

# Employing Virtual Reality Technology at Trial: New Issues Posed by Rapid Technological Advances and Their Effects on Jurors' Search for "The Truth"\*

There is no truth. There is only perception.<sup>1</sup>

—Gustave Flaubert

## I. Introduction

In a visual society where a picture is worth a thousand words and “seeing is believing,” trial lawyers have rapidly adapted to technological advances which allow them to show, rather than merely tell, the jury their case theory. Demonstrative evidence has evolved from black and white photographs to computer-generated animations re-creating the events in question. Today, technology has enabled programmers to create virtual reality environments, which allow users to fully immerse themselves in an alternate world. With the proliferation of immersive virtual environments (IVEs) in areas such as video games<sup>2</sup> and job training,<sup>3</sup> it won't be long until lawyers seek to employ the new technology in the courtroom. However, by combining the most salient features of previous forms of demonstrative evidence, such as the crime-scene view and computer animations, the use of IVEs pose an exponentially greater risk of unfair prejudice, which must be closely monitored by the courts.

This Note argues that IVEs are not merely “another point along a line of technological progression, from scene viewing to photography to video

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1. In the original French, “Il n'y a pas de Vrai! Il n'y a que des manières de voir.” Letter from Gustave Flaubert to Léon Hennique (Feb. 2–3, 1880), in *CORRESPONDENCE* 369, 370 (Louis Conrad ed., 1930).

2. See Chris Suellentrop, *Virtual Reality Is Here. Can We Play with It?: Oculus Rift and Morpheus Take Games to a New Dimension*, N.Y. TIMES, Mar. 23, 2014, [http://www.nytimes.com/2014/03/24/arts/video-games/oculus-rift-and-morpheus-take-games-to-a-new-dimension.html?\\_r=0](http://www.nytimes.com/2014/03/24/arts/video-games/oculus-rift-and-morpheus-take-games-to-a-new-dimension.html?_r=0), archived at <http://perma.cc/M3C6-WHTV> (detailing prototypes and other developments in the video game industry utilizing virtual reality technology).

3. See Michael Downes et al., *Virtual Environments for Training Critical Skills in Laparoscopic Surgery*, in *50 MEDICINE MEETS VIRTUAL REALITY* 316, 316 (James D. Westwood et al. eds., 1998) (discussing the use of IVEs in surgical training simulations).

evidence to virtual evidence,”<sup>4</sup> but rather, that they are fundamentally different from previous forms of demonstrative evidence. As such, the use of IVEs at trial must be scrutinized much more carefully by the courts, especially in criminal trials, because of their unique risk of unfair prejudice. Part II of this Note gives a brief history of the evolution of demonstrative evidence. Part III examines what IVEs are and explains how they differ in significant respects from computer animations. Part IV considers two additional issues that may arise from using IVEs in the context of a criminal trial. Finally, Part V concludes by recommending that courts proceed cautiously in admitting IVEs, especially in criminal trials, because of their inherently prejudicial nature.

## II. The History of Demonstrative Evidence

Demonstrative evidence is a category of nontestimonial evidence that is offered to illustrate the facts or opinions testified to by a witness.<sup>5</sup> Common types of demonstrative evidence include photographs, maps, models, diagrams, and computer animations.<sup>6</sup> Often referred to as a “demonstrative aid,” this evidence is offered on the relevance theory that it will help the trier of fact to better understand the witness’s testimony.<sup>7</sup> At least in theory, “demonstrative aids do not have independent probative value for determining substantive issues in the case.”<sup>8</sup> Therefore, counsel must only establish that the item is a fair and accurate representation of the witness’s testimony.<sup>9</sup> Like all other evidence, the demonstrative aid must also be relevant,<sup>10</sup> and its probative value must not be substantially outweighed by the risk of unfair prejudice.<sup>11</sup>

The use of demonstrative evidence at trial is hardly a new phenomenon. In 1859, the United States Supreme Court issued the first known decision admitting photographic evidence in a jury trial.<sup>12</sup> In 1946, Melvin Belli revolutionized the use of demonstrative evidence when he presented an artificial limb to the jury during his representation of an amputee victim.<sup>13</sup> After the judge set aside the first trial verdict awarding

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4. Carrie Leonetti & Jeremy Bailenson, *High-Tech View: The Use of Immersive Virtual Environments in Jury Trials*, 93 MARQ. L. REV. 1073, 1118 (2010).

5. 2 MCCORMICK ON EVIDENCE § 214, at 18 (Kenneth S. Broun ed., 7th ed. 2013).

6. *Id.* §§ 214–215, at 18, 28–29.

7. *Id.* § 214, at 18–19.

8. *Id.* § 214, at 19.

9. *Id.* § 214, at 19–20.

10. FED. R. EVID. 402.

11. *Id.* R. 403.

12. *Luco v. United States*, 64 U.S. 515 (1859); Vincenzo A. Sainato, *Evidentiary Presentations and Forensic Technologies in the Courtroom: The Director’s Cut*, 2009 J. INST. JUST. & INT’L STUD. 38, 39 (2009).

13. Melvin M. Belli, Sr., *Demonstrative Evidence*, 10 WYO. L.J. 15, 20–21 (1955).

the victim \$65,000 in damages, Belli retried the case and obtained a verdict of \$100,000, which was sustained.<sup>14</sup> When asked why the different result had occurred, Belli replied:

On the second trial, I employed demonstrative evidence and I convinced both jury *and* judge. . . .

