Standard of General Acceptance*

1. *Statement of the Standard.* — In *Frye v. United States*,<sup>72</sup> the Court of Appeals for the District of Columbia Circuit excluded expert testimony based on a "systolic blood pressure deception test," a forerunner of the modern polygraph. The court wrote:

Just when a scientific principle or discovery crosses the line between the experimental and demonstrable stages is difficult to

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<sup>63</sup>*Ferguson v. Commonwealth*, 212 Va. 745, 187 S.E.2d 189 (1972), *cert. denied*, 409 U.S. 861 (1972); 3 WIGMORE, EVIDENCE § 790 (1970).

<sup>64</sup>See Roberts, *A Practitioner's Primer on Computer-Generated Evidence*, 41 U. CHI. L. REV. 254, 256-63 (1974); Sprowl, *Evaluating the Credibility of Computer-Generated Evidence*, 52 CHI.-[ ]KENT L. REV. 547, 557-60 (1976).

<sup>65</sup>Sprowl, *supra* note 64, at 557-60.

<sup>66</sup>*Id.*

<sup>67</sup>*Id.*

<sup>68</sup>*Id.*

<sup>69</sup>*Id.*

<sup>70</sup>*Hanford v. Cole*, 402 P.2d 209 (Wyo. 1965); *see also Payne v. Jones*, 284 Ala. 196, 224 So. 2d 230 (1969); *Jones v. State*, 269 Ind. 543, 381 N.E.2d 1064 (1978).

<sup>71</sup>*Jones v. State*, 269 Ind. 543, 545-46, 381 N.E.2d 1064, 1066 (1978).

<sup>72</sup>293 F. 1013 (D.C. Cir. 1923).

define. Somewhere in this twilight zone the evidential force of the principle must be recognized, and while courts will go a long way in admitting expert testimony deduced from a well-recognized scientific principle or discovery, the thing from which the deduction is made must be sufficiently established to have gained general acceptance in the particular field in which it belongs.<sup>73</sup>

Under the *Frye* standard, it is not sufficient for a qualified expert or even several experts to testify that a particular scientific technique is valid; *Frye* imposes a special burden — the technique must be generally accepted in the relevant scientific community.<sup>74</sup>

The perceived benefits of *Frye* center on its conservative nature and the fact that it excludes evidence that is not proven to be sufficiently accurate. Proponents of the *Frye* standard assert that the principal justification for the standard is that it screens out unreliable scientific evidence, providing for greater accuracy and fairness at trial.<sup>75</sup>

A blistering dissent in *Perma Research and Development v. Singer Co.*<sup>76</sup> by Judge Van Graafeiland summarized many of the concerns that accompany the use of computer simulations as a basis for testimony, concerns that closely mesh with the concerns of *Frye* proponents. He argued that the simulations and the testimony based thereon should not be admitted because the plaintiff's failure to disclose the programs denied the defendant the right to cross-examine the expert; a proper foundation was lacking because the algorithm used in the simulation was apparently based on hearsay; the simulation was not broad enough because it failed to provide for changes in models, cars, road surfaces, road grades, weather, and altitudes; and finally, the testimony was merely speculation, since there were no parallel experiments to establish the simulation's reliability.<sup>77</sup> Van Graafeiland further stated his concern for the use of simulations:

Although the computer has tremendous potential for improving our system of justice by generating more meaningful evidence than was previously available, it presents a real danger of being the vehicle of introducing erroneous, misleading, or unreliable evidence. The possibility of an undetected error in computer-generated evidence is a function of many factors: the underlying data may be hearsay; errors may be introduced in any one of several stages of processing; the computer might be erroneously

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<sup>73</sup>*Id.* at 1014.

<sup>74</sup>Giannelli, *Symposium on Science and Rules of Evidence*, 99 F.R.D. 188, 189 (1983).

<sup>75</sup>*Id.* at 191.

<sup>76</sup>542 F.2d 111, 116 (1976) (Van Graafeiland, J., dissenting).

<sup>77</sup>*Id.* at 121-24.

programmed, programmed to permit an error to go undetected, or programmed to introduce error into the data; and the computer may inaccurately display the data or display it in a biased manner.<sup>78</sup>

Proponents of the *Frye* standard argue further that it is necessary to avoid the "misleading aura of certainty which often envelops a new scientific process."<sup>79</sup> The *Frye* standard is viewed as a means of excluding evidence to which lay jurors often attribute a mystical infallibility.<sup>80</sup>

In two cases, *Schaeffer v. General Motors*<sup>81</sup> and *Starr v. Campos*,<sup>82</sup> state supreme courts have prevented the admission of computer simulations at the trial court level, with each court calling for a *Frye* hearing prior to future introduction. In *Schaeffer*, the plaintiff, whose car crossed the center line and hit an oncoming vehicle, brought an action for negligence in the manufacture and design of an optional differential. An optional differential is an arrangement of gears permitting the rotation of two shafts at different speeds, providing for different rates of wheel rotation on curves. The defendant introduced a computer simulation of the accident, which purported to show that the differential did not adversely affect the operation of the plaintiff's automobile. The Supreme Judicial Court of Massachusetts stated its concern with the trial judge's admission of the evidence:

Our concern is not with the precision of electronic calculations, but with the accuracy and completeness of the initial data and equations which are used as ingredients of the computer program. More generally, we feel that the standard for admissibility of scientific tests may not have been met in this instance. That standard was clearly enunciated in *Commonwealth v. Fatalo*: "Judicial acceptance of a theory or instrument can occur only when it follows a general acceptance by the community of scientists involved."<sup>83</sup>

The court was concerned because the authorities cited by the parties were in substantial disagreement as to the reliability of the computer simulation. Thus, the court promulgated a two-part process to aid in

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<sup>78</sup>*Id.* at 125 (quoting Roberts, *A Practitioner's Primer on Computer-Generated Evidence*, 41 U. CHI. L. REV. 254, 255-56 (1974)).

