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## Assuring the Competency of Computer-Generated Evidence, 9 Computer L.J. 103 (1989)

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## NOTE

# ASSURING THE COMPETENCY OF COMPUTER-GENERATED EVIDENCE

### I. INTRODUCTION

The advent of the computer raises new evidentiary concerns. Legal decisions will turn on evidence created or affected by a computer. Rules should be established which facilitate certainty with respect to the admissibility of computer-generated evidence. Such rules would help avoid the unnecessary expense of developing evidence which might be inadmissible.

Probably the most common type of computer-generated evidence is computer-stored business records. The Federal Rules of Evidence currently provide standards for the admission of business records, but do not address the issues raised by records stored in a computer.<sup>1</sup> The effectiveness and rationale behind the business records hearsay exception should be re-evaluated in light of the new considerations posed by computers.

Computers make it possible to create models and simulate real world conditions in a graphic and visual manner. Technological advances permit litigants to offer computer-generated evidence created specifically for use in litigation. Rules are needed to assure that demonstrative evidence of this type is used in a responsible manner. The rules of evidence must be examined to insure that they adequately address the issues posed by this new type of evidence.

This Note will evaluate the types of computer-generated evidence that an attorney might want to use at trial, and discuss the conditions under which admissibility is supported by the evidentiary goals of the Federal Rules of Evidence.

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1. FED. R. EVID. 803(6). See also Comment, *Admitting Computer Generated Records: A Presumption of Reliability*, 18 J. MARSHALL L. REV. 115 (1984) which provides a good general discussion of the admissibility of computer-generated business records.

## II. COMPUTERIZED BUSINESS RECORDS AND THE HEARSAY EXCEPTION

### A. HEARSAY GENERALLY

Hearsay is defined as "a statement, other than one made by the declarant while testifying at the trial or hearing, offered in evidence to prove the truth of the matter asserted."<sup>2</sup> The hearsay rule is predicated upon a need for accurate testimony. Credible testimony depends upon witnesses' perception, memory, and sincerity, and upon the consistency of the testimony. At trial the taking of an oath, personal presence and cross-examination are used to assure that witnesses' testimony is credible.<sup>3</sup> Hearsay statements are usually excluded from evidence because assurances of reliability are not present.

Ambiguity and insincerity have also been identified as factors contributing to the exclusion of hearsay evidence.<sup>4</sup> Ambiguous evidence lacks probative value in the absence of clarifying testimony. Where the testimony is hearsay, the evidence lacks trustworthiness and reliability, justifying its exclusion. However, exceptions to the rule against hearsay evidence do exist. These exceptions are justified where the evidence is "trustworthy" and "necessary".<sup>5</sup>

It is unlikely that computer-generated evidence will be offered into evidence for some other purpose than "to prove the truth of a matter asserted," and thus is hearsay.<sup>6</sup> Data stored in a computer and computer-generated printouts based upon that data are not admissible at trial, unless they qualify under one of the hearsay evidence exceptions.<sup>7</sup>

### B. BUSINESS RECORDS EXCEPTION TO THE HEARSAY RULE

The common law and Federal Rules of Evidence recognized that records kept in the ordinary course and scope of business carry a circumstantial guarantee of trustworthiness because they are relied upon in the ordinary course of business. Traditionally, business records carried a substantial indicia of reliability, justifying their admission into evidence. Business records are created for a specific purpose: to document actions taken by a business for future reference. By their very nature,

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2. FED. R. EVID. 801(c).

3. MCCORMICK ON EVIDENCE § 245 (E. Cleary 3rd ed. 1984).

4. See Comment, *Triangulating Hearsay*, 87 HARV. L. REV. 957, 964 (1974).

5. D. LOUISELL, FEDERAL EVIDENCE § 412 (1980) (citing 5 WIGMORE, EVIDENCE §§ 1420-22 (Chadbourn rev. 1974)).

6. It has been stated that, "out-of-court conduct that is not an assertion, or that, even though assertive, is not offered to prove the truth of the matter asserted is not hearsay." MCCORMICK, *supra* note 3, § 246, at 730.

7. FED. R. EVID. 802.

business records must be clear and accurate.<sup>8</sup>

Certification and admissibility of records under the business records exception requires the offering party to show that the records were prepared by a business employee who had a business duty to prepare those records in the regular course of business.<sup>9</sup> The offering party must also show that the "informant had personal knowledge of the facts or events reported",<sup>10</sup> and that it was a routine practice of the offering party to prepare such records.<sup>11</sup>

### C. COMPUTERIZED BUSINESS RECORDS

Computerized records introduce a new element with respect to the reliability and trustworthiness of the records. Previously, the reliability of business records depended upon the procedures used in the creation and storage of the records. The accuracy of computer-stored records is additionally dependent upon the computer and software used to create the records.

Some courts have ignored suggestions calling for the creation of special foundational rules for authenticating computerized evidence.<sup>12</sup> Instead, these courts require only a custodian of records to testify that the computerized records were kept in the regular course of business.<sup>13</sup> The custodian is not required to attest to the accuracy of the records, only their authenticity. This policy ignores reliability problems which may be caused by the influence of a computer upon the data.<sup>14</sup>

Failure to adopt special rules for use with computerized evidence runs contrary to the requirements of Federal Rules of Evidence. Rule 803(6) prohibits the admission of evidence "if the source of information or the method or circumstances of preparation indicate a lack of trustworthiness."<sup>15</sup>

Five possible types of errors have been identified as affecting the reliability of computer-stored records: errors in perception, errors in input, errors associated with inadequate hardware security, errors caused

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8. *Louisville & Nashville R.R. Co. v. Know Homes Corp.*, 343 F.2d 887, 896 (5th Cir. 1965). See also E. IMWINKELRIED, *EVIDENTIARY FOUNDATIONS* 170 (1980).