The first trial judge . . . had never seen an artificial limb. When I came into court on the second trial it occurred to me, “I am asking this jury to give my client something. I must show them, if possible, just exactly what it is. I can’t show them an intangible commodity: pain and suffering and tears.”<sup>15</sup>

By invoking the sense of sight and touch alongside the verbal testimony of the witness, Belli persuaded the jury—unlike any lawyer before—by bringing the case to life.

As technology progressed over the latter half of the 20th century, so did the sophistication of the demonstrative evidence allowed at trial. Throughout the 1970s and 1980s, lawyers teamed up with graphic artists as well as other professionals to create vivid three-dimensional models and diagrams.<sup>16</sup> With advances in videotape technology came filmed displays, which often included physical re-creations of actual events, “day-in-the-life” films, and illustrations of expert opinions.<sup>17</sup> By 1990, computer animations began appearing in courtrooms across the country.<sup>18</sup> In 1992, a California trial court admitted a computer animation for the first time in a murder prosecution, leading the defense counsel to lambast the video’s accuracy.<sup>19</sup>

In the past two decades, the decreasing cost of computer-generated evidence has enabled parties to employ cutting edge technology at trial with increasing frequency. Although IVEs are not yet routinely used in actual trials, the technology was successfully employed in a 2002 mock trial conducted by the National Center for State Courts through its “Courtroom 21 Project.”<sup>20</sup> The mock trial concerned a criminal prosecution against a stent manufacturer for manslaughter after the stent allegedly caused a man’s

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14. *Id.* at 21.

15. *Id.*

16. Robert D. Brain & Daniel J. Broderick, *Demonstrative Evidence: The Next Generation*, LITIGATION, Summer 1991, at 21, 21–22.

17. *Id.* at 22.

18. *Id.*

19. Marc A. Ellenbogen, Note, *Lights, Camera, Action: Computer-Animated Evidence Gets Its Day in Court*, 34 B.C. L. REV. 1087, 1097–98 (1993) (rehashing the defense counsel’s argument that the video could not “effectively recreate the human gestures . . . necessary for determining intent, motive, malice and ‘the level of complicity’ in homicide”).

20. Edie Greene & Kirk Heilbrun, WRIGHTSMAN’S PSYCHOLOGY AND THE LEGAL SYSTEM 194 (8th ed. 2014).

death.<sup>21</sup> The defense argued that the surgeon implanted the stent in the wrong location, and therefore, the manufacturer was not responsible.<sup>22</sup> In support of this argument, the defense presented testimony of a nurse wearing a virtual reality headset and specialized goggles.<sup>23</sup> With a three-dimensional view of the operating room, the nurse described the surgery and the stent's placement.<sup>24</sup> In response, the prosecution argued that the nurse could not actually see where the doctor implemented the stent.<sup>25</sup> The jurors observed the virtual reenactment on laptops and were able to decide for themselves, given what appeared on their screens, what the nurse observed,<sup>26</sup> ultimately ruling in favor of the defendants.<sup>27</sup> Although the mock trial involved immersing a witness in an IVE, the day is also quickly approaching where the idea of transporting a jury to experience the disputed events firsthand no longer sounds like a plot out of a futuristic science fiction movie. As Justice Alito astutely noted, “[courts] should not jump to the conclusion that new technology is fundamentally the same as some older thing with which we are familiar.”<sup>28</sup> Rather, in anticipation of this technological progression, courts must be ready to recognize the critical differences between IVEs and prior forms of demonstrative evidence in order to correctly assess the admissibility of IVEs at trial.

### III. Virtual Reality and Immersive Virtual Environments

#### A. *What Is Virtual Reality?*

While the term virtual reality lacks a precise universal definition, it has been described as “a medium composed of interactive computer simulations that sense the *participant*'s position and actions and replace or augment the feedback to one or more senses, giving the feeling of being mentally immersed or present in the simulation (a virtual world).”<sup>29</sup> Virtual reality environments—often referred to as IVEs—allow users to immerse themselves, both physically and mentally, in an artificially created world.<sup>30</sup> This may be accomplished through the use of a head-mounted display

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21. *Id.*

22. *Id.*

23. *Id.*

24. *Id.*

25. *Id.*

26. *Id.*

27. David Horrigan, *Operating in Virtual Reality*, L. TECH. NEWS, May 20, 2002, [http://ltn-archive.hotresponse.com/may02/technology\\_on\\_trial\\_p21.html](http://ltn-archive.hotresponse.com/may02/technology_on_trial_p21.html), archived at <http://perma.cc/U77Y-YHD9>.

28. *Brown v. Entm't Merchs. Ass'n*, 131 S. Ct. 2729, 2742 (2011) (Alito, J., concurring).

29. WILLIAM R. SHERMAN & ALAN B. CRAIG, UNDERSTANDING VIRTUAL REALITY: INTERFACE, APPLICATION, AND DESIGN 13 (2003).

30. *Id.* at 9.

(HMD) worn by the user, which can block out all views of the outside world in favor of the computer-generated environment depicted.<sup>31</sup> By attaching a tracking sensor to the user's head, the HMD communicates to the computer system exactly where the user is looking and accordingly updates the visual image displayed to reflect that vantage point.<sup>32</sup> Advanced virtual reality systems often track the movement of many of the major bodily joints,<sup>33</sup> providing the user with an even greater level of sensory feedback. This technology increases the realistic nature of the IVE by allowing the user to explore and interact with the alternate environment. Taken together, the elements of physical and mental immersion, sensory feedback, and interactivity give rise to the "essential phenomenological feature" of IVEs: presence.<sup>34</sup>

*B. The Persuasive and Prejudicial Effects of Presence*

Presence has been described as the perceived reality and sense of "being there" in the virtual environment.<sup>35</sup> It is this quality that distinguishes IVEs from computer animations.<sup>36</sup> By capturing the sense of presence, IVEs successfully combine the reality experienced during a crime-scene visit with the comprehensive visual re-creation of a computer animation to create a new form of demonstrative evidence whose persuasive power greatly exceeds the sum of its parts. However, the feature of presence also substantially increases the risk that IVEs will cause unfair prejudice to the non-introducing party (in comparison to computer animations).

