Prepare for Impact!
Using Animation to Tell Your Story

Authored by ALFA International Attorneys:

S. Carolyn Ramos
BUTT THORNTON & BAEHR PC
Albuquerque, New Mexico
scramos@btblaw.com

Joseph R. Farris
FRANDEN, FARRIS, QUILLIN, GOODNIGHT + ROBERTS
Tulsa, Oklahoma
jfarris@tulsalawyer.com
“Because of its dramatic power, trial judges should carefully and meticulously examine proposed animation evidence for proper foundation, relevancy and the potential for undue prejudice.”

-- Robinson v. Missouri Pacific R. Co., 16 F.3d 1083, 1088 (10th Cir. 1994)

“[W]e encourage trial judges to first examine proposed videotaped simulation evidence outside the presence of the jury to assess its foundation, relevance, and potential for undue prejudice.”

-- Hinkle v. City of Clarksburg, W.Va., 81 F.3d 416, 425 (4th Cir. 1996)

“Demonstrative vs substantive uses: Demonstrative computer generated visual evidence (CGVE) usually consists of still images or animation which merely illustrates a witness's testimony, while substantive CGVE usually consists of computer simulations or recreations, which are prepared by experts and which are based on mathematical models in order to recreate or reconstruct an incident or event.”


“Since illustrative exhibits ordinarily do not go to the jury room, courts often employ a less rigorous standard in reviewing them... However, because of the prejudicial potential of computer-generated reconstructions and re-creations, a more stringent standard of review is applied assuming that admission is contested.”


“Accident reconstructions, which are generally admitted as substantive, rather than demonstrative evidence, are the most common forms of computer simulations. Accident reconstructions, while purporting to merely illustrate a past event, actually present new evidence which is based upon the limited evidence known of the accident... A proponent of admitting an accident reconstruction generally must demonstrate that it is more likely than not that the reconstruction is fair and accurate.”


¹ The standard that reconstruction evidence must be “more likely than not that [it] is fair and accurate” is applied California, Illinois, Louisiana, Michigan, Missouri, New Jersey, Oklahoma, Texas, and Utah.
Checklist of Authentication for Computer-Generated Animation

1. Factual Foundation
   a. Sufficiency
   b. Admissibility
   c. Permissibility of Use

2. Underlying Scientific or Technical Theory
   a. Must satisfy Daubert or other expert witness test
   b. Under Daubert...
      i. i. Tested?
      ii. ii. Subjected to peer review
      iii. iii. Known/potential error rate? Maintenance standards?
      iv. iv. Generally accepted?

3. Hearsay
   a. Double hearsay
      i. i. Data Entry
      ii. ii. Raw Data

4. Authentication
   a. Four Primary Criteria
      i. i. Completeness of Data
      ii. ii. Complexity of Manipulation
      iii. iii. Routineness of Entire Operation
      iv. iv. Verifiability of Result

5. Mathematical Model
   a. Appropriately measures selected factors?
   b. Are the Factors relevant & inclusive?
   c. Were the mathematical modeling tools correctly applied?
   d. Was the "problem" properly translated into the model?

10th Circuit

“Video animation adds a new and powerful evidentiary tool to the trial scene. McCormick’s work on evidence observes that with respect to one party’s staged reproduction of facts ‘not only is the danger that the jury may confuse art with reality particularly great, but the impressions generated by the evidence may prove particularly difficult to limit.’” Bullock v. Daimler Trucks N. Am., LLC, 819 F. Supp. 2d 1172, 1175 (D. Colo. 2011)(citing 2 McCormick on Evidence 19 (4th ed. 1992)).

To be admissible, the proponent “must lay an adequate foundation for the [animation]’s introduction into evidence.” Bullock, 819 F.Supp.2d at 1175 (citing Fed. R. Evid. 901). “Without knowing the foundations underlying a computer simulation, a court cannot evaluate whether the simulation is probative.” Id. (citing Novartis Corp. v. Ben Venue Labs, Inc., 271 F.3d 1043, 1054 (Fed. Cir. 2001)).
“Because animations are typically used to illustrate witness testimony, if a computer-generated animation is offered into evidence, usually the only foundation necessary is that required of other forms of demonstrative evidence—the testimony of a knowledgeable witness that the animation fairly and accurately depicts what its proponent claims. [A] limiting instruction should be given telling the jury the purpose for which the animation is admitted and that it is not to be considered as substantive evidence. Usually illustrative evidence is not sent to the jury room.” Bullock v. Daimler Trucks N. Am., LLC, 819 F. Supp. 2d 1172, 1176 (D. Colo. 2011)(citing 5 Federal Evidence § 9:26 (3d ed. 2010)).