9. Business Records Act, 28 U.S.C. § 1732 (1982).

10. IMWINKELRIED, *supra* note 8, at 171.

11. For a complete example of the steps for laying a foundation for records and business reports which fall under FED. R. EVID. 803(6), see IMWINKELRIED, *supra* note 8, at 171-73.

12. *United States v. Sanders*, 749 F.2d 195 (5th Cir. 1984); *United States v. Young Bros., Inc.*, 728 F.2d 682 (5th Cir. 1984), *cert. denied*, 469 U.S. 1157 (1984); *United States v. Vela*, 673 F.2d 86 (5th Cir. 1982).

13. *Sanders*, 749 F.2d at 198; *Young Bros.*, 728 F.2d at 694; *Vela*, 673 F.2d at 89-90.

14. See *United States v. Russo*, 480 F.2d 1228, 1241 (6th Cir. 1973), *cert. denied*, 414 U.S. 1157 (1974).

15. *United States v. Croft*, 750 F.2d 1354, 1364 (7th Cir. 1984).

by hardware, and errors associated with computer software.<sup>16</sup>

"Errors in perception" refers to mistakes which occur when computer operators misread information being put into the computer. "Errors in input" occur when typographical mistakes are made. Input errors and perception errors are not, however, unique to computerized records. People are just as prone to make mistakes when using manual record keeping systems as they are with computerized systems.<sup>17</sup> The possibility that "errors in perception" and "errors in input" will affect the validity of business records has always existed, regardless of the system used. The presumption of reliability in the business records exception recognizes that mistakes may occur, but assumes that the foundational requirement of showing that the records are kept in the regular course of business assures accuracy.<sup>18</sup>

A properly designed computer system contains sub-systems to catch input errors. While it is unlikely that an error-checking system will detect all mistakes, such systems decrease the number of errors in the business records.<sup>19</sup> Thus, using computers to store business records does not create any new accuracy concerns with respect to human error and, in fact, may increase accuracy.

Inadequate hardware security potentially affects the reliability of computer-stored records.<sup>20</sup> Security can be a problem with both manual and electronic record keeping systems. The possibility of tampering has always been present with evidence presented pursuant to the business records exception and does not create unique problems with respect to computer-stored records. If tampering is suspected, evidence may be produced showing that the records are not what they purport to be. The probative value accorded the evidence can then be determined by the trier of fact. The possibility of tampering should not preclude the admissibility of the evidence.

The last two problems, involving the reliability of hardware and software, are peculiar to computers themselves. Two alternatives exist with respect to certifying the reliability of computer hardware. The

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16. Pozin, *Computer Evidence Part I - Laying the Foundation*, 15 THE BRIEF 46 (1985).

17. See e.g. *United States v. Orozco*, 590 F.2d 789, 794 (9th Cir. 1979), *cert. denied*, 442 U.S. 920 (1979).

18. At least one court has made the error of linking input reliability to the reliability of the computer itself, impliedly assuming that the computer and program carry with them inherent indicia of reliability. See *Russo*, 480 F.2d at 1240. But see *United States v. Miller*, 771 F.2d 1219, 1237 (9th Cir. 1985), where the court required testimony regarding the accuracy of the computer and program.

19. For a detailed explanation of how error-checking systems operate, see Singer, *Proposed Changes to the Federal Rules of Evidence as Applied to Computer-Generated Evidence*, 7 J. OF COMPUTERS, TECH. & L. 157, 164 (1979).

20. *Id.* at 163-65. See also Pozin, *supra* note 16, at 47.

first involves certifying that the computer was working properly when the records were stored, retrieved, and at all times in between. But rules of this type create overly burdensome testing requirements which would all but wipe out the usefulness of the computer as a business tool. Furthermore, requirements of this type are not necessary. Businesses invest large sums of capital in computer systems based upon past experience, which has shown computers to be reliable. In this case, market forces act as an adequate check over the accuracy of computer hardware.

Reliability of software poses the most difficult problem with respect to the use computer-stored records as evidence. Software, also known as the computer program, dictates the actions and calculations made by a computer.<sup>21</sup> Errors in software protocol cause mistakes and inaccuracies in computer-stored information. This situation gives rise to a need to develop appropriate foundational requirements for the qualification of computer-stored data before the information is admitted into evidence under the business records exception to the hearsay rule.

It can be argued that software possesses the same reliability characteristics as hardware. Making this argument requires one to assume that businesses use both hardware and software in the creation of business records because both are inherently reliable. The differences between software and hardware development and usage, however, directly affect reliability.

Hardware carries out standardized mechanical procedures, which are relatively easy to test. Conversely, software protocols differ greatly. A single computer can run an unlimited variety of software applications. The wide variety of programs leaves considerable room for inaccuracies, especially with newly developed programs. Software is constantly being updated and improved as programmers pinpoint a program's shortcomings and develop new ways of handling old problems. Hardware development does not focus on what the computer can do. The push in hardware development is towards smaller computers which can do more in a shorter period of time. The processes by which the programs are run, however, do not vary greatly from one generation of computer to the next. As a result, the accuracy of hardware raises different concerns than those raised by software.