Computer animations have proven to be a useful tool of persuasion in the courtroom because people have a natural tendency to accept what they see as true.<sup>37</sup> Furthermore, jurors are significantly more likely to remember information presented visually rather than orally.<sup>38</sup> IVE re-creations also harness this persuasive visual power, but go an additional step further by engaging all of a juror's senses and completely immersing the juror in an alternate environment. This complete immersion, or sense of presence,

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31. *Id.* at 14.

32. *Id.*

33. *Id.* at 10.

34. Neal Feigenson, *Too Real? The Future of Virtual Reality Evidence*, 28 L. & POL'Y 271, 273 (2006).

35. *Id.*

36. Jeremy N. Bailenson et al., *Courtroom Applications of Virtual Environments, Immersive Virtual Environments, and Collaborative Virtual Environments*, 28 L. & POL'Y 249, 263 (2006).

37. Mary C. Kelly & Jack N. Bernstein, Comment, *Virtual Reality: The Reality of Getting It Admitted*, 13 J. MARSHALL J. COMPUTER & INFO. L. 145, 161 (1994).

38. *Id.* (citing a recent ABA study that concluded jurors retain 100% more information when it is presented visually rather than orally and a staggering 650% more when a visual presentation accompanies oral testimony).

allows jurors to directly *experience* a party's version of the events,<sup>39</sup> rather than merely seeing it on a two-dimensional display. Since direct experience is shown to be more persuasive than mediated experience—such as observing a two-dimensional computer animation—IVEs are significantly more likely to persuade jurors that the events actually occurred as depicted, or rather, as they experienced them in the IVE.<sup>40</sup>

While the sense of presence and direct experience felt in an IVE makes the technology extremely persuasive, these characteristics also greatly increase the risk of unfair prejudice to the non-introducing party. First, jurors completely immersed within an IVE will be less aware of contradictory real-world facts and will be more reluctant to critically question the facts and assumptions presented in the IVE. Second, there is a high probability that jurors will commit inferential error by giving too much weight to the vivid evidence, finding it more probative than it actually is.

In their 2000 study, Melanie Green and Timothy Brock explored the effects of “transportation”—defined as absorption into a story—on the persuasive impact of narratives.<sup>41</sup> Although Green and Brock did not discuss IVEs, their discussion about immersion into a story, whether told verbally or read in writing, directly parallels a juror's transportation and immersion into an IVE, as exemplified by the juror's sense of presence. Green and Brock found that when people are immersed in a story, they “may be less aware of real-world facts that contradict assertions made in the narrative.”<sup>42</sup> This is more likely to occur when a party employs IVE technology, versus a computer animation, because the IVE completely cuts off the juror's contact with the real world.<sup>43</sup> By completely immersing jurors in the artificial environment, jurors are left, for the time being, with the IVE as their only form of reference. In contrast, when a juror views a computer animation reconstructing the events in question, the juror is not transported to the crime scene. Jurors remain aware that they are still sitting in the courtroom and connected to the real world, from which they may be more able to ascertain facts that contradict the animation.

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39. Feigenson, *supra* note 34, at 273.

40. See Dan Grigorovici, *Persuasive Effects of Presence in Immersive Virtual Environments*, in BEING THERE: CONCEPTS, EFFECTS AND MEASUREMENTS OF USER PRESENCE IN SYNTHETIC ENVIRONMENTS 191, 196 (G. Riva et al. eds., 2003) (positing that the closer a mediated experience gets to approximating a real environment the more likely the experiencer is to react to the environment as if it were real); Kelly & Bernstein, *supra* note 37, at 161–62 (noting the much stronger impact virtual reality has on the ability of a juror to pay attention to and remember information, as compared with computer animation).

41. Melanie C. Green & Timothy C. Brock, *The Role of Transportation in the Persuasiveness of Public Narratives*, 79 J. PERSONALITY & SOC. PSYCHOL. 701, 701 (2000).

42. *Id.* at 702.

43. See Bailenson et al., *supra* note 36, at 251 (explaining that the “sensory information of the [virtual environment] is more psychologically prominent than the sensory information of the physical world,” causing the user to “become enveloped by the synthetic information”).

Green and Brock also posited that “transported individuals are so absorbed in the story that they would likely be reluctant to stop and critically analyze propositions presented therein.”<sup>44</sup> Similarly, a juror may be less likely to recognize and critically analyze contradictory facts and assumptions within an IVE. Complete immersion allows jurors to feel like they are experiencing the events in question firsthand;<sup>45</sup> this decreases juror skepticism over whether the events could have actually occurred that way. Additionally, many of the facts and assumptions included in the IVE are not explicitly stated but rather illustrated through the event’s reconstruction.<sup>46</sup> This implicit incorporation makes it even less likely that jurors will even be able to recognize many of the assumptions made in the IVE reconstruction, let alone critically question their accuracy.