<sup>79</sup>*People v. Kelly*, 17 Cal. 3d 24, 32, 549 P.2d 1240, 1245, 130 Cal. Rptr. 144, 149 (1976) (quoting *Huntingdon v. Crowley*, 64 Cal. 2d 647, 656, 414 P.2d 382, 390, 51 Cal. Rptr. 254, 262 (1966)).

<sup>80</sup>*United States v. Addison*, 498 F.2d 741 (D.C. Cir. 1974).

<sup>81</sup>372 Mass. 171, 360 N.E.2d 1062 (1977).

<sup>82</sup>134 Ariz. 254, 655 P.2d 794 (1982).

<sup>83</sup>*Schaeffer*, 372 Mass. at 177-78, 360 N.E.2d at 1067 (citation omitted).

the judge's determination of whether such evidence is admissible. The court established that the judge should:

(a) Conduct a hearing in the absence of the jury on the question whether the tests conducted and results ascribed thereto meet the prescribed [general acceptance] standards for admissibility of such evidence, and

(b) that he put into the record, by dictation, for the transcript or otherwise, the findings of fact made by him as the basis for the admission or exclusion of the evidence in question.<sup>84</sup>

Thus, although the simulation was excluded, on remand it could possibly be admitted after the hearing.

In *Starr v. Campos*,<sup>85</sup> the Arizona Supreme Court was not convinced that the trial court had used the appropriate standard for determining admissibility. Scientific evidence is only to be admitted in Arizona if it is derived from principles and procedures that have achieved general acceptance in their respective scientific fields.<sup>86</sup> Under this standard, according to the *Starr* court, "it is not sufficient that any one expert relies upon the technique in question or that the technique is 'widely used,' unless that widespread use is without significant objection from the relevant scientific community."<sup>87</sup> As a result, the court established the guidelines that would control subsequent offerings of this type of evidence:

[T]he court is directed to apply the *Frye* standard and determine specifically, in the absence of the jury, whether the procedure used to obtain that evidence is generally accepted among scientists in the relevant fields, including accident reconstruction and automotive engineering. In making this determination *the court may take judicial notice* of the ability of a properly programmed computer to perform mathematical computation and of *the general acceptance of the underlying principle of the method, the law of conservation of linear momentum*. It will only be necessary to determine whether those of sufficient training and experience to judge are in general agreement that the program properly applies that principle (and any others it may involve) to automobile collisions.<sup>88</sup>

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<sup>84</sup>*Id.*

<sup>85</sup>134 Ariz. 254, 655 P.2d 794 (1982).

<sup>86</sup>State v. Mena, 128 Ariz. 226, 231, 624 P.2d 1274, 1279 (1982).

<sup>87</sup>134 Ariz. at 257, 655 P.2d at 797.

<sup>88</sup>*Id.* at 257-58, 655 P.2d at 797-98 (emphasis added).

Again, the court here did not rule out the possibility of admission of the simulations on remand; it merely called for a *Frye* hearing prior to such admission in the future.

*Frye* is not without criticism. *Schaeffer*<sup>89</sup> and *Starr*<sup>90</sup> are indicative of one of the problems opponents perceive in the use of *Frye*, the vague nature of "general acceptance." Is general acceptance required of the underlying theory or of the technique applying it? Case law is far from clear on this point.<sup>91</sup> The *Schaeffer* court requires a demonstration of general acceptance of the underlying theory, that is, of "the accuracy and completeness of the computer program."<sup>92</sup> The *Starr* court, however, permits the trial court to take judicial notice of the underlying principles of computer simulation. This court's general acceptance requirement extends only to a determination of whether there is general acceptance of the technique applying the principles to automobile collisions.<sup>93</sup>

A second perceived problem with the *Frye* standard results from the difficulty courts have had in identifying the relevant scientific community; "the question is whether to identify the field as embracing a broad category . . . or to limit it in some way."<sup>94</sup> The *Frye* rule "does not disclose the *scope* of the scientific community in any given area of scientific evidence."<sup>95</sup> Thus, "under the *Frye* definition the scope of the scientific community could be so large in any given area of science as to render 'general acceptance' for any new development practically impossible."<sup>96</sup>

Cases concerning the admissibility of spectrographic evidence illustrate how a broad versus a narrow definition of the relevant scientific community affects the ultimate admissibility decision. In *Commonwealth v. Lykus*<sup>97</sup> and *Hodo v. Superior Court*,<sup>98</sup> spectrographic evidence<sup>99</sup> was held to be admissible. The court in each case interpreted the relevant scientific community to be "those who would be expected to be familiar

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<sup>89</sup>372 Mass. 171, 360 N.E.2d 1062 (1977).

<sup>90</sup>134 Ariz. 254, 655 P.2d 794 (1982).

<sup>91</sup>Lacey, *supra* note 48, at 261-62.

<sup>92</sup>372 Mass. at 177-78, 360 N.E.2d at 1067.

<sup>93</sup>134 Ariz. at 258, 655 P.2d at 798.