Accuracy of software could be tested by allowing litigants to submit evidence without worrying about foundational requirements. Credibility of the evidence would be tested by the opposing party on cross-examination. The trier of fact would then be left to determine how much weight to give the evidence.

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21. For a technical discussion of software operation, see Roberts, *A Practitioner's Primer on Computer-Generated Evidence*, 41 U. CHI. L. REV. 254 (1974).

Two major problems are raised by this approach. First, custodians of records will be familiar with the administrative procedures for putting data in the computer, but it is unlikely that they will know what the computer does with the data. Leaving the credibility of computer software to be tested by cross-examination would permit records to come into evidence under circumstances where the accuracy of the data contained in the records could not be tested. This system would encourage litigants to use custodians who were not familiar with the computer in order to frustrate the adversary process of litigation. Instead, litigants should be required to lay foundations before computer-generated business records are allowed into evidence. This will assure that the records are subject to cross-examination since the records will be certified by someone familiar with the software's operation.

The second, and related, objection to admitting computer-generated business records before establishing an adequate foundation for those record's trustworthiness pertains to the false indicia of reliability inherent in computer-generated evidence. The probative weight given to evidence is determined by the finder of fact. In the case of computers, finders of fact may tend to attach a degree of reliability to the records which does not exist. Requiring proponents of computer-generated business records to comply with foundational requirements before submitting the evidence frustrates attempts to get overly prejudicial evidence before the finder of fact.

A trend by courts confronted with software reliability issues has been to set stringent foundational requirements which must be met before computer-stored business records are admissible.<sup>22</sup> These requirements involve showing first that the records "have been made in the regular course of business" where the regular course of business involves making the "records contemporaneously or within a reasonable time thereafter."<sup>23</sup> Once the traditional business records requirements have been met, the litigant must additionally provide testimony regarding "the original source of the computer program" and "the procedures for input control including tests used to assure accuracy and reliability."<sup>24</sup>

The drawback to this system of certifying computer-stored business records is that it fails to recognize that various types of computer programs carry different levels of reliability.

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22. *United States v. Scholle*, 553 F.2d 1109, 1124-25, (8th Cir. 1977), *cert. denied*, 434 U.S. 904 (1977); *United States v. Russo*, 480 F.2d 1228, 1240 (6th Cir. 1973), *cert. denied*, 414 U.S. 1157 (1974).

23. *Scholle*, 553 F.2d at 1124 (*citing* *United States v. Anderson*, 447 F.2d 833, 838 (8th Cir. 1971)).

24. *Id.* at 1125. *See also Russo*, 480 F.2d at 1240; *United States v. Miller*, 771 F.2d 1219, 1237 (9th Cir. 1985).

Under certain circumstances, judicial notice of the reliability of computer software may be justified. Some courts have essentially adopted a judicial notice approach to the admission of computerized evidence. Once the proponent has met the foundational requirements of proving that "the records are kept pursuant to some routine procedure", that the records were prepared "for motives that would tend to assure accuracy" and that the records were "not themselves mere accumulation of hearsay or uninformed opinion," the evidence is admitted without regard to the way it was created and stored.<sup>25</sup> The problem with this approach is that it incorrectly assumes that all software is inherently reliable, which is not the case.<sup>26</sup> Judicial notice of software reliability may be appropriate under some circumstance and violate the statutory trustworthiness requirements in others.<sup>27</sup>

It has been suggested that judicial notice is appropriate in circumstances where the records are the result of a long history of computerized record keeping, as with the Internal Revenue Service, for example.<sup>28</sup> Similarly, judicial notice is most appropriate when dealing with some types of off-the-shelf computer programs. These "canned" programs carry high indicia of reliability based upon the fact that market forces monitor their accuracy. Programs which are inaccurate will not survive long. In cases where the evidence was created using an off-the-shelf program, requiring the offeror of the evidence to show that the program was of the off-the-shelf variety should satisfy the foundational requirements assuring reliability.

Relying on the market place to monitor for software accuracy is only appropriate when the data was stored using off-the-shelf programs with structured working environments.<sup>29</sup> Programs requiring the user to create working environments lack the degree of reliability possessed by structured programs. The best example of a program which requires the creation of environments is Lotus 1-2-3 (Lotus) by Lotus Development Corporation. Before Lotus can be used, a series of cells and environments must be designated. Environments are then linked together through mathematical equations which delineate the relationship be-

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25. *United States v. Fendley*, 552 F.2d 181, 184, (5th Cir. 1975); accord *Scholle*, 553 F.2d at 1123-25.

26. For example, Lotus 123, the industry standard for spread sheets still contains some minor bugs in the program's internal calendar. See Seligman, *Lotus Meets the Pope*, *FORTUNE*, March 17, 1986 at 105.

27. See *FED. R. EVID.* 803(6).

28. Comment, *Guidelines for the Admissibility of Evidence Generated by Computer for Purposes of Litigation*, 15 U. C. DAVIS L. REV. 951, 955 n. 14 (1982).

29. For example, *Dollars and Sense* by Monogram gives the user very little flexibility with respect to the operations the program will perform. The user enters financial data into the computer and then instructs the program to generate standardized financial documents.



tween cells. A simple mistake in one of the equations leads to the creation of inaccurate data.<sup>30</sup>

Different foundational requirements are necessary to assure reliability where user defined parameters affect the calculation and retrieval of data. Litigants should be required to prove that the user created environments are accurate when programs of this type were used to create a business record. Adopting a two-tiered foundational process would assure that business records created using an unstructured off-the-shelf computer program were accurate. Litigants would first demonstrate that the data was stored using a commercially produced, off-the-shelf computer program. Litigants then should be required to fulfill an additional requirement, showing that the user-created environments are accurate. Where the person using the program is not familiar with the underlying assumptions, litigants should elicit the testimony of both the custodian of records and a technician before the records could be entered into evidence.