Further, IVEs are likely to be unfairly prejudicial because jurors will tend to find IVE evidence to be more probative than it actually is because of its realistic and vivid qualities.<sup>47</sup> Professor Victor Gold has described evidence as being unfairly prejudicial “when it detracts from the accuracy of fact-finding by inducing the jury to commit an inferential error.”<sup>48</sup> The jury commits inferential error when it “decides that evidence is more or less probative of a fact or event than it is.”<sup>49</sup> This error becomes unfairly prejudicial “when opposing counsel is unable to expose the error or otherwise negate its harmful effects.”<sup>50</sup>

Judgmental heuristics—cognitive processes that reduce complex inferential tasks to simpler judgmental operations—may cause people to commit inferential error.<sup>51</sup> In the context of IVEs, the availability heuristic—“a cognitive procedure designed to simplify the process of choosing data used in making a decision”<sup>52</sup>—is particularly relevant. When people are required to judge the likelihood of particular events, the heuristic dictates that they will be influenced most heavily by the data that is “most available to [their] perceptions, memory and imagination.”<sup>53</sup> The problem arises when factors that are independent of probative value, such as the

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44. Green & Brock, *supra* note 41, at 703.

45. Kelly & Bernstein, *supra* note 37, at 167.

46. See David S. Santee, *More than Words: Rethinking the Role of Modern Demonstrative Evidence*, 52 SANTA CLARA L. REV. 105, 130–32 (2012) (describing the use of a computer-generated animation to “illustrate not only the opinion of an expert but also the party’s theory of the case”).

47. Leonetti & Bailenson, *supra* note 4, at 1076–77.

48. David B. Hennes, *Manufacturing Evidence for Trial: The Prejudicial Implications of Videotaped Crime Scene Reenactments*, 142 U. PA. L. REV. 2125, 2161 (1994).

49. Victor J. Gold, *Federal Rule of Evidence 403: Observations on the Nature of Unfairly Prejudicial Evidence*, 58 WASH. L. REV. 497, 506 (1983).

50. Hennes, *supra* note 48, at 2163–64.

51. *Id.* at 2164–65.

52. Gold, *supra* note 49, at 516.

53. *Id.*

evidence's salience and vividness, cause the information conveyed to become more easily "available" to an individual.<sup>54</sup>

Although vivid evidence itself does not necessarily cause unfair prejudice, dangers arise "when that evidence's vividness exceeds its objective probative value,"<sup>55</sup> which is precisely the case with IVE recreations. As demonstrative evidence, IVE re-creations have no independent probative value to the case, because the evidence is "purely illustrative in nature," at least in theory.<sup>56</sup> However, due to the vividness and realistic nature of IVEs, there is a substantial probability that the availability heuristic "will cause cognitive overreliance upon that piece of evidence and will cause unfair prejudice to occur."<sup>57</sup> Therefore, when jurors enter an IVE and directly experience a comprehensive re-creation of the events in question, they are likely to give this evidence too much weight in deliberations, not because of its inherent probative value, but because it is the most easily available evidence. Although IVEs are persuasive and attention catching, the risks of unfair prejudice posed by IVEs have the potential to greatly outweigh any probative value of the evidence, especially in a criminal trial.

#### IV. The Use of Immersive Virtual Environments in Criminal Trials

In the context of a criminal trial, a party's use of an IVE reconstruction of the events in question raises several additional issues. First, I will explore the implications of admitting IVEs on the non-introducing party's right of cross-examination. Second, I will explain the increased potential for unfair prejudice when only one party has the financial resources to employ the technology, and how courts have dealt with monetary disparities between parties. Finally, I will discuss the potential impact of IVE technology on a defendant's choice of whether or not to testify at trial.

##### A. *Immersive Virtual Environments and the Right of Cross-Examination*

Common law jurisdictions have long recognized the absolute necessity of cross-examination as the ultimate safeguard for testing the value of human statements.<sup>58</sup> As noted by Professor Wigmore, cross-examination "is beyond any doubt the greatest legal engine ever invented for the discovery of truth."<sup>59</sup> The importance of this mechanism is magnified in a criminal trial where defendants are ensured the right to confront those who

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54. Hennes, *supra* note 48, at 2168–69.

55. *Id.* at 2171.

56. *Id.* at 2178.

57. *Id.* at 2172.

58. 5 JOHN HENRY WIGMORE, EVIDENCE IN TRIALS AT COMMON LAW § 1367 (James H. Chadbourne rev. ed. 1974).

59. *Id.*



testify against them.<sup>60</sup> The admission of IVEs does not per se deprive the non-introducing party of the right of cross-examination because counsel remains free to cross-examine the witness whose testimony accompanied the demonstrative evidence.<sup>61</sup> However, practically speaking, the IVE “becomes a [testifying] witness” beyond the scope of an effective cross-examination for several reasons.<sup>62</sup>

First, an IVE is likely to be introduced through the testimony of an expert witness, who need not rely on personal knowledge of the facts and data underlying his opinion.<sup>63</sup> Therefore, to the extent that information was obtained from out-of-court witness statements, cross-examining the expert does little to test the credibility of the underlying information. Second, although deemed demonstrative evidence, an expert’s reference to an IVE effectively communicates nonverbal testimony to the jury.<sup>64</sup> Because the standard to admit demonstrative evidence is lower than that of substantive testimonial evidence, a party may be able to introduce otherwise inadmissible evidence through an IVE.<sup>65</sup> If the subsequent cross-examination of the expert is limited to verbal testimony—for example, due to the non-introducing party’s inability to procure an alternative visual representation—it will be largely ineffective in countering the persuasive impact of the IVE.<sup>66</sup> Thus, when presented in court to a jury, IVEs “become[] nothing less than a testifying witness that abrogates the opposing party’s right to cross examination.”<sup>67</sup>

*1. Cross-Examining the Expert Witness.*—A party would likely seek to admit an IVE as demonstrative evidence through the testimony of an expert witness, presumably the person who created the IVE.<sup>68</sup> The expert would then take the jury through the IVE, which illustrated the expert’s opinion by re-creating the critical events in question at trial.<sup>69</sup> Afterwards, opposing counsel would have the opportunity to cross-examine the expert as to the facts and data underlying his opinion, thus satisfying, in theory, the right of cross-examination.