“A simulation designed to recreate an event at issue is normally offered as substantive evidence and requires a much more rigorous foundation, because the jury is being asked to accept the simulation, which may go beyond anything a witness observed, as evidence of what actually happened.” Id. A substantive simulation normally must be authenticated by showing:

(1) the qualifications of the expert who prepared the simulation;
(2) the capability and reliability of the computer hardware and software used;
(3) the calculations and processing of data were done on the basis of principles meeting the standards for scientific evidence under Fed.R.Evid. 702;
(4) the data used to make the calculations were reliable, relevant, complete, and properly inputted; and
(5) the process produced an accurate result. Simulations which are not properly authenticated are excluded.


“The cases in this circuit support affirmance of the district court's ruling relating to the animation as illustrative of the expert's testimonial theory of the accident.” See Brandt v. French, 638 F.2d 209, 212 (10th Cir.1981) (Where an experiment is offered for demonstrative purposes only, the trial judge should make “clear to the jury that even though there is not similarity to the events of the accident that the information is received on a theoretical basis for the limited purpose for which it is offered.”). See also Gilbert v. Cosco, Inc., 989 F.2d 399, 402 (10th Cir.1993) (“experiments which purport to recreate an accident must be conducted under conditions similar to that accident, while experiments which demonstrate general principles used in forming an expert's opinion are not required to adhere strictly to the conditions of the accident.”). Robinson v. Missouri Pac. R. Co., 16 F.3d 1083, 1087 (10th Cir. 1994).
“In my view, the [plaintiffs] raise several good reasons why [defendant’s occupant kinematic expert]’s reliance on the 1958 study should not be misconstrued as an application of a scientific methodology. Ingersoll’s opposition to the motion does little to overcome this negative impression. On balance, although I consider the 1958 study to contain many findings that contribute to the body of expert knowledge on “occupant kinematics,” [The expert]’s affidavit provides absolutely no rationale as to why data on the specific timing of occupant motion in the 1958 study can be reliably utilized to recreate a separate collision involving entirely different vehicles, G-forces, speeds, occupants, vectors, etc. The fact that the 1958 study may contain the only available motion/timing data taken from a staged collision certainly does not support a finding that that data can be reliably exported into the context of this dissimilar collision.” *Thordike v. DaimlerChrysler Corp.*, 266 F. Supp. 2d 172, 178 (D. Me. 2003).

“The fact that the 1958 study may contain the only available motion/timing data taken from a staged collision certainly does not support a finding that that data can be reliably exported into the context of this dissimilar collision. I am forced to agree with the [plaintiffs] that an analytical gap exists when it comes to explaining why the 1958 collision can be relied upon to supply specific timing data for a recreation of the actual collision event. In the absence of such an analysis, I conclude that the connection is only provided through [the expert]’s *ipse dixit* and that [his] opinion about [the injured plaintiff] exact motion in time lacks a reliable scientific basis. This is not to say that every finding contained in the 1958 study is irrelevant or that [the expert] should be precluded from sharing his knowledge about occupant kinematics… It is only to say that [the expert] has not pinpointed [the injured plaintiff]’s precise position at given time intervals through the application of a reliable methodology and that, therefore, the [incident site] interior animation that would pretend to illustrate the collision with this degree of precision is unreliable and should be excluded.” *Thordike v. DaimlerChrysler Corp.*, 266 F. Supp. 2d 172, 178–79 (D. Me. 2003).

**2nd Circuit**

*Regarding Heightened Scrutiny in Absence of Objection…*

“As courts are drawn willy-nilly into the magic world of computerization, it is of utmost importance that appropriate standards be set for the introduction of computerized evidence.” *Perma Research & Dev. v. Singer Co.*, 542 F.2d 111, 124 (2d Cir. 1976), Van Graafeiland, dissenting. “[The computer] 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 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. Because of the complexities of examining the creation of computer-generated evidence and the deceptively neat package in which the computer can display its work product, courts and practitioners must exercise more care with computer-generated evidence than with

3rd Circuit

Regarding Modeling Methodology…

“While the Federal Rules of Evidence do not have specific provisions governing the admission of computer-generated simulations, reconstruction and animation as substantive evidence, such computer-generated evidence has long been accepted as an appropriate means to communicate complex issues to a lay audience, so long as the expert's testimony indicates that the processes and calculations underlying the reconstruction or simulation are reliable.” Ortiz v. Yale Materials Handling Corp., 2005 WL 2044923, at *9 (D.N.J. Aug. 24, 2005)(emphasis added)(citing 57 Am.Jur. Proof of Facts 3d 455, § 12 (2005) (“In order to have a computer animation or simulation admitted into evidence, the proponent of that evidence generally must acquire and have an expert in computer reconstruction or animation testify at trial.”); 2 McCormick On Evidence § 218 (6th ed. 2009) (“The computer-generated ‘opinion’ is determined by the scientific principles that an expert has programmed into the computer. Thus the simulation must be authenticated as an accurate result of a system or process, pursuant to Federal Rule of Evidence 901(b)..... [R]eliability is the ‘watchword’ in determining the admissibility of computer-generated evidence.”) Bullock v. Daimler Trucks N. Am., LLC, 819 F. Supp. 2d 1172, 1176–77 (D. Colo. 2011).