Problems with software reliability become even more acute when businesses use advanced and specialized software packages which were custom made to deal with a specific business's needs. As programs become more specialized and unique, the indicia of reliability present in the standardized canned program disappears. The only way to certify that a custom software package is reliable is to require detailed testimony from someone familiar with the program's operation.

Testimony regarding the accuracy of custom programs may be offered in two ways. The programmer could be required to testify, since he is the only one with actual knowledge of the program's operation.<sup>31</sup> Unfortunately this could cause otherwise admissible evidence to be excluded where the programmer was unavailable or could not be located. A better solution involves securing the testimony of a person familiar with the use of the computer and program.<sup>32</sup> This person would not have to be the programmer himself, but should be someone familiar with the operation and results the particular program delivers. The

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30. For a discussion of the effect of errors in spreadsheets, see Ditlea, *Spreadsheets Can Be Hazardous To Your Health*, PERSONAL COMPUTING, Jan. 1987 at 60.

31. See *United States v. Scholle*, 553 F.2d 1109, (8th Cir. 1977), cert. denied, 434 U.S. 904 (1977), where the testifying witness had developed and written the program.

32. See *United States v. Russo*, 480 F.2d 1228, 1241 (6th Cir. 1973), cert. denied, 414 U.S. 1157 (1974), where the court admitted computer printouts certified by experts familiar with the computer system used, noting that the expert witnesses were qualified by: education, training and experience and they showed a familiarity with the particular computers in question. The mechanics of input control to assure accuracy were detailed at great length as was the description of the nature of the information which went into the machine and upon which the printout was based.

See also *United States v. Weatherspoon*, 581 F.2d 595, 598 (7th Cir. 1978), examining factors a court may require in certifying the accuracy of computer-stored records.

level of sophistication of the testimony will depend upon the program being used. If the program is a custom accounting package, reliability could be established by showing that the program delivered accurate financial statements, based upon comparisons with manually created records. More sophisticated applications, like inventory tracking and decisional programs would require a more technological basis in order to establish reliability.

#### D. SUMMARIES OF BUSINESS RECORDS

Evidence contained in business records can also be submitted to the court in the form of a summary of records. Article X of the Federal Rules of Evidence pertains to the "[c]ontents of Writings, Recordings, Photographs." The Federal Rules of Evidence permit parties to submit "a chart, summary, or calculation" of "voluminous, writings, recordings, or photographs which cannot conveniently be examined in court," provided that the originals are made available for inspection by the opposing party.<sup>33</sup> The Federal Rules also contain provisions which provide for the admissibility of a computer-generated summary of large amounts of data.<sup>34</sup>

Admissibility of evidence is initially dependant upon the admissibility of the underlying data.<sup>35</sup> The data serving as the basis of the summary consists of data entered into the computer during the regular course of business. The underlying data, although hearsay, is thus admissible under the business records exception to the hearsay rule.<sup>36</sup>

Once the foundational requirements for the underlying data have been established, the summary must comply with the terms of rule 1006 of the Federal Rules of Evidence.<sup>37</sup> Initially, Rule 1006 requires making the data upon which a summary is based available to the opposing

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33. FED. R. EVID. 1006.

34. The Federal Rules of Evidence broadly define "writings", "recordings" and "originals" so as to provide for the admissibility of data stored in a computer. Writings and recordings are defined as "letter, words, or numbers, or their equivalent, set down by . . . magnetic impulse mechanical or electronic recording, or other form of data compilation." FED. R. EVID. 1001(1) (emphasis added). "An 'original' of a writing or recording is the writing or recording itself or any counterpart intended to have the same effect by a person executing or issuing it. . . . If data are stored in a computer or similar device, any printout or other output readable by sight, shown to reflect the data accurately, is an 'original'." FED. R. EVID. 1001(3) (emphasis added).

35. *Paddack v. Christensen*, 745 F.2d 1254, 1259-60 (9th Cir. 1984); *United States v. Johnson*, 594 F.2d 1253, 1255 (9th Cir. 1979), cert. denied, 444 U.S. 964 (1979).

36. See *supra* notes 2-11 and accompanying text.

37. FED. R. EVID. 1006 specifically states that "the contents of voluminous writings, . . . which cannot conveniently be examined in court may be presented in the form of a chart, summary or calculation. The originals, or duplicates, shall be made available to examination of copying, or both, by other parties at reasonable time and place."

party. It is clear that the rule requires the disclosure of all individual records which go into compiling the summary. A more difficult issue is whether the computer and program should also be made available for inspection.