<sup>94</sup>Lacey, *supra* note 48, at 261.

<sup>95</sup>Note, *Evidence—Spectrographic Method of Voice Identification — Tendency of the Courts Toward Admitting Scientific Evidence*, 12 WAKE FOREST L. REV. 879, 884 (1976).

<sup>96</sup>*Id.* at 885.

<sup>97</sup>367 Mass. 191, 327 N.E.2d 671 (1975).

<sup>98</sup>30 Cal. App. 3d 778, 106 Cal. Rptr. 547 (1973).

<sup>99</sup>BLACK'S LAW DICTIONARY 1255 (5th ed. 1979) defines a spectrograph as voice print analysis used as a method of identification based on the comparison of graphic representations or "spectrograms" made of human voices.

with its use,"<sup>100</sup> who conduct research in spectrographic analysis, who employ the identification technique, and who are familiar with the particular process involved.<sup>101</sup>

In contrast, spectrographic evidence was held to be inadmissible in *Cornett v. State*<sup>102</sup> and *United States v. Addison*<sup>103</sup> for its failure to attain general acceptance. Each of these courts required acceptance by a majority of all scientists who study and conduct research in the general field of phonetics.<sup>104</sup> This broad definition of the relevant scientific community resulted in the exclusion of the evidence. Thus, a court's definition of the relevant scientific community frequently proves to be the factor determinative of admissibility. Nonetheless, *Frye* is silent as to the actual meaning of the term and its opponents consider this omission to be a major weakness in the standard.

A final perceived problem with the use of *Frye* is that it functions to keep valuable, reliable evidence from the trier of fact.<sup>105</sup> Jurisdictions that rely on this standard for admissibility "lag behind the advances of science, while the courts wait for novel scientific techniques to win general acceptance."<sup>106</sup> "*Frye* frustrates rather than enhances that search for the truth."<sup>107</sup>

Because of the conservative nature of the *Frye* standard, the litigator will face the most difficulty in admitting computer simulations in a *Frye* jurisdiction. The admissibility of such evidence is not necessarily precluded, however, by the standard. If the attorney irrefutably establishes the accuracy of the simulation process and the credibility of the expert witness and further demonstrates that the simulation is based upon theories long recognized under the laws of physics, there is an excellent chance that the simulation will be admitted even under the stricter *Frye* standard. No case actually indicates that simulations are inadmissible under *Frye*; rather the cases mandate a hearing to determine if simulations meet the *Frye* requirements.

2. *Abandonment of Frye and the Adoption of the Relevancy Standard.* — Under the relevancy approach, a court evaluates evidence based upon "probativeness, materiality, and reliability on the one side and any

<sup>100</sup>*Hodo*, 30 Cal. App. 3d at 788, 106 Cal. Rptr. at 553; *Lykus*, 367 Mass. at 203, 327 N.E.2d at 677.

<sup>101</sup>*Hodo*, 30 Cal. App. 3d at 788, 106 Cal. Rptr. at 552-53; *Lykus*, 367 Mass. at 203, 327 N.E.2d at 677-78.

<sup>102</sup>450 N.E.2d 498 (Ind. 1983).

<sup>103</sup>498 F.2d 741 (D.C. Cir. 1974).

<sup>104</sup>*Addison*, 498 F.2d at 745; *Cornett*, 450 N.E.2d at 503.

<sup>105</sup>Imwinkelreid, *A New Era in the Evolution of Scientific Evidence — A Primer on Evaluating the Weight of Scientific Evidence*, 23 WM. & MARY L. REV. 261, 265 (1981) [hereinafter cited as Imwinkelreid, *A New Era*].

<sup>106</sup>*Id.*

<sup>107</sup>Lacey, *supra* note 48, at 265.

tendency to mislead, prejudice, or confuse the jury on the other."<sup>108</sup> In recent years, there has been a trend moving away from the *Frye* standard to the relevancy approach suggested by the Federal Rules of Evidence, thereby providing for greater use of scientific evidence.<sup>109</sup> Three principal arguments have been advanced in support of the movement away from *Frye*:

1) Several jurisdictions have abandoned the standard as a rule of decisional law which was not binding upon them.

2) Others have advanced a statutory construction argument saying that since *Frye* was not codified in the Federal Rules of Evidence it has been impliedly abolished.

3) Finally, some jurisdictions have invalidated *Frye* on constitutional grounds.<sup>110</sup>

Each of these arguments will be considered separately.

The first argument concerns judicial movement away from non-binding precedent of the Court of Appeals of the District of Columbia in *Frye* to more liberal admission standards through case law. A case representative of this line of reasoning rejecting *Frye* is *People v. Daniels*.<sup>111</sup> In *Daniels*, the court said:

To require general acceptance would in essence mandate absolute infallibility. Instead, a court should weigh and consider the admissibility . . . in the same manner it makes other decisions related to admissibility of any evidence. If the evidence has substantial probative value and is relevant to the issues and does not endanger the defendant's rights, or prejudice the jury, nor mislead the proper administration of justice, then it should be admitted as any other evidence.<sup>112</sup>

The court abandoned *Frye* as non-binding precedent, which should not be used to exclude scientific evidence where reliability could be otherwise established. A similar argument has resulted in the abandonment of *Frye* in seven other jurisdictions.<sup>113</sup>

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<sup>108</sup>United States v. Williams, 583 F.2d 1194, 1198 (2d Cir. 1978).