4th Circuit

Confusing ‘Art’ with ‘Reality’…

“We are convinced Appellants suffered no undue prejudice as a result of this computer animation, and we will not disturb the broad discretion afforded trial judges in this area. In reaching this holding, however, we are not unmindful of the dramatic power of this type of evidence; hence, we encourage trial judges to first examine proposed videotaped simulation evidence outside the presence of the jury to assess its foundation, relevance, and potential for undue prejudice.” Hinkle v. City of Clarksburg, W.Va., 81 F.3d 416, 425 (4th Cir. 1996).

“The court is not persuaded that the conditions in the videotape are sufficiently close to those of the accident to make its probative value outweigh its prejudicial effect. Specifically, the court is concerned that the videotape appears to be inconsistent with prior witness and expert testimony, as the tar kettle valve sticks every single time in the videotape, unlike in Plaintiff's deposition, where he testified that the flow valve mechanism functioned properly 60% of the time. In addition, Plaintiff's expert, Mr. McCarthy, testified in his deposition that he operated the tar kettle flow valve numerous times and it performed perfectly every time but one.” Ingram v. ABC Supply Co., Inc., 2009 WL 5205970, at *6 (D.S.C. Dec. 23, 2009).
“The court finds the inconsistency between the video demonstration and the testimony of Plaintiff and his expert to be significant. Because the film does not portray the ‘original facts in controversy, but rather represents a staged reproduction of one party’s version of those facts,’ the court finds the danger of the jury confusing ‘art with reality is particularly great.’” Id.

5th Circuit

Regarding hearsay & double hearsay issues...

“Under Rule 803(6) [business records hearsay exception], computer data compilations may be business records themselves, and should be treated as any other record of regularly conducted activity. United States v. Fendley, 522 F.2d 181 (5th Cir. 1975). This court has held that computer business records are admissible if three conditions are met:

(1) The records must be kept pursuant to some routine procedure designed to assure their accuracy,
(2) they must be created for motives that would tend to assure accuracy (preparation for litigation, for example, is not such a motive), and
(3) they must not themselves be mere accumulations of hearsay or uninformed opinion.

Rosenberg v. Collins, 624 F.2d 659, 665 (5th Cir. 1980)

TEXAS - “Video animation and other demonstrative evidence that ‘summarize, or perhaps emphasize, testimony are admissible if the underlying testimony has been admitted into evidence, or is subsequently admitted into evidence.’” N. Am. Van Lines, Inc. v. Emmons, 50 S.W.3d 103, 130 (Tex. App. 2001).

MISSISSIPPI – “Demonstrative evidence has evolved from still photographs, to films, color slides, videotapes, and computer-generated demonstrations. However, the standard is the same. The trial judge must exercise sound discretion in determining whether the proffered evidence is relevant under Miss. R. Evid. 401 and even if relevant, whether such relevant evidence is admissible applying the Miss. R. Evid. 403 criteria. Our learned trial judges are the gatekeepers, not only in determining the admissibility of expert testimony under Miss. R. Evid. 702, but also in fairly determining the admissibility of all proffered evidence both under the Mississippi Rules of Evidence and the subsequent case law interpreting these Rules.” Eckman v. Moore, 876 So. 2d 975, 985 (Miss. 2004).

6th Circuit
"[T]he Sixth Circuit determined that “[a] court may properly admit experimental evidence if the tests were conducted under conditions substantially similar to the actual conditions. Admissibility, however, does not depend on perfect identity between actual and experimental conditions. Ordinarily, dissimilarities affect the weight of the evidence, not its admissibility.” Dugle v. Norfolk S. Ry. Co., 2010 WL 2612331, at *1 (E.D. Ky. June 25, 2010).

“The…clear intent of the animations is to recreate the collision from [plaintiff]'s view. [Plaintiff's expert] will opine as to standard head movements. However, the animations do not depict the head movements but instead the driver's views when making those movements…even if the intent behind the animations was not to recreate the collision from [plaintiff]’s view, the animations are 'sufficiently close in appearance to the original accident to create the risk of misunderstanding by the jury,' thus requiring that the animations be substantially similar to the actual conditions.” Id.

Additionally, “the animations are vivid and are not themselves subject to cross-examination. The animations place the viewer in the driver's seat of [plaintiff]’s cruiser. They could very well create an indelible impression in the jury of what [plaintiff] saw in the seconds leading up to the collision. The risk of such an impression is too great given that there is simply no evidence in the record indicating that the animations correctly capture [plaintiff]’s views before and at impact.” Id.