The ability to compel production of records in computer readable form was addressed by the court in *National Union Electric Corp. v. Matsushita Electric Industrial Co.*<sup>38</sup> Defendant, Matsushita, sought production of records in machine readable form. The plaintiff objected, stating that Matsushita was only entitled to production of the records on paper. The court granted the defendant's request and ordered the plaintiff to provide Matsushita with the requested records in a form which could be read by a computer. The court justified its holding, in part, upon the unnecessary expense Matsushita would incur by entering the raw data into a computer.<sup>39</sup>

One objection raised by *Matsushita* was that the requested materials were protected by the attorney work-product privilege.<sup>40</sup> Computer systems and printouts are protected if they contain "the mental impressions, conclusions, opinions, or legal theories of an attorney or other representative of a party concerning the litigation."<sup>41</sup> The court dealt with this claim by noting that the information requested "[wa]s limited to exactly the same data (in the same arrangement) which [National Union Electric] furnished defendants in paper printout reports."<sup>42</sup>

The attorney work-product rule does not bar the production of computerized records in machine readable form, but may protect the computer system itself where the computer is a litigation support system. Computers used to prepare business records are not litigation support systems and are subject to discovery.

An issue which did not arise in *Matsushita* is the problem associated with the discovery of trade secrets. Computer programs may not be discoverable where the program qualifies as a trade secret. A tension may exist between the need for full discovery and protection of trade secrets; however, trade secrets should be protected from discovery provided that their non-disclosure does not work some injustice. Judges currently determine the appropriateness of the trade secret privilege based upon the facts of each case. This case by case approach is well suited to the discovery of computer programs. Case by case determinations do not overly burden the courts, and protect trade secrets unless justice dictates otherwise.

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38. 494 F.Supp. 1257 (E.D. Pa. 1980).

39. *Id.* at 1258.

40. *Id.* at 1260.

41. FED. R. CIV. P. 26(b)(3). *See also Matsushita*, 494 F.Supp. at 1260.

42. *Matsushita*, 494 F.Supp. at 1260.

The issues raised in *Matsushita* should extend to the production of both the computer and program used to generate a summary of business records. The availability of the computer and program makes it possible for a party to ascertain the reliability and validity of a summary with a minimum of time and expense.

It has been suggested that Rule 1006(b) be revised to permit discovery of both the computer and program used to create a summary.<sup>43</sup> The proposed revisions would require litigants to:

ma[k]e available for examination or copying or both, by other parties at a reasonable time and place:

1. The original computer stored data being translated.
2. The program or programs used to translate the data.
3. Documentation for the computer stored data and programs.

The court may order that they be produced in court. The process used to translate the data shall be shown by the testimony of a qualified witness.<sup>44</sup>

Availability of the program gives opposing parties the chance to work with data in the same manner as the offering party. With this rule, the offering party would not have an incentive to try and hide the data by creating a printout of useless information. It also offers the opposing party a fair chance to interpret the data. Requiring the testimony of a "qualified witness" helps assure that the methods used to create the summary are accurate, by giving the opposing party a chance to discredit the witness and thus the report.<sup>45</sup>

If the computer and program used to create a summary are not discoverable, then litigants are forced to recreate the program and data used in the summary, with no assurances of success. Making the computer and program discoverable has the twin benefits of economic efficiency and accuracy.

#### E. HOUSEHOLD RECORDS

Traditionally, personal records have not been admissible evidence, regardless of how regularly the records were kept.<sup>46</sup> Recently courts have begun to recognize that household financial records may be just as reliable as those of a business.<sup>47</sup> This is due to the fact that households, like businesses, are subject to regular billing cycles and routine financial patterns. As computers become common household appliances, organized personal financial records will follow. Families will conduct

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43. Singer, *supra* note 19, at 189.

44. *Id.*

45. *Id.* at 190.

46. Comment, *supra* note 1, at 141.

47. *Id.* See also *Sabitino v. Curtiss Nat'l Bank* 415 F.2d 632 (5th Cir. 1969), *cert. denied*, 396 U.S. 1057 (1970); *Keogh v. Comm'r*, 713 F.2d 496 (9th Cir. 1983).

financial transactions by computer,<sup>48</sup> and the shoebox will be replaced by the hard disk as the method of keeping track of household financial matters. The result will be a situation where personal financial records are indistinguishable from those kept by a small business. A sensible solution is to permit individuals to use personal financial records as evidence, subject to the same foundational requirements as business records.

### III. SIMULATIONS, MODELS AND PROJECTIONS

#### A. OVERVIEW

The second major type of computer-generated evidence is created expressly for use in litigation. This type of evidence can take two forms. First, computers can be used to create numerical projections and predictions. Second, computers can also be used to simulate or graphically recreate past physical occurrences.

#### B. NUMERICAL PROJECTIONS

In personal injury cases, experts are regularly called upon to testify as to litigant's loss of wages, future medical costs, and various other damages involving complex calculations based upon empirical data. Expert testimony of this type involves assumptions and predictions about future trends.

The Federal Rules of Evidence authorize the use of expert witnesses when such testimony will assist the trier of fact to make an informed judgement on the merits of the case.<sup>49</sup> Expert opinions may go to matters which are ultimately matters of fact.<sup>50</sup> Under Rule 703 an expert's testimony may be based upon facts of which the expert has personal knowledge, which are brought to his attention at trial, or are learned of in any other way so long as "they are of a type reasonably relied upon by other experts in the field."<sup>51</sup>

Computers allow experts to create convincing schedules and predictions projecting future trends and occurrences.<sup>52</sup> Some courts have in-

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48. Programs like Anthony Tobias's *Managing Your Money* from M.E.C.A. and *Dollars and Sense* from Monogram provide easy home record keeping and financial management capabilities. See generally S. BRAND, *WHOLE EARTH SOFTWARE CATALOG FOR 1986*.

49. The rules specifically provide that "[i]f, scientific, technical, or other specialized knowledge will assist the trier of fact to understand the evidence or to determine a fact in issue, a witness qualified as an expert by knowledge, skill, experience, training, or education may testify there to in the form of an opinion or otherwise." FED. R. EVID. § 702.