<sup>109</sup>Imwinkelreid, *The Standard for Admitting Scientific Evidence: A Critique from the Perspective of Juror Psychology*, 100 M.L. L. REV. 99, 101-107 (1983) [hereinafter cited as Imwinkelreid, *The Standard for Admitting Scientific Evidence*].

<sup>110</sup>Lacey, *supra* note 48, at 265-66.

<sup>111</sup>102 Misc. 2d 540, 422 N.Y.S.2d 832 (N.Y. Sup. Ct. 1979).

<sup>112</sup>*Id.* at 545-46, 422 N.Y.S.2d at 837.

<sup>113</sup>Coppolino v. State, 223 So. 2d 68 (Fla. Dist. Ct. App.), *cert. denied*, 399 U.S. 927 (1970) (where evidence is based solely upon scientific tests and experiments, it is essential that the reliability of the tests and the results thereof shall be recognized and

A second argument for the abandonment of *Frye* is based on statutory construction. Rule 402 of the Federal Rules of Evidence provides that “[all] relevant evidence is admissible, except as otherwise provided by the Constitution of the United States, by Act of Congress, by these rules, or by other rules prescribed by the Supreme Court pursuant to statutory authority . . . .”<sup>114</sup> “The argument of statutory construction is straight-forward: since [rule] 402 requires a constitutional, statutory, or court rule basis for excluding evidence that passes muster under [rules] 401 through 403, *Frye* has been impliedly abolished.”<sup>115</sup> Because *Frye* has not been codified, it does not meet the requirements of rule 402 and it cannot function to keep out relevant scientific evidence.<sup>116</sup> This approach was adopted in *State v. Williams*.<sup>117</sup> The *Williams* court stated:

The controlling criteria regarding the admissibility of expert testimony, so long as the proffered expert is qualified and probative value is not substantially outweighed by the factors mentioned in Rule 403, are whether in the sound judgment of the presiding Justice the testimony to be given is relevant and will

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accepted by scientists or that demonstrations shall have passed from the stage of experimentation and uncertainty to that of reasonable demonstrability); *Harper v. State*, 249 Ga. 519, 292 S.E.2d 389 (1982) (the *Frye* rule of counting heads in the scientific community is not an appropriate way to determine the admissibility of a scientific procedure; it is proper for the trial judge to decide whether the procedure or technique has reached a state of verifiable certainty — whether the procedure rests upon the laws of nature); *State v. Hall*, 297 N.W.2d 80 (Iowa 1980), *cert. denied*, 450 U.S. 927 (1981) (the rationale of *Frye* should apply insofar as it bears upon the reliability of the proffered evidence; general scientific acceptance is not a prerequisite to admission of evidence if the reliability of the evidence is otherwise established); *Brown v. Commonwealth*, 639 S.W.2d 758 (Ky. 1982), *cert. denied*, 460 U.S. 1037 (1983) (any relevant conclusions supported by a qualified expert witness should be received unless there are other reasons for exclusion); *People v. Young*, 106 Mich. App. 323, 308 N.W.2d 194 (1981) (strict *Frye* rule does not apply to scientific evidence; in general the distinction is based upon whether or not there was significant difference of opinion among scientists concerning accuracy); *State v. Kersting*, 50 Or. App. 461, 623 P.2d 1095 (1981), *aff'd*, 292 Or. 350, 638 P.2d 1145 (1982) (the only foundation requirement where the technique has not been accepted in this state is that there be credible evidence on which the trial judge may make the initial determination that the technique is reasonably reliable; if so, the evidence may be admitted and the weight to be given it is for the jury, who may consider evidence as to its reliability); *Phillips v. Jackson*, 615 P.2d 1228 (Utah 1980) (admissibility is not governed solely by the general acceptance test; an analysis of the admissibility of scientific evidence, while taking into account general scientific acceptance and widespread practical application, must focus in all events on proof of inherent reliability).

<sup>114</sup>FED. R. EVID. 402.

<sup>115</sup>Imwinkelreid, *The Standard for Admitting Scientific Evidence*, *supra* note 109, at 105.

<sup>116</sup>*Id.*

<sup>117</sup>388 A.2d 500 (Me. 1978).

assist the trier of fact to understand the evidence or determine a fact in issue.<sup>118</sup>

Three other jurisdictions<sup>119</sup> have also used this approach in abandoning *Frye*.

A third argument advanced in abandonment of the *Frye* standard is a constitutional claim based on a criminal defendant's sixth amendment right to due process. In *Chambers v. Mississippi*,<sup>120</sup> the United States Supreme Court recognized a constitutional right to present critical, reliable evidence in a criminal prosecution. The Court held that a state evidentiary rule prohibiting the introduction of critical, reliable evidence by the accused violated due process.<sup>121</sup> Commentators have argued that "[b]roadly construed, [*Chambers*] appears to recognize that the accused in a criminal proceeding has a constitutional right to introduce *any* exculpatory evidence, unless the state can demonstrate that it is so inherently unreliable as to leave the trier of fact no rational basis for evaluating its truth."<sup>122</sup> This approach has also been adopted by state courts in *State v. Dorsey*<sup>123</sup> and *State v. Sims*.<sup>124</sup> Although this argument appears to be limited to a criminal proceeding, the attorney should keep it in mind as potentially persuasive if he seeks to admit a simulation in a criminal trial.

The advantage of the relevancy standard over *Frye* is that relevant evidence, critical to the determination of the truth, is considered by the factfinder. Proponents of the relevancy standard believe that

unless an exaggerated popular opinion of the accuracy of a particular technique makes its use prejudicial or likely to mislead

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<sup>118</sup>*Id.* at 504.