7th Circuit

Regarding Audio Narration…

“[T]here is no objection in principle to presenting evidence of noise levels through a sound recording, even one made long after the accident. But to be admissible—at least as a matter of law, rather than in the trial judge's discretion—the recording must, of course, meet minimum standards of reliability. This one did not. The microphone was not placed where [plaintiff] had been standing when he was hit by the log, though it easily could have been; the recording was made by an amateur, using amateur's equipment; and there is no indication that in the courtroom the video recorder's volume control would have been adjusted to produce the same decibel level as the sounds actually recorded.” Abernathy v. Superior Hardwoods, Inc., 704 F.2d 963, 968 (7th Cir. 1983). 2

8th Circuit

2 “Juries have a tough enough time deciding cases intelligently even when they are not assailed by evidence of tangential relevance, and federal trials already take up enough time without being prolonged to receive such evidence. Nor can a district judge rely on counsel's self-interest not to offer worthless evidence. A lawyer with a weak case may throw in a lot of evidence just to confuse the jury—a tactic sometimes called ‘serving up a muddle.’ As the federal courts become ever busier, the need for district judges to manage trials with a firm hand becomes ever greater. The district judge in this case is to be commended rather than criticized for not taking the easy way out, which would have been to let in all the minimally relevant nonprivileged evidence either party cared to offer.” Abernathy v. Superior Hardwoods, Inc., 704 F.2d 963, 968 (7th Cir. 1983).
Regarding prejudice on appeal…

“[A]ppellant argues that exhibit 8, a diagram illustrating the process for loading soybean meal at the Cargill plant, was improperly admitted because it lacked proper foundation. [Defendant] also claims that the court unduly emphasized the chart by allowing the jury to use it during its deliberations. A Cargill employee testified at trial regarding his familiarity with the operation at the plant and the accuracy of the exhibit. Thus, the foundation was sufficient. The question whether to allow the jury to use the exhibit during its deliberations was obviously within the district court's discretion. Nothing indicates that the defendant was prejudiced in any way.” United States v. Williams, 657 F.2d 199, 203 (8th Cir. 1981).

9th Circuit

Regarding unfair prejudice…

Courts should grant “motion[s] in limine to admit a computer animation of [a] shooting so long as ‘all facial expressions are removed’” so as not to “portray [an individual] as ‘a nutty android,’” even where more detailed, emotive facial expressions may be consistent with other evidence. Byrd v. Guess, 137 F.3d 1126, 1134 (9th Cir. 1998), superseded on other grounds.

11th Circuit

Regarding the need to produce during discovery…

Failing to produce recreation animations in discovery exposes the withholding party to monetary sanctions. In Ellison v. Ford Motor Co. the plaintiff withheld a video on the grounds that it was work product (despite showing it to several people during an unsuccessful mediation). The court granted Ford's motion to compel production, and only declined to award sanctions because of Ford's gamesmanship in seeking the video.

“First, the Court observes that the discovery requests and responses at issue were served in 2007; however, Defendant waited until the very last day of discovery to file its Motion to Compel. Given the delay in filing the Motion to Compel, the Court is hard-pressed to believe that Defendant's counsel believed the discovery responses at issue were seriously deficient.

“Second, and as the Court previously has noted, Defendant's counsel apparently sent only one letter to Plaintiffs' counsel in an attempt to resolve this discovery dispute. Although Defendant's counsel contends that Plaintiffs' counsel never responded to that letter, the record is devoid of any evidence indicating that Defendant's counsel made other attempts to resolve this dispute… For the[se] reasons…the Court finds that the circumstances presented by the instant Motion make an award of expenses to Defendant unjust…[and] therefore denies the portion of Defendant's Motion to Compel that requests

---

**156 F.R.D. 327**  
**Federal Rules Decisions** October, 1994 Gregory P. Joseph  
Copyright (c) by Gregory P. Joseph, 1994

---

**A SIMPLIFIED APPROACH TO COMPUTER-GENERATED EVIDENCE AND ANIMATIONS**

*327* It is not necessary to understand computers to be able to address the evidentiary issues that computer-generated evidence presents. Three principles simplify the process. *First*, there are certain common types of computer-generated evidence that present no genuine issues of trustworthiness. For these, ordinary evidence rules are sufficient to gauge admissibility without reference to the fact that the exhibits have in fact emanated from a computer. *Second*, some types of computer-generated exhibits are inherently hearsay because they reflect extrajudicial assertions. For those, it is necessary to consider whether any hearsay exception or exemption applies. *Third*, if a genuine issue of trustworthiness is raised, there are four straightforward criteria to apply, and a few checklists to follow, in order to assess admissibility.

These principles apply across the board to computer-generated evidence and provide a convenient framework for evaluating complex animations (reconstructions, animations, simulations, etc.).
recreations, simulations and the like). There are also a few attendant issues raised by computer-generated evidence that should be addressed both pretrial and at trial.

I. COMPUTER FOUNDATION PRESUMPTIVELY UNNECESSARY: FOUR CATEGORIES

There are at least four categories of frequently-proffered computer-generated evidence as to which no computer-specific foundation is usually necessary, unless the opponent raises a genuine issue as to the trustworthiness of the exhibit. As to each, the proponent's burden under Rule 104(a) is satisfied without the more elaborate foundation discussed in §§II-IV, below, in the absence of a genuine issue as to trustworthiness.