50. MCCORMICK, *supra* note 3, at 30.

51. 3 D. LOUISELL & C. MUELLER, *FEDERAL EVIDENCE*, § 387 (1979).

52. See Estin, *The Use of Models in Litigation: Concise or Contrived?*, 52 CHI.-KENT L. REV. 610 (1976).

correctly assumed that these computer programs act as calculators, generating infallible accounts of reality.<sup>53</sup> The "calculator theory" of computer programs, assumes that objective "facts" are entered into a computer and the computer then arrives at a "correct" result by running standardized numerical procedures, much like a hand-held calculator.

Mathematical formulations and assumptions, however, have important independent evidentiary value which must reflect real world conditions.<sup>54</sup> For example, a computer can be used to calculate the loss of future earnings if the proper variables and values are correctly identified. In the case of calculating the loss of future earnings, these factors will include the victim's expected lifespan, expected income stream if not for the injury, the rate of inflation, and interest rates over the victim's life.<sup>55</sup>

Determination of the factors to be evaluated in calculating complex damages has traditionally been the job of expert witnesses. Today, however, computer programs can be written to calculate damages. Appropriate numerical values can be entered into a computer, and damages will then be computed according to a fixed formula. This system's obvious flaw is that experts must still write the programs and determine the appropriate weight given to the variables. Evidence of this type should only be admissible as part of an expert witness's opinion testimony. Requiring an expert to describe the method by which damages are calculated educates jurors and reminds them that the information obtained from a computer is only as good as the information put in. Furthermore, cross-examination, an essential feature of the adversary process, assures that juries are provided with sufficient evidence upon which to base an award of damages.

In offering this tupe of evidence litigators and experts should also be prepared to address issues concerning the reliability of the computer. For the most part, experts using computers to calculate damages will use computers to run complex, but routine, mathematical calculations. Mathematical calculations are relatively standard procedures. Therefore, it is likely that standard, mass produced software will have been

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53. See *Perma Research and Dev. v. Singer Co.*, 542 F.2d 111, 124 (2nd Cir. 1976) (Van Graafeiland, J., dissenting), *cert. denied*, 429 U.S. 987 (1976), where the District Court Judge is said to have referred to computers as "but calculators [sic] with a giant 'memory' and the simulations the computer produces are but the solutions to mathematical equations in a 'logical' order."

54. *Perma*, 542 F.2d at 121-22.

55. See *Shu-Tao Lin v. McDonnell Douglas Corp.* 574 F.Supp. 1407, 1411 (S.D.N.Y. 1983), where the court held that a computer printout showing loss of wage calculations in a wrongful death action was "devoid of probative value" until proof was offered to support the underlying suppositions.

used to do the calculations.<sup>56</sup> If this was the case, the indicia of accuracy associated with the reliability and accuracy of the hardware are high, just as if a calculator or adding machine were used.<sup>57</sup>

### C. MODELS AND SIMULATIONS OF PAST OCCURRENCES

The availability of affordable animation and graphics programs promises to have a profound affect on the way trials are conducted.<sup>58</sup> Instead of relying on charts to demonstrate how an accident occurred, attorney's will be able to call upon expert witnesses to visually reconstruct favorable versions of past occurrences.

Computer models and simulations differ from numerical projections in a variety of ways. First, numerical projections predict are merely attempts, based upon past occurrences and trends to what the future is going to look like. Computer models and simulations however, are used to recreate and explain past physical occurrences.<sup>59</sup> A well prepared computer simulation or demonstration can help provide juries with a clear understanding of how an accident occurred.

The absence of appropriate safeguards in the use of computer models and simulations, has the potential of creating substantial relevancy problems. "Relevant evidence" is defined as "evidence having any tendency to make the existence of any fact that is of consequence to the determination of the action more probable or less probable than it would be without the evidence."<sup>60</sup> Demonstrations do not become relevant until it is shown that the model accounts for the crucial characteristics and factors present when the accident occurred.

One of the best discussions dealing with the problems created by computer simulations is the dissent by J. Van Graafeiland in *Perma Re-*

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56. For examples of the flexible application abilities present in standardized, off-the-shelf spreadsheets see Matheny, *Simulation with Electronic Spreadsheets*, BYTE, March 1984, at 411.

57. See *supra* notes 30-31 and accompanying text. See also *D & H Auto Parts, Inc. v. Ford Marketing Corp.* 57 F.R.D. 548, 552 (E.D.N.Y. 1973).

58. Relatively inexpensive animation programs are currently available for the Apple Macintosh and the Commodore Amiga. See Bartimo, *The Mac Gets Animated*, PERSONAL COMPUTING, Feb. 1986, at 146; Ditton and Ditton, *Amiga Animation*, BYTE, Sept. 1986, at 241-47; McLaughlin, *Painting and Animation on the Amiga*, BYTE, Feb. 1986, at 37.

59. For example, computer programs have been used to reconstruct the explosion of the space shuttle Challenger. *Computer Graphics Depict Events Leading to Explosion*, AVIATION WEEK & SPACE TECH., March 24, 1986, at 74. Computers have also been used in medical malpractice cases. For example a computer simulation was used to reconstruct the radiation treatment process for a brain tumor in a medical malpractice case. Jenkins, *Computer-Generated Evidence Specially Prepared For Use At Trial*, 52 CHI.-KENT L. REV. 600, 602 (1976).

