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COMPUTER-GENERATED EVIDENCE SPECIALLY PREPARED FOR USE AT TRIAL

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Computers are not magic. Computers and their workings are not even—at least conceptually—all that complicated. Nevertheless, computers make it possible to consider, collate, manipulate, and analyze millions of discrete items of information, a task we humans have neither the time nor powers of concentration to perform effectively.

Though computer-generated evidence can do nothing which lawyers have not been doing via testimonial, documentary, real, or demonstrative evidence for years, computers make it possible to present the same kinds of evidence on a much grander scale and to deal with larger volumes and more complex manipulations, often at less cost. This article will explore these latter possibilities. The uses of the computer as a substantive as well as a litigation management aid are mind boggling. It is hoped that this article will encourage lawyers to consider what the computer can do for them in a variety of cases and to constantly be on the lookout for new applications.

It is not the function of this article to be pessimistic.[1] Nevertheless, it would be irresponsible not to issue a brief warning. While the computer may be used to generate, for use at trial, evidence that can aid in the "search for truth," it may also be used carelessly or in a biased fashion. Because the law on the admissibility of computer-generated evidence is still in the developmental stage, casual or greedy use of this tool may adversely affect its growth. Computer-generated evidence tends to mesmerize factseekers and relax their natural critical natures, yet there is great danger of it being erroneous, misleading, or unreliable. The underlying data may be full of errors or discrepancies, or it may, for one reason or another, be irrelevant or improper as evidence. The data may have been fed into the computer inaccurately. The computer may have been improperly programmed or not programmed to detect errors. The assumptions on which the program was based may be wrong, illogical, or simply irrelevant to the issues sought to be proved. Each one of these potential problem areas must be guarded against by proponents and assiduously investigated by counsel opposing the evidence.

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1. The other articles published as part of this symposium are intended to and do point out some of the problems and dangers in the use of computers.

While there are almost no reported decisions on the admissibility of computer-generated evidence that has been specially prepared for trial, the state of the art would lead one to believe that such evidence is frequently used in creative ways. If so, wise and skillful counsel and courts must have done so without the kind of evidentiary disputes which lead to published opinions.

THE RANGE OF POSSIBILITIES

Computers can perform a number of functions which may be very useful in the context of litigation.[2] In particular, the ability of the computer to rapidly summarize and manipulate a large volume of data has made it useful in executing the technical aspects of models.

One class of models commonly used and of great potential use to litigators deals with the simulation of physical events—simulation models. These models accept data which is representative of actual events, manipulate this data according to sets of rules which represent how the world works, and present results which are an approximation of the actual results.

One potentially useful simulation model is based on what economists call "queuing theory." The queuing theory, as the name suggests, basically means to line things up. It is a model used to determine the optimum allocation of resources or to show how something runs. An example of a common use of queuing theory models is that of a bank which wants to determine the most efficient method of serving customers, e.g., how many teller windows it should have, whether it should have teller windows for all transactions, or whether teller windows should be designated to handle specific kinds of transactions. The bank creates a model to process in the computer the information it has on the number of people who will want to be served, some random pattern of their coming in, what times of day demands for service are heaviest, how many and what kinds of transactions people will engage in, and any other relevant data. The model, when executed utilizing the data described above, will tell the bank what use of tellers and windows will most efficiently serve its customers. Any case involving allocation or "best use" of resources might be ripe for construction of this type of model.

Other types of simulation models are designed to duplicate physical or mechanical motions. This kind of model is common in industry. It is most frequently used in the design of products, particularly products with moving parts such as machinery, automobiles, and aircraft, to determine how they will stand up to the stresses to which they will be exposed. A model of this type would be useful, for example, in a product liability case to determine whether a particular failure was the result of a design defect and was predictable.

2. The author particularly appreciates the suggestions and aid of James A. Sprowl, Carol P. Eastin, Jerome J. Roberts and J. David DeHetre.