Simple Demonstrative Evidence

Charts, graphs and diagrams are admissible if they are fairly accurate, are judged helpful in understanding the matters at issue, and any deficiencies are made known to the factfinder. Exhibits of this sort today are commonly computer-generated rather than drawn by hand. The test of admissibility, however, remains the same. Once a knowledgeable witness testifies that a graph, chart, diagram, or other demonstrative exhibit generated by a computer fairly and accurately portrays a relevant subject matter, the exhibit has been authenticated and may be received, without more, subject to Rule 4.

---

4 See, e.g., United States v. Williams, 657 F.2d 199, 203 (8th Cir.1981).
5 See, e.g., People v. McHugh, 124 Misc.2d 559, 560, 476 N.Y.S.2d 721, 722 (Sup.Ct.Bronx Co.1984) (“Whether a diagram is hand drawn or mechanically drawn by means of a computer is of no importance”).
403 (prejudice, confusion, waste of time, cumulativeness), Rule 611(a) (vesting in the trial judge discretion over the mode and order of the presentation of evidence), and, where applicable, Rule 1006 (charts, calculations and summaries permissible to present the contents of voluminous data that are independently admissible and have previously been made available to adversaries). Unless the opponent raises a genuine issue as to trustworthiness—calling into question the computerized genesis of the exhibit—no additional authentication is generally requisite.

**Business and Public Records**

Businesses and government offices generate innumerable documents by computer in ordinary course. A printout of this sort, prepared and maintained in accordance with Rule 803(6) or (8), is a “record” of the business or public office involved. Reliability and trustworthiness are said to be presumptively established by a showing that a computer printout was made in conformance with Rule 803(6) and actually relied upon in the regular course of an enterprise’s activities. Computer-generated public records that satisfy Rule 803(8) are presumptively authentic under Rule 901(b) (provided that they derive from a “public office where items of this nature are kept”), Rule 902(4) (certified copies of public records self-authenticating), and Rule 1005 (certified copies of public records may be offered in lieu of originals).

---

6 As discussed below, the terms “record” within Rule 803(6) and “public records” in Rule 803(8) also encompass each of the electronic data entries that underlie the printout and are contained in the computer.

7 See, e.g., Rosenberg v. Collins, 624 F.2d 659, 665 (5th Cir.1980).
Admissions

Computer printouts associated with an adverse party may be admissions, within Rule 801(d)(2). After the proponent has offered proof that the computer output falls within one of the five types of admission catalogued in Rule 801(d)(2), it is the opponent's burden to challenge the exhibit as untrustworthy or otherwise inadmissible.

*329 D. Non-Prejudicial Illustrative Exhibits

Since illustrative exhibits ordinarily do not go to the jury room, courts often employ a less rigorous standard in reviewing them. Even complex animations may, in the judge's discretion, fall within this category. However, because of the prejudicial potential of computer-generated reconstructions and re-creations, a more stringent standard of review is applied (assuming that admission is contested), regardless of whether they are nominally offered for illustrative or substantive purposes. (The four criteria to be used in deciding whether—or how much—detailed, computer-specific authentication should be required are set forth in §III(B), below.)

HEARSAY FOUNDATION

If a genuine issue as to the trustworthiness of any computer-generated exhibit is raised, there are both hearsay and authentication issues that must be considered. As

---

9 See, e.g., the cases discussed in G. Joseph, MODERN VISUAL EVIDENCE at §§4.5 and 9.02 (1984; Supp.1994).
discussed below, there are two types of computerized evidence, and hearsay problems arise in connection with only one of them. Authentication issues arise in connection with both.

A. Two Types Of Computerized Evidence: Computer-Stored Declarations vs. Computer-Generated Output

The hearsay rule applies to computerized evidence that reiterates human declarations, as opposed to evidence that does not consist of, or contain, extrajudicial assertions. Exhibits of the first sort (computer-stored declarations) are the more prevalent. They include, for example, accounting records, invoices, charts, graphs, and summaries—generally, any printouts reiterating data that has been entered into the computer. In contrast, purely computer-generated output includes, e.g., automated telephone call records, computer-enhanced photographic images, computerized test-scoring— generally, output not reiterating human declarations but simply performing programmed tasks on non-assertions.

B. Two Levels Of Hearsay

Both the entry of the data into the computer, and any underlying assertions that are so entered, must satisfy a hearsay exception or exemption.

1. Data Entry
The act of data entry is an extrajudicial statement—*i.e.*, assertive nonverbal conduct within Rule 801(a)—as is any underlying declaration, under Rule 801(c). Data entry is usually a regularly-conducted activity within Rule 803(6) (or, in appropriate circumstances, falls within Rule 803(8) *(public records exception)*). It also often falls within Rule 803(1) (present sense impression exception).