60. FED. R. EVID. 401. See also Young, *Computer-Generated Evidence (When Is It Admissible at Trial?)*, TRIAL, Jan. 1985, at 15.

*search and Development v. Singer Co.*<sup>61</sup> The dispute in *Perma* revolved around whether a new automotive braking system could be perfected. In order to prove their case, the plaintiff, Perma Research, offered the testimony of two expert witnesses, over objection, that based upon the computer simulations, the brake system could be perfected.<sup>62</sup> On appeal, the court held that the "trial judge did not abuse his discretion in allowing the experts to testify as to this particular basis for their ultimate conclusion."<sup>63</sup>

Testimony of this sort is fraught with reliability problems. Models and simulations are not as reliable as other types of evidence. Models and simulations exist in a controlled environment which may not account for all of the factors surrounding an accident. Judge Van Graafeiland, in his dissent in *Perma*, pointed out that "[s]imulation is 'make-believe' - it's a game - but it should have some solid relationship with the real world.' It is the 'construction and manipulation of a model of a real world reference system by utilizing theoretical simplification and assumptions.'"<sup>64</sup> These concerns are present both where experts are testifying regarding the results of a simulation, and when the simulation or animated depiction is run in the court room.

If litigants are going to be permitted to use computer simulations as an evidentiary tool, safeguards are necessary. First, litigants proposing to use computer simulations at trial should be required to make the model and modeling programs available to opposing counsel prior to trial. Analyzing the accuracy of a complex computer model in the short time that an expert witness is on the stand is nearly impossible.<sup>65</sup> Disclosure of the model and its underlying assumptions would provide the opposition with the opportunity to verify the accuracy of the evidence. In the case of well defined, convincing models, disclosure will also encourage out of court settlements.

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61. 542 F.2d 111 (2nd Cir. 1976) (Van Graafeiland, J., dissenting), *cert. denied*, 429 U.S. 987 (1976).

62. *Id.* at 115.

63. *Id.*

64. *Id.* at 122 (citations omitted) (*quoting* FAVRET, INTRODUCTION TO DIGITAL COMPUTER APPLICATIONS 122 (1965)).

65. Under the Federal Rules of Evidence an "an expert may testify in terms of opinion or inference and give his reason therefore without prior disclosure of underlying facts or data unless the court requires otherwise." FED. R. EVID. § 705. Some courts however have realized that computer simulation offers a unique set of circumstances to which rule 705 should not apply. See *United States v. Cepeda Penes*, 577 F.2d 754, 760-61, (1st Cir. 1978), *cert. denied*; *City of Cleveland v. Cleveland Elec. Illuminating Co.*, 538 F. Supp. 1257, 1266 (N.D. Ohio 1980); see also, *United States v. Liebert*, 519 F.2d 542, 547 (3rd Cir. 1975), *cert. denied*, 423 U.S. 985 (1975). Cf. *United States v. Bastinpour*, 697 F.2d 170, 177 (7th Cir. 1982), *cert. denied*, 460 U.S. 1091 (1983) where it was held that the computer printout is admissible as a component of an expert's opinion testimony.



At trial, litigants must be required to lay detailed foundations explaining the assumptions made in creating the model. A complete foundation educates juries with respect to the model's relevance to the controversy, and helps minimize the prejudicial effect of the model.<sup>66</sup>

Foundations must be more than just an explanation of the variables used in creating a model. Models depict idealized conditions, and may fail to account for discrepancies between the model's idealized assumptions and real world conditions. Computer modeling programs are uniquely designed, based upon a programmer's modeling technique and assumptions which went into creating the model. Once a programmer identifies the appropriate variables, determinations are then made regarding the relationship between the variables. The weight given to any specific variable will greatly effect the outcome of the simulation. The evidentiary value of a computer simulation is thus directly related to full disclosure, explaining the reason a model acts as it does.

Computer-generated simulations may be presented to the court in two ways. In the ideal case, models and simulations are presented by the expert who wrote the computer program. Under these circumstances, the programmer can be cross-examined regarding the creation of the computer program.

A more difficult situation is created when simulations are created by one person, using programs written by another. Experts routinely testify based upon experience and information gathered through education and published materials. Computer simulations differ from traditional expert testimony because the expert might not actually know the process by which a program manipulates data. Furthermore, opinions based upon computer-generated projections are actually the opinion of the person responsible for writing the program, not the testifying witness.

The court has four possible ways of dealing with these problems: the court can take judicial notice of the program's accuracy, require testimony from the testifying expert witness about the reliability of the program, require the presence of the expert who wrote the program, or require the testimony of some third party familiar with the design and assumptions built into the program.

Judicial notice of the inherent reliability of the program and adoption of the "calculator theory" of computers offers the most efficient method for admitting computer simulations at trial.<sup>67</sup> However, this is not viable in light of the judicial goal of assuring that evidence is reliable. Modeling programs are likely to be specialized, and consequently they will not possess the same degree of accuracy as the mass-marketed

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66. See *infra* notes 73-75 and accompanying text.

67. See *supra* notes 51-56 and accompanying text.

programs.<sup>68</sup> Furthermore, modeling programs are based upon a programmer's assumptions about the interaction of physical objects in the real world. Judicial notice of the reliability of the program would effectively allow expert testimony to be offered at trial without providing the opposition the opportunity to cross-examine testifying experts. This system would encourage the proliferation of experts who do not testify, but market computer programs with a built-in bias.