An interesting example of a model simulating physical or mechanical motions was given by R. Crawford Morris of Arter & Hadden, Cleveland, Ohio when he spoke on the use of computers in medical malpractice cases at the American Bar Association Litigation Section National Institute in New York in March, 1975. In the example he discussed, a patient had been treated and subsequently died, allegedly from radiation burns. The patient had a tumor in his head, and his doctors had prescribed a certain radiological treatment. The treatment was later reconstructed via computer. The precise measurement of the patient's skull, the location of the tumor, and the direction, timing and strength of the radiological treatment was all fed into the computer. The parties were thus able to determine that the radiological treatment ordered was, in fact, not the appropriate one, that the burns were caused by the treatment, and that the patient died as a result of them.

Simulation models can also simulate particular environments such as the ecology of the entire world, the economy of the United States, or the workings of a particular industry, business, or organization. They may be used to predict what may happen in the model environment if a particular course of action is followed. For example, econometric models are commonly used to manipulate economic indicators to show what the economy is going to do. Similar models are used to simulate businesses to determine the effects of various courses of action. They are also used retroactively to determine what happened or whether a particular course of action was a reasonable one.[3] At least one large corporation has an executive game room where executives play with corporate models and are given prizes for having the most profitable business or the happiest employees. Business schools have also developed models of the business environment for use as a teaching tool.

Environmental and ecological areas are appropriate for the use of simulation models for determining scientific facts such as what effect a particular substance might have on the environment. The purpose is to precipitate rational decisionmaking.[4] Environmental impact reports required by the National Environmental Policy Act of 1969 (NEPA) are

3. *See* accompanying symposium article by Carol P. Eastin.

4. *E.g.*, Pierce & Gutfreund, *Evidentiary Aspects of Air Dispersion Modeling and Air Quality Measurements in Environmental Litigation and Administrative Proceedings*, 25 FEDERATION INS. COUN. Q. 341 (1975); Ackerman & Sawyer, *The Uncertain Search for Environmental Policy: Scientific Factfinding and Rational Decisionmaking Along the Delaware River*, 120 U. PA. L. REV. 419 (1972). *See also* Crowther v. Seaborg, 315 F. Supp. 1205 (D. Colo. 1970) in which computers are not specifically mentioned, but the data accepted by the court was highly technical and the opinion is replete with words like "projected," "extrapolate," and "estimated." The case involved an attempt to enjoin detonation of nuclear devices as a means of obtaining natural gas from nonporous rock formations. The case turned on whether the court was satisfied with the Atomic Energy Commission's projection of the adequacy of their safety devices against projections of possible harmful radiation effects.

frequently prepared with the aid of computer technology and mathematical modeling.[5]

An especially interesting project involving a simulation model of the environment is described in an article by Bruce Ackerman and James Sawyer.[6] The Delaware River Basin Commission consisting of representatives of the various riparian states and several federal agencies was formed to control the development of the Delaware River Basin and to alleviate water pollution. There were many problems in terms of comparative pollution, the unequal costs to each polluter of purifying its effluent, and, in general, the allocation of the burdens of cleaning up the river. The Department of the Interior constructed a mathematical model simulating the impact of pollutants discharged by industries and cities along the river. This model was used to attempt to quantify the costs and benefits of a variety of proposed clean-up programs.

Another use of a simulation model might be in the area of zoning. A computer model could be constructed of a town. Elements relevant to the essentials of zoning decisions such as streets and traffic patterns, schools, utilities, necessity for open spaces, and other variables would be programmed into the model. An application for a zoning variance could then be tested initially with this town model and its effects upon critical elements noted. If the model were not constructed until after litigation began, the decision could later be tested as to its reasonableness.

A model of a geographical area might also be used by businesses to select sites for stores, outlets or offices, or to uphold the business necessity or reasonableness of such selection at a later time in the face of an antitrust claim, shareholders' derivative claim, or tort claim. Similar models could be used in an antitrust case to determine whether a merger or acquisition might lessen competition. They could also be used to help define a relevant market or to determine whether a particular anticompetitive practice would injure another's business or property.[7]

5. Examples of environmental impact statements are frequently published in or reviewed in the Ecology Law Quarterly.

6. Ackerman & Sawyer, *The Uncertain Search for Environmental Policy: Scientific Factfinding and Rational Decisionmaking Along the Delaware River*, 120 U. PA. L. REV. 419 (1972).