The real question about the data entry function is its accuracy. This is, in substance, an issue of authenticity (*see* §§III-IV, *infra*) and should be addressed as part of the requisite authentication foundation whenever a genuine doubt as to trustworthiness has been raised. If the foundational evidence establishes that the data have been entered accurately, the hearsay objection to the data entry function should ordinarily be overruled. *See also* Rule 803(24).

**The Electronic “Record.”** As previously noted (in §I), the paper or other hard-copy output of a computer may constitute a business or public “record” within Rules 803(6) and (8). At the same time, each electronic data entry contained in the computer is itself a Rule 803(6) or (8) “record.” In the terminology of these Rules, each electronic entry is a “data compilation, in any form.”

**Implications Of Entry-Based Analysis.** Consequently, if each entry has been made in conformance with Rule 803(6) or Rule 803(8), the computer-generated output satisfies the hearsay exception even if it: (a) was not printed out at or near the time of the events recorded (as long as the entries were timely made), (b) was not prepared in

---

10 *See, e.g., United States v. Sanders*, 749 F.2d 195, 198 (5th Cir.1984); *United States v. Catabran*, 836 F.2d 453, 456 (9th Cir.1988).
ordinary course (but, e.g., for trial), and (c) is not in the usual form (but, e.g., is in graphic form). 11

Trustworthiness Requirement. Rules 803(6) and (8) effectively incorporate an authentication requirement. Rule 803(6) contemplates the admission of hearsay, if its criteria are satisfied, “unless the source of information or the method or circumstances of preparation indicate lack of trustworthiness.” Rule 803(8) contains substantially identical language. This trustworthiness criterion parallels the Rule 901(a) requirement of “evidence sufficient to support a finding that the matter in question is what its proponent claims.” (See the discussion in §§III-IV, below, of the extent to which detailed authentication of the computer process is required to establish trustworthiness.)

2. Underlying Data

If the underlying data that are entered into the computer are themselves hearsay declarations, they in turn must satisfy a hearsay exception or exemption under Rule 805.

II. AUTHENTICATION

Basic Requirements

The authentication standard is no different for computer-generated evidence than for any other. Under Rule 901(a), “The requirement of authentication ... is satisfied by

evidence sufficient to support a finding that the *331 matter in question is what its proponent claims." There is a specific illustration of sufficient authentication for computer evidence tucked into Rule 901(b)(9), and it requires only "evidence ... showing that the process or system produces an accurate result."

**Four Primary Authentication Criteria**

Four criteria are generally sufficient to assess whether, and how much, detailed computer authentication is needed in any given case:

1. **Completeness Of Data.**

   To the extent that the computer process is dealing with known data, fewer questions are raised than if the computer is performing operations on partial data that are assumed in whole or in part (*e.g.*, if the computer program is filling gaps in the data—using various assumptions—before it is manipulating the data).

2. **Complexity Of Manipulation.**

   Simple addition and subtraction raise fewer questions than complex formulae.

3. **Routineness Of Entire Operation.**

   Routineness suggests reliability. Key components are:

   --Data collection.
4. Verifiability Of Result.

Can it be tested or checked? (Compare a pie chart depicting corporate sales results or inventory (testable) vs. a sophisticated animation depicting underground pollution contamination or recreating the cause of an aircraft crash (inherently untestable).)

The weight to be given these variables will vary from case to case, but the implications are straightforward enough. More complete data, simpler manipulation, more routine processing and more verifiable results all augur against the need for elaborate, computer-specific authentication. As any of these variables tends in the opposite direction, the court must consider the magnitude of that variance and the strength of the doubt that has been raised as to the exhibit's genuineness. If more detailed authentication is appropriate, the following checklists may prove useful.

Detailed Computer Authentication—Checklists

To the extent that detailed authentication is warranted or advisable in the circumstances, there are three primary areas to be covered:

--Input (getting the information into the computer),
--Processing (doing something with the data inside the computer), and

--Output (getting the result out of the computer).

Not all three areas will necessarily be implicated in every attack on a computer-generated exhibit.

*332 1. Input—Authentication Checklist

There are three distinct areas of potential concern with respect to input authentication: (a) the underlying data must be probative and admissible or otherwise usable; (b) the integrity of that data must be established (e.g., that all of the documents were present to be input); and (c) the data must be input properly (e.g., only once). As reflected in the following checklist, input authentication involves both hardware and software issues.

a. Underlying Data.

i. Authenticity.

ii. Relevance/Admissibility/Utility.\(^\text{12}\)

b. Integrity Of Input Data.

i. Completeness of source documents/data.

---

\(^{12}\) To the extent that the computer-generated output may take the form of, or comprise, an expert opinion, the underlying data need not necessarily be admissible, under Rule 703.
ii. No duplication of documents/data.

iii. No tampering with data.

iv. Input Procedures.