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60. U.S. CONST. amend. VI; U.S. CONST. amend. XIV, § 1.

61. *Cf.* Kelly & Bernstein, *supra* note 37, at 170–73 (discussing the necessity of witness testimony to authenticate a VR demonstration).

62. Michael J. Kelly, *Computer Generated Evidence as a Witness Beyond Cross-Examination*, 17 J. PRODUCTS & TOXICS LIABILITY 95, 95 (1995).

63. FED. R. EVID. 702–03.

64. Santee, *supra* note 46, at 134–35.

65. *Id.* at 136.

66. *Id.* at 141.

67. Kelly, *supra* note 62, at 96.

68. *See* Leonetti & Bailenson, *supra* note 4, at 1098–99 (“An expert witness is needed to explain . . . the array of sophisticated methodological and interpretive techniques and assumptions that were involved in the creation of the IVE.”).

69. *Id.* at 1099.

In reality, the ability to cross-examine the expert does little to test the validity of the facts and data underlying his opinion as illustrated by the IVE. Under the Federal Rules of Evidence, expert witnesses are not required to have personal knowledge of the facts and data underlying their opinions.<sup>70</sup> As a result, the expert witness who creates the IVE may rely on an assortment of information, including real evidence, photographs, crime-scene visits, and interviews with relevant parties.<sup>71</sup> Critically, where the expert relies in part on witness interviews to create the IVE, opposing counsel's ability to cross-examine the expert is largely ineffective with respect to evaluating the credibility of those witnesses. Although opposing counsel may point out that the expert has no personal knowledge of the underlying information and may inquire about the witness interviews, jurors are nevertheless unable to observe the witnesses' demeanors on the stand.<sup>72</sup> While opposing counsel is typically free to call those witnesses and question them during its case in chief, commentators have long opined that the impact of such an examination is largely diminished relative to the impact of cross-examining the original witness. As Wigmore eloquently stated:

The difference between getting the same fact from other witnesses and from cross-examination is the difference between slow-burning sulphurous gunpowder and quick-flashing dynamite; each does its appointed work, but the one bursts along the weakest line only, the other rends in all directions.—Cross-examination, then, will do things that cannot be done by questioning other witnesses.<sup>73</sup>

In addition to the already diminished impact of subsequently calling and questioning another witness, certain witnesses—such as those asserting a privilege—may not be examined at all if later called by opposing counsel.<sup>74</sup>

With respect to visual re-creations, it may not be clear “that a cross-examination will overcome the images etched in the jurors’ minds.”<sup>75</sup> Furthermore, because of IVEs’ complex nature, cross-examination alone will often be insufficient to enable the non-introducing party to educate the

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70. FED. R. EVID. 702–03.

71. *See id.* R. 703 (“An expert may base an opinion on facts or data in the case that the expert has been made aware of or personally observed.”).

72. *Cf. Broad. Music, Inc. v. Havana Madrid Rest. Corp.*, 175 F.2d 77, 80 (2d Cir. 1949) (“The liar’s story may seem uncontradicted to one who merely reads it, yet it may be ‘contradicted’ in the trial court by his manner, his intonations, his grimaces, his gestures, and the like . . .”).

73. WIGMORE, *supra* note 58, § 1368 (footnote omitted).

74. *See, e.g., MCCORMICK ON EVIDENCE, supra* note 5, § 78 (explaining the circumstances in which spouses can assert spousal privilege and avoid testifying against one another).

75. 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, 580 (1998).

jury on the limitations of the expert testimony concerning IVEs.<sup>76</sup> Non-introducing parties—public defenders in particular—are likely to lack experience in the advanced IVE technology.<sup>77</sup> Therefore, unless counsel can effectively prepare, which “frequently requires the advice of a[n] . . . expert,”<sup>78</sup> it is unlikely that the cross-examination will be effective in combating the highly persuasive IVE evidence.

2. *Cross-Examining Nonverbal Testimony.*—In theory, IVEs, as well as other forms of demonstrative evidence, are not admitted as substantive evidence but rather as illustrations of other admitted evidence.<sup>79</sup> In reality, an IVE communicates to the jury nonverbal testimony of the expert; but as demonstrative evidence, an IVE is not subject to the heightened admissibility standards governing testimonial evidence.<sup>80</sup> While an expert’s testimony must be based upon “sufficient facts or data,”<sup>81</sup> an IVE accompanying the expert’s testimony need only be a “‘fair and accurate’ representation of the evidence it purports to explain.”<sup>82</sup> However, demonstrative evidence does not simply “explain[], illustrate[], or clarify evidence that may have been admitted”: “Every time a witness uses demonstrative evidence, the witness communicates something in addition to what the witness has said, if for no other reason than providing an alternative means of communication.”<sup>83</sup>

The problematic consequences of this lower evidentiary burden become especially apparent in the context of IVEs. In constructing the IVE, an expert must inevitably make certain assumptions because “[n]o matter how much evidence exists, there is never enough to fill in every detail necessary to complete the [reconstruction].”<sup>84</sup> Some assumptions may be arbitrary yet harmless; others, however, involve resolving disputed facts that cannot be determined by expert opinion.<sup>85</sup> By graphically

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76. See Edward J. Imwinkelried, *Impoverishing the Trier of Fact: Excluding the Proponent’s Expert Testimony Due to the Opponent’s Inability to Afford Rebuttal Evidence*, 40 CONN. L. REV. 317, 343 (2007) (explaining why cross-examination alone may be inadequate to apprise the jury of deficiencies in an expert’s testimony on complex issues).