7. *See* Lozowick, Steiner & Miller, *Law and Quantitative Multivariate Analysis: An Encounter*, 66 MICH. L. REV. 1641 (1968), describing complex economic and statistical calculations to define the relevant market in a bank merger case. *See generally Bibliography on Economic and Scientific Proof*, ABA SECTION ON ANTITRUST LAW 1973; Bok, *Section 7 of the Clayton Act and the Merging of Law and Economics*, 74 HARV. L. REV. 226 (1960). For a sometimes entertaining debate injecting some balance into the infusion of economics, computers and higher mathematics into the law, see the articles discussing POSNER, ECONOMIC ANALYSIS OF LAW (1973): Polinsky, *Economic Analysis as a Potentially Defective Product: A Buyer's Guide to Posner's Economic Analysis of Law*, 87 HARV. L. REV. 1655 (1974); Leff, *Economic Analysis of Law: Some Realism About Nominalism*, 60 VA. L. REV. 451 (1974).

The use of computer models in construction cases is of growing benefit to litigators. In cases where delay damages or contract payments turn on what went wrong and whose fault it was, the "critical path" analysis of construction progress is of great use. The critical path method is not new, but its sophistication through the use of the computer is. A critical path analysis of how a construction project is to proceed typically is made prior to the beginning of construction. A similar analysis can be made at the end of a project to analyze what actually occurred and identify which events were the cause of delays. The critical path program can be written to consider when each contractor began working, the phases of the work in which he was engaged, the calendar days and employee man days spent by the contractor, strikes, weather, delivery of materials and supplies, delivery of necessary equipment, and other factors affecting the progress of the construction.[8] The program can recreate the status of the project at particular points in time, identify the effects of events on the progress of the project, or demonstrate the timely completion of the project if a particular sub-contractor had performed as promised or if some other event had not occurred.

A model might also be utilized simply to take a complex situation and put it into a more comprehensible form. Perhaps a particular section of the Internal Revenue Code could be isolated and its rules programmed. Real data could then be fed into the computer to see the effect of the application of the rules. This would allow evaluation of whether the policies behind the rules are being served in situations where either the Code or the facts are too complex to conceptualize.

Statistical analysis is facilitated through the use of computer models. Statistical models consist of certain operating assumptions. Data is fed into the computer and manipulated according to the operating assumptions to test whether the statistical results are likely to have happened randomly or as the result of other causative factors. Employment discrimination is an area particularly susceptible to statistical analysis via the computer to show the probability that out of a given labor market a company intentionally discriminated in the hiring of particular groups of people or that the hiring ratios of the company could have occurred randomly.[9]

Computers are also increasingly used in cases where other kinds of statistical proofs are necessary. For example, in the antitrust area, in bid-

8. Joseph E. Bennett Co., Board of Contract Appeals, G.S.A., 4 C.L.S.R. 1022, GSBCA-72-1, 2362 (1972), discussed a critical path method construction plan reduced to computer logic. In that case, however, the Board of Contract Appeals refused to accept the critical path construction plan as fully reliable because of mathematical errors, the degree to which the plan ignored apparently forseeable winter weather conditions, and changes made to the schedule when it was computerized for purposes of the litigation.

9. A discussion of the use of models in employment discrimination situations may be found in Dawson, *Probabilities and Prejudice in Establishing Statistical Inferences*, 13 JURIMETRICS J. 191 (1973); Ewald, *Discovery and the Computer*, 1 LITIGATION 27 (1975). *See also* Note, *Beyond the Prima Facie Case in Employment Discrimination Law: Statistical Proof and Rebuttal*, 89 HARV. L. REV. 387 (1975).

rigging or price-fixing cases the computer can be useful in ascertaining patterns of behavior that previously would have been excruciatingly difficult to find.[10]

In addition to executing models, computers may be used in a complicated case merely to collate and summarize data into a form which can be understood by counsel, judges, and juries. Complex securities, antitrust, or criminal fraud cases would be ideal for such treatment.