<sup>119</sup>*Barmeyer v. Montana Power Co.*, 657 P.2d 594 (Mont. 1983) (the general acceptance rule is not in conformity with the spirit of the new rules of evidence); *State v. Dorsey*, 87 N.M. 323, 532 P.2d 912 (N.M. Ct. App.), *aff'd*, 88 N.M. 184, 539 P.2d 204 (1975) (the New Mexico Rules of Evidence § 20-4-702 provides for admission of scientific, technical, or other specialized knowledge which will assist the trier of fact to determine a fact in issue or understand the evidence through testimony of an expert witness); *State v. Williams*, 4 Ohio St. 3d 53, 446 N.E.2d 444 (1983) (the rules of evidence establish adequate preconditions for admissibility of expert testimony, and we leave to the discretion of this state's judiciary, on a case-by-case basis, to decide whether the questioned testimony is relevant and will assist the trier of fact to understand the evidence or to determine a fact in issue).

<sup>120</sup>410 U.S. 284 (1973).

<sup>121</sup>*Id.* at 302.

<sup>122</sup>Westen, *The Compulsory Process Clause*, 73 MICH. L. REV. 71, 151-52 (1974) (emphasis in original).

<sup>123</sup>87 N.M. 323, 532 P.2d 912 (N.M. Ct. App.), *aff'd*, 88 N.M. 184, 539 P.2d 204 (1975) (polygraph results admissible under due process clause when defendant's credibility is a crucial issue).

<sup>124</sup>52 Ohio Misc. 31, 369 N.E.2d 24 (1977) (due process entitles defendant to a new trial during which he may undergo a polygraph examination, the results of which can go to the jury).

or confuse the jury, it is better to admit relevant scientific evidence in the same manner as other expert testimony and allow its weight to be attacked by cross-examination and refutation.<sup>125</sup>

The argument is that even though scientific evidence is admitted at trial, the jury need not accept its validity. Because it is still the jury's function to decide how much weight and credibility to assign such evidence, the conclusion that the evidence will be determinative upon admission does not logically follow.<sup>126</sup> Opponents can still cross-examine the expert who prepared the evidence to demonstrate that the expert is unqualified and to refute the accuracy of the process. Consequently, the factfinder still will make the ultimate reliability/accuracy determination; it remains a judgment call within the province of the finder of fact.

Commentators, however, have recognized three disadvantages of the relevancy standard. First, they are concerned that a trial judge with no scientific background will have difficulty determining the probative value of the evidence. "[I]n the case of scientific evidence the court will generally be forced to accept the probative value of the evidence as what a qualified expert testifies it to be . . . ."<sup>127</sup> Further, there is concern that the adversary discovery rules and the provisions for opponent experts will not ensure adequate cross-examination and refutation because there is not the pool of experts assured under the *Frye* standard.<sup>128</sup> Finally, there is concern that the relevancy approach will not assure the accuracy of the procedure prior to admission.<sup>129</sup>

Despite the valid concerns that these issues raise, they should not bar admission of computer simulations. In weighing the evidence to determine if probative value is outweighed by prejudicial effect, the trial judge can consider each of these concerns. If, in any case, the trial judge is not sufficiently assured that the simulation is reliable, he can exclude such evidence. Further, the trial judge can prevent the cross-examination problem by excluding evidence where the opposing party has not been provided with the program. These concerns, although legitimate, can be addressed by having the trial court weigh them against the value of the evidence.<sup>130</sup> Consequently, they should not bar the ad-

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<sup>125</sup>United States v. Baller, 519 F.2d 463, 466 (4th Cir.), cert. denied, 423 U.S. 1019 (1975); see also United States v. Stifel, 433 F.2d 431 (6th Cir. 1970), cert. denied, 401 U.S. 431 (1971).

<sup>126</sup>Baller, 519 F.2d at 466-67; Stifel, 433 F.2d at 441.

<sup>127</sup>Giannelli, *Symposium on Science and Rules of Evidence*, 99 F.R.D. 188, 203 (1983) (quoting Strong, *Questions Affecting the Admissibility of Scientific Evidence*, U. ILL. L.F. 1, 22 (1970)).

<sup>128</sup>Note, *Scientific Evidence: Defining a New Approach to Admissibility*, 67 IOWA L. REV. 879, 911 (1982).

<sup>129</sup>*Id.* at 909.

<sup>130</sup>*Id.* at 911.

mission of relevant evidence, but should only be factors considered by the trial judge in determining admissibility.

### C. *The Relevancy Standard Under the Federal Rules of Evidence*

Relevant evidence relates to or bears directly upon the point or fact in issue and proves or has a tendency to prove the proposition alleged.<sup>131</sup> There are three issues to be addressed by the litigator seeking to admit computer simulations under the relevancy standard of the Federal Rules of Evidence: authentication requirements, relevancy requirements, and procedural requirements. With regard to the authentication requirements of the Federal Rules of Evidence, rules 901(a) and 901(b)(9) are instructive on the responsibilities of the litigator. Rule 901(a) provides that "the requirement of authentication or identification as a condition precedent to admissibility is satisfied by evidence sufficient to support a finding that the matter in question is what its proponent claims."<sup>132</sup> Rule 901(b)(9) illustrates how to meet 901(a) requirements for a process or system.<sup>133</sup> The rule indicates that the process can be authenticated by providing "evidence describing a process or system used to produce a result and showing that the process or system produces an accurate result."<sup>134</sup> Here, the litigator will likely want to utilize a test program with known results to indicate that the process used for simulation properly applies generally accepted and recognized principles of physics and mathematics, thereby providing the foundation for computer simulations. Authentication can be achieved through a showing that "the evidence reasonably has the tendency to establish facts of consequence in the action as more probable than they would be without the evidence."<sup>135</sup>