77. See BUREAU OF JUSTICE ASSISTANCE, U.S. DEP’T OF JUSTICE, NCJ 179003, INDIGENT DEFENSE AND TECHNOLOGY: A PROGRESS REPORT 2 (1999), available at <https://www.ncjrs.gov/pdffiles1/bja/179003.pdf>, archived at <http://perma.cc/Y2M-RPGY> (“Public defenders’ ability to use technology effectively is being hampered by disparities in resources and technological expertise.”).

78. Paul C. Giannelli, *Ake v. Oklahoma: The Right to Expert Assistance in a Post-Daubert, Post-DNA World*, 89 CORNELL L. REV. 1305, 1376 (2004).

79. Santee, *supra* note 46, at 124.

80. See *supra* notes 64–65 and accompanying text.

81. FED. R. EVID. 702.

82. Santee, *supra* note 46, at 125.

83. *Id.* at 123.

84. *Id.* at 135.

85. *Id.*

incorporating assumptions into the IVE that are not otherwise based upon sufficient facts or data, the expert effectively communicates to the jury nonverbal testimony that the expert would not be permitted to directly testify to.<sup>86</sup>

This problem was exemplified in the context of a computer-generated animation in *Commonwealth v. Serge*.<sup>87</sup> In *Serge*, the defendant was charged with first-degree murder after shooting and killing his wife.<sup>88</sup> The defendant argued that “he had acted in self-defense after his wife attacked him with a knife.”<sup>89</sup> The Commonwealth maintained that the killing was intentional and that the defendant, using knowledge gained from his time spent as a police officer, moved his wife’s body after the shooting and planted a knife on the floor to support his story.<sup>90</sup> At trial, the prosecution was allowed to introduce a computer animation through an expert witness that demonstrated the Commonwealth’s theory.<sup>91</sup> The animation was based on both forensic and physical evidence.<sup>92</sup> Consistent with this theory, although unsupported by evidence, the computer animation portrayed the victim without a knife at the time of the shooting, yet showed a knife on the floor next to her after she had fallen to the ground.<sup>93</sup> If asked whether he believed that the victim was armed, the expert would not have been allowed to answer the question with verbal testimony; the expert had “neither personal knowledge nor sufficient facts or data [on which] to form a scientific opinion on the subject.”<sup>94</sup> However, the court still allowed the animation depicting this fact to be presented in conjunction with the expert’s testimony at trial.<sup>95</sup> While the prosecution remained free to argue its theory of self-defense, it should not have been allowed to do so through the animation depicting the expert’s opinion.

Even if the expert’s nonverbal testimony would be otherwise admissible, the problem remains that a purely verbal cross-examination of the expert’s nonverbal testimony is, by comparison, largely ineffective in combating the visual persuasiveness of the opposing party’s version of events.<sup>96</sup> In *Racz v. R.T. Merryman Trucking, Inc.*,<sup>97</sup> a district court judge correctly recognized this problem and refused to admit the defendant’s

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86. *Id.* at 135–36.

87. 896 A.2d 1170 (Pa. 2006).

88. *Id.* at 1173.

89. *Id.* at 1175.

90. *Id.*

91. *Id.*

92. *Id.*

93. Santee, *supra* note 46, at 136.

94. *Id.*

95. *Serge*, 896 A.2d at 1187.

96. *See supra* note 66 and accompanying text.

97. No. 92-3404, 1994 WL 124857 (E.D. Pa. Apr. 4, 1994).

computer animation, concluding that the danger of unfair prejudice outweighed any relevance the animation might have had.<sup>98</sup> The primary question presented in the case was “whether the back wheels of the tractor-trailer driven by [the] defendant’s employee entered the [adjacent] passing lane while [the] plaintiff’s decedent was passing the truck, prompting her to swerve to avoid a collision.”<sup>99</sup> The defendant sought to admit a computer animation based on the opinions of the defendant’s accident reconstruction expert.<sup>100</sup> The expert concluded that the wheels of the tractor trailer did not enter the car’s lane. In refusing to admit the computer animation, the court reasoned that:

The apparent decision of the accident reconstructionist to discount the testimony of a witness who reported seeing the trailer portion of the truck encroach into the decedent’s lane of travel is magnified and given enhanced credibility when such decision becomes part of the data upon which an animated visual representation is based. 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.<sup>101</sup>

Thus, “[u]nless the animation could be altered based on testimony elicited on cross-examination, the plaintiff [would be] unable to show the jury its version of how the accident occurred,” leaving it with no means of effectively rebutting the defendant’s depiction of events.<sup>102</sup>

Although the dispute in *Racz* concerned a computer animation, the concerns voiced by the court apply with even greater force to IVEs. As previously discussed, IVEs are likely to be significantly more persuasive than computer animations due to their additional feature of presence.<sup>103</sup> If countering a computer animation of the accident would be an “inordinately difficult task,” it logically follows that countering what the jurors perceived to be their own direct experience of the events in question would be nearly impossible. Thus, the non-introducing party would face an even greater challenge trying to cross-examine an IVE through mere oral testimony.

#### *B. The Effect of Monetary Disparity Between Parties on the Prejudicial Impact of Immersive Virtual Environments*

Although the *Racz* court did not address the plaintiff’s ability to procure his own visual representation of the events, the court’s decision to

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98. *Id.* at \*5.