The possible uses of the computer to execute models, to facilitate statistical inference, to simulate environments, or to aid in the decision-making process are endless. In addition to the uses already suggested, this technology could be used to determine the optimum management of investment portfolios, the impact of pornography or capital punishment, or an optimum reapportionment plan. There is an infinite variety of possible uses.

While essentially extraneous to this article, the usefulness of computers can be turned around. Since the state of the art offers many analytical tools, perhaps a reasonably prudent person must use them. Thus, a person or business entity could be held liable for the failure to use computer models to determine the effects of a course of action, for the failure to control a potentially dangerous industrial process, or for the failure to train personnel operating nuclear power stations or aircraft with simulated environments and simulated emergencies.

THE ADMISSIBILITY OF COMPUTER-GENERATED EVIDENCE SPECIALLY PREPARED FOR LITIGATION

Though the reported cases are few, some courts and administrative agencies have dealt with the question of the admissibility of computer-

10. In terms of statistics, with or without computer technology, see the jury discrimination cases of the civil rights era. Alexander v. Louisiana, 405 U.S. 625 (1972); Whitus v. Georgia, 385 U.S. 545 (1967); Swain v. Alabama, 380 U.S. 202 (1965). *See also* Gairys, *Juror Selection: The Law & Mathematical Method of Analysis, and a Case Study*, 10 AM. CRIM. L. REV. 77 (1972); Finklestein, *The Application of Statistical Decision Theory to the Jury Discrimination Cases*, 80 HARV. L. REV. 338 (1968). Also of interest are some of the cases applying statistical methods to the identification of defendants in criminal cases. They should at least make one think before playing too fast and loose with statistical proofs or models. State v. Coolidge, 109 N.H. 403, 260 A.2d 547 (1969); People v. Heard, 266 Cal. App. 2d 747, 72 Cal. Rptr. 374 (1968); Miller v. State, 240 Ark. 340, 399 S.W.2d 268 (1966); State v. Sneed, 76 N.M. 349, 414 P.2d 858 (1966); People v. Trujillo, 32 Cal. 2d 105, 194 P.2d 681 (1948); People v. Risley, 214 N.Y. 75, 108 N.E. 200 (1915); Kingston, *Application of Probability Theory in Criminalistics*, 60 J. OF AM. STATISTICAL ASS'N 1028 (1975); Kingston & Kirk, *The Use of Statistics in Criminalistics*, 55 J. OF CRIM. L.C. & P.S. 514 (1964); Finkelstein & Fairley, *A Bayesian Approach to Identification Evidence*, 73 HARV. L. REV. 489 (1970); Tribe, *Trial by Mathematics: Precision and Retrial in the Legal Process*, 84 HARV. L. REV. 1329 (1971); Finkelstein & Fairley, *The Continuing Debate over Mathematics in the Law of Evidence*, 84 HARV. L. REV. 1801 (1971); Tribe, *A Further Critique of Mathematical Proof*, 84 HARV. L. REV. 1810 (1971).

generated data developed specifically for use at trial. This question must be distinguished from the admissibility of computer-generated business records.[11]

In *United States v. Dioguardi*,[12] the defendants were charged with fraudulently transferring and concealing property of a bankrupt and fraudulently concealing assets from the trustee in bankruptcy. To prove its case, the prosecutor made a computer run of the inventory, daily sales, and purchases to determine when items of inventory were or should have been exhausted on a specific basis and as a whole. The court had no trouble admitting the computer-generated evidence, but it did chastise the government for not turning the computer program over to the defense. It seems obvious that the defense should have been given the program since it was specifically developed for use at the trial. The question of the producibility of a program is more troublesome where the program is a regular business program of the organization which was developed at great time and expense, the production of which could conceivably result in the loss of a competitive advantage. Protective orders may be readily fashioned, however, to protect against all such contingencies.