Relevancy requirements are set out in rule 401.<sup>136</sup> "'Relevant evidence' means evidence having any tendency to make the existence of any fact that is of consequence to the determination of the action more probable or less probable than it would be without the evidence."<sup>137</sup> Courts find that evidence is relevant when it is persuasive or indicative that a fact in controversy did or did not exist, because the conclusion in question may be logically inferred from that evidence; that is, if the probability of the existence of a fact is greater with the evidence, it is

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<sup>131</sup>BLACK'S LAW DICTIONARY 1160 (5th ed. 1979).

<sup>132</sup>FED. R. EVID. 901(a).

<sup>133</sup>FED. R. EVID. 901(b)(9).

<sup>134</sup>*Id.*

<sup>135</sup>United States v. Brewer, 630 F.2d 795 (10th Cir. 1980); *see also* Finance Co. of Am. v. BankAmerica Corp., 493 F. Supp. 895 (D.C. Md. 1980) (authentication satisfied by evidence supporting finding that the matter in question is what the proponent claims).

<sup>136</sup>FED. R. EVID. 401.

<sup>137</sup>*Id.*

relevant.<sup>138</sup> Competency of evidence finally "depends upon whether it is likely, all things considered, to advance the search for the truth . . . ."<sup>139</sup>

Rule 402 provides for the admission of all relevant evidence absent a constitutional, statutory, or court rule basis for exclusion.<sup>140</sup> Thus, if the attorney can establish that the simulation is relevant, he faces good probability of admission. As several courts have provided, the laws of evidence in the federal courts are "designed to permit the admission of all evidence which is relevant and material to the issues in controversy, unless there is a sound and practical reason for excluding it."<sup>141</sup> Again, the general criterion required for admission under the federal rules is the evidence's "relevance or tendency to prove material fact[s]."<sup>142</sup>

Although the federal rules are decidedly more liberal than the *Frye* standard, not all relevant scientific evidence would be admissible at trial. Rule 403 establishes a balancing test, which the trial judge should employ in making the admissibility decision.<sup>143</sup> The rule states: "Although relevant, evidence may be excluded if its probative value is substantially outweighed by the danger of unfair prejudice, confusion of the issues, or misleading the jury, or by considerations of undue delay, waste of time, or needless presentation of cumulative evidence."<sup>144</sup> The court properly excludes evidence when it determines that the "costs of the evidence outweigh its benefits."<sup>145</sup> Rule 403 is designed to keep out evidence with an undue tendency to suggest a decision on an improper basis, such as evidence that "appeals to the jury's sympathies, arouses its sense of horror, provokes its instinct to punish, or otherwise may cause a jury to base its decision on something other than the established propositions in the case."<sup>146</sup> Nonetheless, courts have also declared that the rule is to be "sparingly used for the purpose of ruling out otherwise relevant evidence."<sup>147</sup> The general belief is that "it is better to admit

<sup>138</sup>See generally *Goff v. Continental Oil Co.*, 678 F.2d 593 (5th Cir. 1982); *Greenwood Ranches, Inc. v. Skie Constr. Co.*, 629 F.2d 518 (8th Cir. 1980); *United States v. Carter*, 522 F.2d 666 (D.C. Cir. 1975); *United States v. Jones*, 520 F. Supp. 842 (E.D. Pa. 1981); *Papizzo v. O. Robertson Transp., Ltd.*, 401 F. Supp. 540 (E.D. Mich. 1975).

<sup>139</sup>*United States v. Krulewitch*, 145 F.2d 76, 80 (2d Cir. 1944).

<sup>140</sup>FED. R. EVID. 402.

<sup>141</sup>*United States v. 1,129.75 Acres of Land, More or Less in Cross and Poinsett Counties*, 473 F.2d 996, 999 (8th Cir. 1973); see also *United States v. 60.14 Acres of Land, More or Less in Warren and McKean Counties*, 362 F.2d 660 (3d Cir. 1966).

<sup>142</sup>*United States v. Zeiger*, 350 F. Supp. 685, 687-88 (D.D.C.), *rev'd on other grounds*, 465 F.2d 1280 (D.C. Cir. 1972).

<sup>143</sup>FED. R. EVID. 403.

<sup>144</sup>*Id.*

<sup>145</sup>*United States v. Mangiameli*, 668 F.2d 1172, 1176 (10th Cir.), *cert. denied*, 456 U.S. 918 (1982).

<sup>146</sup>*Carter v. Hewitt*, 617 F.2d 961, 972 (3d Cir. 1980) (quoting J. WEINSTEIN & M. SERGER, *WEINSTEIN'S EVIDENCE* ¶ 403[3], at 403-15 to 403-17 (1978)).