   A. Batch controls.

   B. Verification processes.

   C. Input edit routines.

   D. System controls.

   E. Tape library handling procedures and controls.

c. **Accuracy Of Input Method.**

   i. Proper conversion of data (machine readable).

   ii. Hardware checks.

      A. Capacity.

      B. Capability.

      C. Reliability.

   iii. Software checks.

Sample tests of processing of source documents/data.
2. Processing—Authentication Checklist

The primary purpose of processing authentication is to show that the hardware and the software are properly functioning and including all of the appropriate data. Note that, as the following checklist highlights, there are two types of software—systems programs (which govern the operation of the computer) and application programs (which put the computer to a particular use, such as to create a balance sheet or recreate an event)—to be authenticated.

a. Hardware.

   i. Should detect errors in transmission.

   ii. Should take recovery measures:

       A. Correct error or

       B. Alert user.

*333 b. Software.

i. Two Types.

   A. Systems Programs.

      I. Govern operation of computer.

      II. Handle:

          a. Input.
b. Output.

c. Error Recovery.

III. Oversee application programs.

B. Application Programs.

I. Put computer to a particular use.

II. Three basic types:


b. Customized.

c. Custom-designed.

III. Tests governing the admissibility of expert evidence—such as Daubert— apply at the application program level to both:

a. The scientific theory underlying the program, and

b. Implementation of that theory in the program.

ii. Authenticity Tests.

A. Not erroneously programmed.

B. Program does not introduce errors.

---

C. Flags errors.

D. Unbiased display.
   I. Successful running of benchmark data.
   II. Absence of prior problems.
   III. Popular commercial programs.

E. Security of system (Absence of tampering after data input).
   I. Security of physical plant.
   II. Systems security procedure
      a. Key words.
      b. Passwords.
      c. Limited access.
   III. Computer alerts user of alteration.

3. **Output—Authentication Checklist**

   Authentication of output largely consists of proof that the proffered exhibit is in fact the output that was described in the earlier foundational testimony. There are three principal areas:
a. Security of output.

Dating/signing/other procedures.

b. Proper request.

*334 Output requested is same as output generated.

c. No transmission errors.

Ability of hardware/software to detect errors.

Subtlety/obviousness of common errors.

Statistical/historical experience.

IV. SPECIAL AUTHENTICATION ISSUES FOR COMPUTER-GENERATED ANIMATIONS AND SIMULATIONS

A. Animations

Computer-generated animations and simulations raise some unique issues. At its simplest, an animation is merely a sequence of illustrations that, when filmed, videotaped or computer-generated, creates the illusion that the illustrated objects are in motion. Traditionally—because they are drawings—animations have been subjected to the fair-
and-accurate-portrayal test and have been admitted, within the trial judge’s discretion, generally for illustrative purposes.\textsuperscript{14}

\section*{B. Simulations (Reconstructions, Re-creations)}

Computer-generated simulations are based on mathematical models, and particular attention must be paid to the reliability and trustworthiness of the model. A model is a set of operating assumptions—a mathematical representation of a defined set of facts, or system. To be accurate, it must produce results that are identical or very similar to those produced by the physical facts (or system) being modeled. In order to do that, the model must contain all relevant elements—and reflect all relevant interactions—that occur in the real world.

A simulation model, in particular, is a computer program that consists of a set of assumptions about precisely what would transpire under certain clearly defined circumstances. If the simulation model works well, the result is to show the probable consequences that are predicted by the theory that underlies the equations.

Because of the difficulty of reflecting all of the complexities of any real world system in a computer program, various simplification techniques are used. The danger is that the introduction of simplification creates the risk of invalidating the simulation that is produced.

C. Checklist Of Authentication Issues For Computer-Generated Animations And Simulations.

1. Factual Foundation.
   a. Sufficiency.
   b. Admissibility.
   c. Permissibility of Use (e.g., under Rule 703).

2. Underlying Scientific Or Technical Theory.
   a. Must satisfy Daubert\textsuperscript{15} or any other governing test.
   b. Under Daubert:
      i. Tested?
      ii. Subjected to peer review/publication?
      iii. Known/potential error rate? Existence/maintenance of standards?
      iv. Generally accepted?


4. Mathematical Model:
   a. Appropriately measures the selected factors.

\textsuperscript{15} See n. 10, supra, and accompanying text.
b. Factors are relevant and inclusive.

c. Underlying mathematical formulae and simplification techniques are apt.

d. *Daubert* or other governing test is satisfied (principal *Daubert* criteria are set forth in item 2(b), *supra*).

e. Mathematical tools were correctly applied.

f. Problem was appropriately translated into the model.