Computer studies are frequently reported in administrative proceedings, though the opinions are not particularly helpful here. For example, common carriers frequently computerize many of the studies they are required to file in pursuit of higher rates, different operating authorities, or other changes they seek from the Interstate Commerce Commission.[13] As

11. *See generally* Younger, *Computer Print-Outs in Evidence: Ten Objections and How to Overcome Them*, 2 LITIGATION 28 (1975); Freed, Fenwick & McGonigal, *Mock Trial: Admissibility of Computerized Business Records*, 15 JURIMETRICS J. 206 (1975); Roberts, *A Practitioner's Primer on Computer-Generated Evidence*, 41 U. CHI. L. REV. 254 (1974); FREED, COMPUTERS AND LAW—A REFERENCE WORK (4th ed. 1974); Bigelow, *Researching Computer Law*, 20 PRAC. LAW. 71 (1974).

12. 448 F. 2d 1033 (2d Cir. 1970).

13. The main argument in those cases has not been so much the admissibility of the studies per se, as whether the carriers attempting to introduce those studies have supplied underlying data and other information to their adversaries. *See, e.g.*, Aggregate Weight Provisions on Paper, Mass. to N.Y. and N.J., 323 I.C.C. 525, 1 C.L.S.R. 327 (1974) (Unit cost study based on annual report not admitted because of failure to have a qualified witness available for cross-examination having knowledge of the preparation of the study and for failure to have any underlying data available); Glass Bottles, Muskogee, Okla. to Chicago Group, 323 I.C.C. 258, 1 C.L.S.R. 306 (1964) (Cost analysis study for 23 carriers would be admissible when a qualified person was made available to explain who selected the data input and the basis of the selection, the manner in which the data was processed, and that the procedure complied with that generally accepted); American Colloid Co. v. Akron, Canton & Youngstown R. Co., 321 I.C.C. 91, 1 C.L.S.R. 244 (1963) (Computer cost analysis offered to show railroad rates were too high was admitted over objection because underlying data and working papers were made available with any deficiencies going to its weight not its admissibility). The I.C.C. recognizes the usefulness of computers in making the complicated studies it requires. 49 C.F.R. § 1104.3(d) requires, for example, that, when a computer is used in making a required cost study, a manual application of the costing procedure for one traffic and cost study carrier be submitted with the computer study to demonstrate the procedures by which the

lawyers become more aware of the possible uses of the computer, the written authorities should increase rapidly.

General Evidentiary Considerations

Due to the dearth of reported cases on specially prepared computer-generated evidence, no firm evidentiary rules can be given for the admissibility of such documents. Nor can one do more than speculate because of the infinite variety of possible uses, underlying data sources, and factual and legal contexts. The authority for the admissibility of these programs will vary only with the imagination of the attorney seeking their admissibility and the type of computer-generated data which is sought to be admitted.

A highly respected jurist and scholar once told the author that one could get anything into evidence if one was open-minded and gave the matter enough thought and study. While the author has not tested this thesis—and would hate to have to do so for some of the more blatant examples of improper evidence that can be imagined—it is, nevertheless, an admonition not to let anything go too easily. In the computer area there are many possible avenues of approach beginning with business records, opinion evidence, scientific and demonstrative evidence, samples, polls, summaries, or any combination of these or other rules of evidence.

Some computer-generated evidence will be admissible because it is based entirely on underlying business records and perhaps is merely a compilation or summary of those records even though it was prepared solely for use at trial and is organized differently from the originals. *Dioguardi* is an example of this type of evidence. The Federal Rules of Evidence sections 803(6) and 1006 read together permit such evidence. Bid-fixing information in an antitrust case may also fall into this category. The computer may be the only way to summarize all of the relevant dates, bidders, and prices into a comprehensible form.