<sup>147</sup>*Ebanks v. Great Lakes Dredge and Dock Co.*, 688 F.2d 716, 722 (11th Cir. 1982); see also *United States v. Thevis*, 665 F.2d 616, 633 (5th Cir. 1982).

relevant scientific evidence in the same manner as other expert testimony and allow its weight to be attacked by cross-examination and refutation."<sup>148</sup>

The last consideration under a relevancy standard is a determination of the reliability of the evidence. In *United States v. Williams*,<sup>149</sup> in deciding whether admission of spectrographic voice analysis as identification evidence was error, the court weighed the probativeness, reliability, and materiality of the evidence against its tendency to mislead, prejudice, or confuse the jury. The court found that determining the probativeness and materiality of the evidence was of little difficulty in the case and, therefore, proceeded to a discussion of reliability.<sup>150</sup> The court listed five elements the judge should consider in determining the reliability of the proffered evidence: the potential rate of error in the use of the technique,<sup>151</sup> the existence and maintenance of standards governing its use,<sup>152</sup> the care and concern with which the technique was employed,<sup>153</sup> analogy of the technique to others whose results are admissible,<sup>154</sup> and the presence of "failsafe" characteristics of the technique.<sup>155</sup> The litigator's admission arguments should be reasonably focused on these elements to establish a solid foundation for reliability.

A final concern of the litigator seeking to introduce computer simulation evidence is the procedural requirements that accompany such an offer. There will undoubtedly be procedural safeguards to offset any potential prejudice. Four requirements that the litigator will likely face and should consider prior to offering the simulation are:

- 1) Examination by the trial court of the qualifications of the expert to assure that the technique used is reliable and that his opinion is probative and relevant;<sup>156</sup>
- 2) Permission to cross-examine as to the expert's qualifications and competence;<sup>157</sup>
- 3) Instruction to the jury as to how to evaluate scientific evidence;<sup>158</sup> and

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<sup>148</sup>*United States v. Baller*, 519 F.2d 463, 466 (4th Cir.), *cert. denied*, 423 U.S. 1019 (1975).

<sup>149</sup>583 F.2d 1194 (2d Cir. 1978), *cert. denied*, 439 U.S. 1117 (1979).

<sup>150</sup>*Id.* at 1198.

<sup>151</sup>*Id.*

<sup>152</sup>*Id.*

<sup>153</sup>*Id.* at 1199.

<sup>154</sup>*Id.*

<sup>155</sup>*Id.*

<sup>156</sup>*See People v. Daniels*, 102 Misc. 2d 540, 553-55, 422 N.Y.S.2d 832, 843 (N.Y. Sup. Ct. 1979).

<sup>157</sup>*Id.*

<sup>158</sup>*Id.* at 555-56, 422 N.Y.S.2d at 844.

4) A requirement that the results, simulations, and all other pertinent data be maintained and exchanged before trial in order for opponents to familiarize themselves with it for possible cross-examination and refutation.<sup>159</sup>

Compliance with these four guidelines will probably be sufficient to avoid exclusion of computer simulation evidence on procedural grounds.

#### V. RESPONSES TO A HEARSAY OBJECTION TO INTRODUCTION OF COMPUTER SIMULATION EVIDENCE

The attorney presenting a computer simulation at trial should anticipate a hearsay objection and should have responsive arguments prepared. One strategy the attorney could use would be to state that the evidence is illustrative of expert testimony and as such, should be admissible as are other forms of demonstrative evidence.<sup>160</sup> Hearsay is defined in rule 801(c) of the Federal Rules of Evidence as "a statement, other than one made by the declarant while testifying at the trial or hearing, offered in evidence to prove the truth of the matter asserted."<sup>161</sup> Thus, the litigant in a jurisdiction that has adopted the federal rules could avoid a hearsay problem upon offering a simulation by presenting the simulation as demonstrative rather than substantive evidence. If the simulation is introduced as demonstrative evidence, it is not being offered to prove the "truth of the matter asserted."<sup>162</sup> Consequently, it does not qualify as hearsay under the definition of the federal rules.

An attorney in a jurisdiction that has not adopted the federal rules could be equally successful with this argument provided the jurisdiction's hearsay definition includes only evidence presented to prove the truth of the matter asserted. Indiana provides an example of this argument in a jurisdiction that has not adopted the federal rules. Indiana courts have defined hearsay as an "extrajudicial declaration of another offered to prove the truth of the facts asserted therein, and thus resting on the credibility of a declarant who is not in court and available for cross-examination."<sup>163</sup> Again, demonstrative evidence does not qualify as hearsay because its purpose is not to prove the truth of the facts asserted. It functions to illustrate expert testimony. Thus, the evidence should not be subject to a hearsay objection.

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<sup>159</sup>*Id.* at 555, 422 N.Y.S.2d at 843.

<sup>160</sup>*See generally* *People v. McHugh*, 124 Misc. 2d 559, 476 N.Y.S.2d 721 (N.Y. Sup. Ct. 1984).

<sup>161</sup>FED. R. EVID. 801(c).

<sup>162</sup>*Id.*

<sup>163</sup>*Sills v. State*, 463 N.E.2d 228, 234 (Ind. 1984); *see also* *Roberts v. State*, 268 Ind. 348, 353, 375 N.E.2d 215, 219 (1978).

A second argument an attorney could advance in response to a hearsay objection would be that computer simulations are analogous to hypothetical questions, which are acceptable methods of introducing evidence. A hypothetical question is defined as "[a] combination of assumed or proved facts and circumstances, stated in such form as to constitute a coherent and specific situation or state of facts, upon which the opinion of an expert is asked, by way of evidence on a trial."<sup>164</sup> A computer simulation can be viewed as performing a similar function in that observed data is entered into the computer as "a combination of assumed or proved facts" constituting a "coherent and specific situation" upon which the expert, a computer programmed with the appropriate laws of physics and mathematics, is to render an opinion.