99. *Id.* at \*1.

100. *Id.* at \*5.

101. *Id.*

102. Santee, *supra* note 46, at 143.

103. *See supra* subpart III(B).

exclude the defendant's animation necessarily took into account the fact that only one party possessed the highly persuasive technology.<sup>104</sup> In criminal cases, where monetary disparities frequently arise between the prosecution and indigent defendants, the danger that a defendant will be unable to employ advanced technology in response to the prosecution's use of an IVE is especially great. A study conducted by the National Bureau of Justice Statistics reveals that over 80% of felony defendants in the nation's largest seventy-five counties were represented by public defenders or court-appointed counsel.<sup>105</sup> It is no secret that public defenders are consistently underfunded and strapped for resources.<sup>106</sup> In such situations, commentators have accurately pointed out the "inherent unfairness" that exists "when the state is permitted to use such powerful evidence against a defendant who cannot afford to do the same."<sup>107</sup>

While our judicial system does not prohibit a party from employing an expensive legal team and expert witnesses based upon more limited resources of the other party,<sup>108</sup> several judges have indicated a willingness to consider the parties' relative monetary positions in determining whether or not to admit a computer-generated animation.<sup>109</sup> In an informal survey of U.S. district court and magistrate judges in three California districts, fifteen judges responded to the question of "whether a disparity in resources should be considered when deciding the admissibility or use of computer-generated presentations."<sup>110</sup> Seven of the judges indicated that they would consider the economic circumstances of the parties.<sup>111</sup> One judge even indicated that he or she would require some sort of shared use of the technology underwritten by the side with the greater resources.<sup>112</sup>

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104. See *Racz*, 1994 WL 124857, at \*5 (acknowledging that it would be an "inordinately difficult task" for the plaintiff to overcome the defense's animation through cross-examination); accord *Commonwealth v. Serge*, 896 A.2d 1170, 1185 (Pa. 2006) (concluding that "the relative monetary positions of the parties are relevant for the trial court to consider when ruling on whether or not to admit a [computer-generated animation] into evidence").

105. CAROLINE WOLF HARLOW, U.S. DEP'T OF JUSTICE, BUREAU OF JUSTICE STATISTICS, DEFENSE COUNSEL IN CRIMINAL CASES 1 (2000).

106. E.g., STANDING COMM. ON LEGAL AID & INDIGENT DEFENDANTS, AM. BAR ASS'N, *GIDEON'S BROKEN PROMISE: AMERICA'S CONTINUING QUEST FOR EQUAL JUSTICE* 7-11 (2004), available at [http://www.americanbar.org/content/dam/aba/administrative/legal\\_aid\\_indigent\\_defendants/ls\\_sclaid\\_def\\_bp\\_right\\_to\\_counsel\\_in\\_criminal\\_proceedings.authcheckdam.pdf](http://www.americanbar.org/content/dam/aba/administrative/legal_aid_indigent_defendants/ls_sclaid_def_bp_right_to_counsel_in_criminal_proceedings.authcheckdam.pdf), archived at <http://perma.cc/8SCC-KG9F>.

107. D'Angelo, *supra* note 75, at 581.

108. Bailenson et al., *supra* note 36, at 258.

109. Victor G. Savikas & David L. Silverman, *Making the Poverty Objection: Parties Without Fancy Exhibits Could Claim Unfair Prejudice, But Not All Judges Would Agree*, NAT'L L.J., July 26, 1999, at C1.

110. *Id.*

111. *Id.*

112. *Id.*

Additionally, the Pennsylvania Supreme Court indicated in *Serge* that the “relative monetary positions” of the parties is a relevant factor in determining whether or not to admit a computer-generated animation.<sup>113</sup> The court explained, in dicta, that “the trial court sitting with all facts before it, including the monetary disparity of the parties, must determine if the potentially powerful effect of the [computer-generated animation] and the inability of a defendant to counter with his or her own . . . should lead to its preclusion.”<sup>114</sup> Thus, the court suggested that in an extreme case a proponent’s otherwise admissible expert testimony may be excluded on the ground that the opponent could not afford adequate rebuttal evidence.<sup>115</sup> Monetary disparity between the parties is not itself a basis for exclusion under Federal Rule of Evidence 403, which permits a court to exclude otherwise relevant evidence “if its probative value is substantially outweighed by a danger of . . . unfair prejudice, confusing the issues, misleading the jury, undue delay, wasting time, or needlessly presenting cumulative evidence.”<sup>116</sup> However, the *Serge* court’s dictum certainly opened the door to the possibility that such disparity could factor into the Rule 403 balancing test.

*C. The Impact of Immersive Virtual Environment Technology on the Defendant’s Decision of Whether to Testify*

Finally, whether introduced by the defense or prosecution, a party’s decision to employ IVE technology has significant implications on a defendant’s decision about whether or not to testify at trial. First, if introduced by the defense, an IVE provides a defendant with a mechanism to communicate his version of the relevant events to the jury, without testifying at trial and thereby exposing himself to cross-examination. Second, if introduced by the prosecution, the persuasive power of the IVE essentially forces the defendant to testify in rebuttal by effectively and impermissibly shifting the burden of proof.

*1. Introduction by a Defendant.*—By introducing an IVE, a defendant not only communicates his version of the relevant events to the jury, but also enables the jury to experience the events themselves; the defendant does this all without testifying at trial, thus avoiding cross-examination.<sup>117</sup>

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113. Commonwealth v. Serge, 896 A.2d 1170, 1185 (Pa. 2006).