V. PRACTICAL ISSUES BEARING ON INTRODUCTION OF COMPUTER-GENERATED ANIMATIONS AND SIMULATIONS

A. Audio Narration

Computer-generated animations are sometimes coupled with prerecorded narrations. Because any prerecorded narration is an extrajudicial statement, a hearsay exception or exemption is required. However, live testimony from the narrator—or, if a professional narrator is used, from the author of the narration—adopting the narration as true cures the hearsay objection.¹⁶ Rule 611(a) vests the trial judge with discretion to decide whether to permit prerecorded narration or to require live testimony or narration

---

¹⁶ See Advisory Committee Note to Fed.R.Evid. 801(d)(1) (“If the witness admits on the stand that he made the statement and that it was true, he adopts the statement and there is no hearsay problem”).
from the witness on the stand. The court may also exclude all or any part of the narration, and permit the remainder—or just the video—to be displayed to the jury.\textsuperscript{17}

\section*{B. Limiting Instructions}

Concerns about the potential of an animation or simulation to confuse or mislead the jury can frequently be addressed in cautionary or limiting instructions. At the time of admission, the jury should be instructed (and the record in a bench trial should reflect):

\textbf{1. Purpose.} The purpose for which the evidence is being received, such as:

\begin{itemize}
  \item[a.] To visualize or clarify a witness's testimony.
  \item[b.] To illustrate a litigation theory.
  \item[c.] To demonstrate scientific principles.
  \item[d.] To show results of experiments or tests.
  \item[e.] To re-create or reconstruct events at issue.
\end{itemize}

\textbf{2. Assumptions.} The principal assumptions underlying the exhibit. \emph{E.g.}, that it is predicated on one party's versions of the facts; that the facts are in dispute; that

\textsuperscript{17}See, \emph{e.g.}, \textit{Abernathy v. Superior Hardwoods, Inc.}, 704 F.2d 963, 968 (7th Cir.1983).
the exhibit is no better than the assumptions on which it rests; and that it is for the jury to decide whether those assumptions are warranted.

3. **Differences.** Any salient differences between the exhibit and facts at issue—for example, that the exhibit does not purport to be drawn to scale or to include all (or certain specific) variables.

### C. Partial Admission

As indicated above,\(^{18}\) exclusion of any portion of an animation—video or audio—does not necessarily render the remainder inadmissible. Exclusion of the entirety of the audio does not preclude admission of the video, in whole or in part, in the court's discretion.

### D. Pretrial Discovery And Disclosure

**Need And Authority.** If a party first sees a sophisticated computer-generated exhibit when it is offered at trial, that party labors under a very serious disadvantage in attempting to mount an effective inquiry into, or challenge to, any assumptions (factual or theoretical) on which the exhibit rests, to the manner in which it has been created, and

---

\(^{18}\) *See §V.A. and specifically the text accompanying n. 14, supra.*
otherwise to the fairness of the evidence. To avoid unfair prejudice, pretrial discovery of computerized evidence, including the underlying computer program, is essential.

The Federal Judicial Center’s *Manual for Complex Litigation 2d* provides (in §21.446) that discovery into the reliability of computerized evidence, “including inquiry into the accuracy of the underlying source materials, the procedures for storage and processing, and some testing of the reliability of the results obtained,” should be conducted “well in advance of trial.”

The mandatory disclosure provisions of the 1993 amendments to the Federal Rules of Civil Procedure are also important in this regard since they mandate pretrial exchange of exhibits to be used as “support for the opinions” of any expert, and animations are invariably offered in connection with expert testimony. As a practical matter, pretrial exchange of computerized exhibits, and discovery into underlying programs, should be assured by provisions in the pretrial order.

**Scope Of Discovery.** The scope of discovery should: (1) extend into the foundational areas described in §§II, III and IV, above, and (2) expressly include any deleted excerpts, or outtakes, from any computer-generated video or exhibit, including any prior versions of any exhibit. If there ever was a viable work-product defense to production—which is dubious in light of the good cause that the opponent could always show—it cannot likely survive the 1993 amendment to Federal Rule of Civil Procedure

---

19 See Fed.R.Civ.P. 26(a)(2)(B) (eff. Dec. 1, 1993, in jurisdictions that have not deferred its effectiveness). Parallel provisions are in force in several districts that have opted out of the 1993 amendments to Rule 26(a). See also Fed.R.Civ.P. 26(a)(3)(C) (eff. Dec. 1, 1993, in jurisdictions that have not deferred its effectiveness), and analogous local rules in force in many district courts, which similarly dictate pretrial exchange of “an appropriate identification of each ... exhibit, including summaries of other evidence.”
26(a)(2)(B), which requires disclosure of “the data or other information considered by the witness in forming the opinions.”

**Preview Prior To Introduction**

If for any reason a computerized exhibit has not been disclosed to all counsel prior to trial and is not to be excluded for that reason, the exhibit should be disclosed prior to introduction outside the presence of the jury and the opponent afforded a reasonable opportunity to review it. The court, too, should review the exhibit before the jury is exposed to it, to preclude potential prejudice to either side.20

The views expressed are those of the author and do not necessarily reflect the views of the publisher.

156 F.R.D. 327

---