Hypothetical questions have "long been recognized as [a] generally approved method of eliciting expert opinion testimony."<sup>165</sup> In fact, several courts have required the use of hypothetical questions when the evidence upon which the expert is to render his opinion is voluminous, complicated, or conflicting in nature.<sup>166</sup> Further, it is well recognized that an expert is not precluded from answering a hypothetical question even if the expert has no personal knowledge of the facts of the case.<sup>167</sup> Resort to this type of questioning is within the attorney's discretion.

As a general rule, the facts assumed in a hypothetical question must be supported by the evidence in the case.<sup>168</sup> In *Chicago, Indianapolis, and Louisville Railroad, Inc. v. Freeman*,<sup>169</sup> the Indiana Court of Appeals said:

If the question assumes facts which are so clearly exaggerated as to impair the opinion, or are such manifest assumptions as to be misleading, confusing, and outside the evidence or fair inferences to be drawn therefrom, it should be excluded. Where most of the facts assumed in the question were supported by some evidence or by reasonable inferences from the evidence, especially in view of proper instructions as to the weight to be

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<sup>164</sup>BLACK'S LAW DICTIONARY 669 (5th ed. 1979).

<sup>165</sup>2 WIGMORE, EVIDENCE §§ 672-686 (1979).

<sup>166</sup>O'Brien v. Wallace, 137 Colo. 253, 324 P.2d 1028 (1958); Evans v. DeKalb County Hosp. Auth., 154 Ga. App. 17, 267 S.E.2d 319 (1980); State v. Wangberg, 272 Minn. 204, 136 N.W.2d 853 (1965); Zelenka v. Industrial Comm'n of Ohio, 165 Ohio St. 587, 138 N.E.2d 667 (1956); Young v. Members Life Ins. Co., 624 S.W.2d 821 (Tex. Civ. App. 1981).

<sup>167</sup>Feldstein v. Harrington, 4 Wis. 2d 380, 90 N.W.2d 566 (1958). See generally Annot., 82 A.L.R. 1338 (1933).

<sup>168</sup>Donaldson v. Buck, 333 So. 2d 786 (Ala. 1976); Nisbet v. Medaglia, 356 Mass. 580, 254 N.E.2d 782 (1970); Barnett v. State Workmen's Compensation Comm'r, 153 W. Va. 796, 172 S.E.2d 698 (1970).

<sup>169</sup>152 Ind. App. 492, 284 N.E.2d 133 (1972).

given such testimony, the question is not to be excluded. In addition, a failure to prove a part of the facts embraced in a hypothetical question affects only the reliability of the opinion and the weight to be given the answer.<sup>170</sup>

In the formulation of a computer simulation, the data entered into the computer will generally be known or observed data and, as such, will qualify as evidence of record or as a reasonable inference from such evidence. Thus, it is information that is the proper basis of a hypothetical question. Consequently, it can be considered the proper subject of a simulation to the extent that a computer simulation is, in essence, a modern form of hypothetical question.

## VI. CONCLUSION

Litigation is becoming more sophisticated, and in response, the evidence needed to prove a case is becoming equally sophisticated. Computer simulations have tremendous potential to aid an attorney in proving a case. But such evidence can only be an aid if it is admitted at trial. Thus, whenever an attorney considers using a simulation, he should carefully prepare an admissibility argument. There are three standards for admission that the court may employ: common law principles of demonstrative evidence, the *Frye* standard of general acceptance in the relevant scientific community, and the relevancy/balancing test suggested in rule 403 of the Federal Rules of Evidence.

Under the principles of demonstrative evidence, the attorney should stress that the simulation is offered to illustrate and clarify expert testimony. Further, the attorney should demonstrate the relevance of the evidence; that is, its logical tendency to make a fact in issue more or less probable. Most jurisdictions have readily admitted demonstrative evidence; thus, the likelihood of successful admission of a computer simulation is great.

Under the *Frye* standard, the litigator faces the greatest admissibility challenge. This standard is more conservative than the others, and it imposes the special burden of general acceptance. Admission of simulations is not precluded by this standard, however. If the attorney irrefutably establishes the accuracy of the simulation and the credibility of the expert and further demonstrates that the simulation is based upon theories long recognized under the principles of physics and mathematics, there is great possibility of a favorable admission decision.

Under a relevancy standard, the litigator should address three issues: authentication requirements, relevancy requirements, and procedural re-

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<sup>170</sup>*Id.* at 497, 284 N.E.2d at 136; see also *Walters v. Kellam and Foley*, 172 Ind. App. 207, 360 N.E.2d 199 (1977); *Chicago South Shore & South Bend R.R. v. Brown*, 162 Ind. App. 493, 320 N.E.2d 809 (1974).

quirements. Authentication requirements can be met by evidence describing the process or system used in formulating the evidence and by a showing that it produces accurate results. Relevancy requirements will be satisfied generally if the evidence is persuasive or indicative that a fact in controversy did or did not exist, because the conclusion in question may be logically inferred from that evidence. Procedural requirements will primarily be satisfied if the simulation and pertinent data are provided to opposing counsel before trial, thereby ensuring an adequate basis for cross-examination. If the litigator focuses on these requirements, he should have the simulation admitted under the relevancy standard. Because simulations have great potential to aid in the clear presentation of complex information, attorneys with cases that lend themselves to computer simulation evidence should consider this novel technique — they might like the results.

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