Some computer-generated evidence, for example, models of a business environment, may be admissible as expert opinion evidence. The oral testimony of an expert could be based on a computer study or model which had processed the sort of evidence typically considered by the expert in his field,[14] or it could be typical for the expert in the particular field to rely on just such a model as happens to have been constructed. A good deal

computer program distributes the annual report statistics and applies service unit-costs for each shipment. *See also* 49 C.F.R. § 1104.10 (1974) which requires all underlying data to be made available. *See generally* Finklestein, *Regression Models*, 86 HARV. L. REV. 1442 (1973) (Regression models purport to furnish estimates of the economic effect of changes in a factor subject to regulatory control on the assumption that other factors will remain constant or change according to a certain set of rules).

14. How much different from this was the evidence in Brown v. Board of Education, 347 U.S. 483 (1954) and its progeny or the "Brandeis Briefs?"

of support for this is lent by Federal Rules of Evidence section 703, which states:

> The facts or data in the particular case upon which an expert bases an opinion or inference may be those perceived by or made known to him at or before the hearing. *If of a type reasonably relied upon by experts in the particular field in forming opinions or inferences upon the subject, the facts or data need not be admissible in evidence.*[15]

Some types of computer-generated evidence, for example, the evaluation of radiological treatment described above, may be admissible as demonstrative or scientific evidence on much the same basis as a physical model of a railroad crossing or a laboratory test might be admitted.

In terms of the practicalities of admissibility, the attorney should disclose to opposing counsel and the court at the earliest possible point in litigation an intention to use computer-generated data.[16] This may have a number of advantages. First, if the case is presided over by a judge who still thinks computers are a newfangled invention, the judge will have a chance to become acclimated to the idea. Second, opposing counsel may well have objections to the manner in which the attorney offering the evidence wishes to proceed. To the extent the attorney is able to obviate an opponent's objections at this point or even to enlist his affirmative assistance, the opponent may well become, if not bound by the results of the attorney's program, at least estopped from making certain objections. Third, it is extremely important to give the opposing side the opportunity to conduct full discovery as to the validity of the underlying data; the selection of that data; the validity of the program and of the assumptions that the program makes; the reliability of the programming, the data input, and the computer itself; and whether the end results of the program are appropriate to the original assumptions and techniques. As a caveat to those opposing admissibility, full advantage of discovery should be taken and objections noted prior to trial. No counsel should be permitted at trial to go on a fishing expedition or to suggest vague possibilities of problems with the computer-generated evidence. For example, the suggestion that on a ninety degree summer day the electricity load was so high that the transmission voltage was irregular and might have adversely affected the computer's functioning should be rejected out of hand unless counsel has proof that such a contingency did, in fact, have a deleterious effect on the computer.

Admissibility should depend on whether the computer-generated data is related to a material issue in the case; whether the data fits within a chain of inferences which would connect the data to an ultimate issue in the case; and whether the data can and will be presented in such a manner that it will not

15. FED. R. EVID. 703 (emphasis added). *See also* FED. R. EVID. 705, 402.
16. *See* MANUAL FOR COMPLEX LITIGATION §§ 2.70 *et seq.*

unduly confuse the issues or so confound and overawe the jury (if it is a jury trial) that it would be prejudicial to the opposing side.[17] In actuality, this analysis is no more than what counsel should do in every case. Counsel should have a clear idea prior to going to trial what the basic propositions are that must be proved. Evidence should be available to prove each of those propositions, and there should be a clear chain of proof from each element of proof through permissible inferences to the ultimate elements of the claim for relief.

CONCLUSION

Many companies now offer ready-made programs to assist attorneys in some or all of the areas suggested. Many universities and business schools have knowledgeable people who have already developed programs to do some or all of the things suggested in this article. Bar associations around the country are offering informative seminars relating to the use of computers. Law schools are beginning to offer courses in quantitative methods and the law or computers and the law. It should be an interesting though not very predictable future.

17. *See* FED. R. EVID. 401-03. A similar analysis is made with respect to criminal cases in Dawson, *supra* note 9, at 193.