114. *Id.*

115. Imwinkelried, *supra* note 76, at 320.

116. FED. R. EVID. 403.

117. Leonetti & Bailenson, *supra* note 4, at 1116–17.

As previously discussed in section IV(A)(1), a party may introduce an IVE as demonstrative evidence through the testimony of an expert witness, likely the person who created the IVE.<sup>118</sup> The expert's opinion of how the events in question occurred, as illustrated by the IVE re-creation, may be based upon interviews with the defendant, and the prosecution may cross-examine the expert as to that information.<sup>119</sup> However, for the same reasons advanced in section IV(A)(1), cross-examining the expert witness will be largely ineffective in testing the credibility of defendant's statements.<sup>120</sup>

This inadequacy is further magnified by the fact that, although the prosecution may technically subpoena the defendant, it cannot force the defendant to testify due to the defendant's Fifth Amendment privilege against self-incrimination.<sup>121</sup> Ordinarily, the prosecution remains free to subpoena any person interviewed by the expert<sup>122</sup>—assuming that the expert based his opinion at least in part upon that interview—to testify at trial. Once on the stand, the prosecution would be free to examine the witness and test the credibility of his statements directly. Although this option is inconvenient and unlikely to have the same persuasive impact on the jury as the IVE,<sup>123</sup> it may provide for a partial solution. However, even this partial solution is not available to the prosecution with regard to an expert who, in forming his opinion, relies in part upon an interview with the defendant. Unlike other witnesses, the defendant may assert his Fifth Amendment right and refuse to testify without concern about disobeying the subpoena and being held in contempt. The result is that the expert shields the defendant from examination while acting as a conduit for the defendant's testimony.<sup>124</sup>

2. *Introduction by the Prosecution.*—If introduced by the prosecution, an IVE's overwhelmingly persuasive nature essentially establishes a presumption as to how the events in question occurred, which effectively and impermissibly shifts the burden of proof to the defendant. An IVE allows jurors to directly experience a party's re-creation of events by placing the jurors into the scene itself. Because direct experience is significantly more persuasive than mediated, indirect experience (such as hearing witness testimony about the events or viewing a two-dimensional computer animation) jurors are more likely to accept the prosecution's

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118. See *supra* text accompanying note 68.

119. See *supra* notes 69–71 and accompanying text.

120. See *supra* section IV(A)(1).

121. U.S. CONST. amend. V.

122. Cf. FED. R. CIV. P. 45 (detailing requirements for subpoenas in federal cases).

123. See *supra* notes 72–74 and accompanying text.

124. This problem may similarly arise when an expert relies on interviews with other parties whom the prosecution cannot compel to testify, such as spouses asserting a spousal privilege. See *supra* note 74 and accompanying text.



version of events, as depicted by the IVE, as the truth about what actually happened.<sup>125</sup> Thus, the IVE re-creation effectively allows the prosecution to establish a presumption as to how the events in question occurred. This is problematic because, in a criminal trial, the Due Process Clause of the Fifth and Fourteenth Amendments protect the accused against conviction by requiring the prosecution to bear the burden of proving each and every element of the crime “beyond a reasonable doubt.”<sup>126</sup> The presumption established by the highly persuasive IVE effectively shifts the burden of proof to the defendant by providing the jury with a comprehensive “default” version of how the events in question occurred, leaving the defendant to prove that the events occurred otherwise.

In addition to shifting the burden of proof, the inability to meaningfully cross-examine the IVE<sup>127</sup> effectively forces the defendant to testify in rebuttal. This is especially likely to occur in situations where the defendant is the sole (potential) witness with knowledge of the critical events, but lacks the resources to procure his own IVE in response to the prosecution. For example, in *Serge* the prosecution successfully introduced a computer animation depicting the victim empty-handed when shot, yet showing a knife on the floor next to her after.<sup>128</sup> The only person with firsthand knowledge of whether or not the victim was armed was the defendant.<sup>129</sup> By allowing the prosecution to introduce a computer animation depicting its theory of the case, unsupported by any witness or expert testimony, the court not only impermissibly shifted the burden of proof to the defendant but also effectively forced the defendant to testify. The defense could not cross-examine the prosecution’s expert, nor any other witness, as to whether the victim possessed a knife, and absent the defendant’s ability to produce his own IVE re-creation, the defendant was the only potential witness with knowledge of what had occurred. Thus, in order to rebut the prosecution’s highly persuasive IVE re-creation of the events, the defendant had to testify.

## V. Conclusion

Technology has advanced at an astonishing rate in the last fifty years, enabling trial lawyers to present their cases with increased clarity and persuasiveness. Recently, developments in virtual reality technology have allowed lawyers to combine the most persuasive aspects of previous forms of demonstrative evidence to create an immersive virtual environment, a fundamentally different form of demonstrative evidence whose persuasive

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125. See Feigenson, *supra* note 34, at 281.

126. *In re Winship*, 397 U.S. 358, 364 (1970).

127. See *supra* subpart IV(A).

128. See *supra* note 93 and accompanying text.

129. Santee, *supra* note 46, at 132.

power exceeds the sum of its parts. Although the birth of this new class of evidence does not necessarily warrant the creation of new evidentiary rules, it is imperative that judges understand the exponentially greater risk of unfair prejudice posed by IVEs due to their ability to allow jurors to directly experience the events in question firsthand. Especially in the context of a criminal trial, judges must closely examine the underlying accuracy of IVEs and carefully weigh the risks of this new technology against any potential benefit under Rule 403. While the future of trial courts' treatment of IVE evidence is unknown, lawyers will undoubtedly embrace such technology with greater frequency, and courts must be prepared to respond to the changing landscape of demonstrative evidence brought before them.

—*Caitlin O. Young*