The second alternative involves permitting experts to testify with respect to the processes used by the program. This option is viable when experts use a standardized program, like a spreadsheet,<sup>69</sup> to model numerical projections.<sup>70</sup> Under these circumstances the expert was actually the programmer, and his assumptions are subject to cross-examination.<sup>71</sup> If the testimony is subject to discovery prior to trial, the program's accuracy can be tested. Where objective mathematical operations are performed, double checking the data merely requires running it through two different programs.<sup>72</sup>

This system offers only a partial solution to the problems presented by computer-generated simulations. It falls short of being an ideal solution in that it cannot guarantee reliability in circumstances when the expert is unable to testify as to the technical assumptions made by the program. For example, in a dispute arising out of an automobile accident one issue in determining liability is likely to be speed. Testimony regarding speed itself might be difficult to obtain. Objective evidence, like skid marks, however, can be used by accident reconstruction experts to approximate the speed at which a car was traveling. Using a computer animation program, an expert can create a visual depiction of the car accident, including the making of the skid marks. Skid mark length, however, depends on more than just speed. Other factors, such as the condition of the road and weather conditions, affect stopping distance and must be factored into the simulation. The results generated by a computer program will vary, based upon the assumptions made by the programmer.<sup>73</sup>

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68. See *supra* notes 29-30 and accompanying text.

69. See *supra* notes 29-30 and accompanying text.

70. See Matheny, *supra* note 56, at 411.

71. See *supra* notes 29-30 and accompanying text.

72. Singer, *supra* note 19, at 172.

73. For another example, Pittsburgh, Pennsylvania was recently rated the best city in the United States by Rand McNally in the *Places Rated Almanac*. Over 300 metropolitan areas were critiqued on the basis of numerical values assigned to nine different subjective factors. Lotus 123 was then used to generate the rankings. In generating these rankings, each of the factors was given equal weight. Obviously the results obtained would be quite different without the programmers assumption that each of the factors evaluated is equally important to the quality of a city. See, Seligman, *Lotus Looks at Pittsburgh*, *FOR-TUNE*, May 13, 1985, at 127.

It is essential that an opposing party be provided with a chance to rebut the assumptions made by a computer program. Rebuttal gives litigants a chance to show that salient factors were either left out of the program, or that the program did not accurately replicate the conditions under which the event being litigated occurred. Affording an opportunity for rebuttal requires proffering parties to provide testimony from someone who is familiar with the computer program. Unfortunately, the use of computer simulations as an evidentiary tool would be greatly limited where the programmer is unavailable.

Computers simulations are a useful way of providing a jury with graphic, easy to understand, case theories. The goal of the Federal Rules of Evidence is not to exclude probative evidence, but to substantiate the evidence's reliability. Requiring the appearance of the programmer at trial would result in the exclusion of computer models where the programmer was unavailable.

A fourth alternative, and a better approach, permits litigants to introduce the testimony of experts familiar with the program to testify as to the reliability and methodology employed by the program. This approach provides a screen against inaccurate computer programs, while still allowing litigants to use computer models.

A rule of law requiring the certification of programs by experts creates additional incentives for the experts in a particular field. The experts may either work with computer programmers in the creation of the programs, or, ideally, become familiar with programming techniques so that litigants would only have to use one expert witness.

#### IV. PREJUDICIAL EFFECT OF COMPUTER PRINTOUTS

Regardless of the care taken in laying a foundation, computer-generated evidence is likely to carry an air of reliability with juries which really does not exist.<sup>74</sup> This can be offset in a couple of ways.

First, the proponent of computer-generated evidence could be required to disclose plans to submit such evidence at trial, and provide for the availability of the computer program.<sup>75</sup> Disclosure assures that the opponent of the evidence will be able to educate the finder of facts regarding the shortcomings of computer-generated evidence. By pointing out that a computer-generated report is only as reliable as the data which went into creating the report, litigants will be able to overcome the potential prejudicial effects of computer-generated evidence.

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74. Comment, *supra* note 28, at 961.

75. See *United States v. Weatherspoon*, 581 F.2d 595, (7th Cir. 1978); *United States v. Cepeda Penes*, 577 F.2d 754, 760, (1st Cir. 1978); *Perma Research and Dev. v. Singer Co.*, 542 F.2d 111, 124 (2nd Cir. 1976), *cert. denied*, 429 U.S. 987 (1976); *United States v. Russo*, 480 F.2d 1228, 1241 (6th Cir.1973), *cert. denied*, 414 U.S. 1157 (1974).

Second, in cases where there was not full disclosure, the judge may exclude the computer-generated evidence if, the judge determines that the evidence is more prejudicial than probative.<sup>76</sup>

## V. CONCLUSION

Properly used, computers have the potential to become a powerful tool for the litigator. Computerized business records, and computer-generated reports are readily available. It is more likely than not that any type of case involving business records is going to involve evidence affected by a computer.

With a few modifications, the business records exception to the hearsay rule will easily handle any reliability and accuracy problems presented by the use of computerized business records.

Different problems arise when the computer is used to create demonstrative evidence for the purpose of illustrating either past occurrences or future likelihoods. The only way to assure that computer models and simulations are not abused is to adopt strict foundational requirements which clearly demonstrate the steps used to arrive at a result or opinion. In order to lay a proper foundation the proponent of the computer-generated evidence should be required to put forth expert testimony not only as to the methods used to reach the result, but also regarding the methods and assumptions inherent in the software.

*Randy Snyder*

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76. FED. R. EVID. 403.

