CONTENTS

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ARTICLES

Thinking Like a Lawyer: Expert Systems for Legal Analysis
Richard Gruner 259

An Artificial Intelligence Application in the Law: CCLIPS, A Computer Program that Processes Legal Information
Cary G. Debessonet and George R. Cross 329

COMMENTS

Protecting the "Look and Feel" of Computer Software
John Pinheiro and Gerard Lacroix 411

Is There a Property Interest in Scientific Research Data?
Richard H. Jones 447

Medical Expert Systems: Grappling with Issues of Liability
Christopher J. Gill 483

BOOK REVIEWS

Software Protection by G. Gervaise Davis III; *and*
Legal Protection of Computer Programs and Data by Christopher J. Millard
Lois W. Abraham 521

SOFTWARE REVIEWS

The Cite Checker Published by Legal Software, Inc.; *and*
CiteRite: The Bluebook Expert Published by JURISoft, Inc.
Mark J. Welch 527

LEGISLATIVE UPDATE

..... 537

RESEARCH PATHFINDER

Expert Systems and Law 559

BOOKS RECEIVED

..... 587

ARTICLES

THINKING LIKE A LAWYER: EXPERT SYSTEMS FOR LEGAL ANALYSIS

BY RICHARD GRUNER †

The statute of limitations was about to run and attorney John Smith was faced with a highly complex problem in a very difficult field of law. Fortunately, Smith had access to LEX, a legal expert system containing knowledge in this field of law based on the accumulated expertise of top attorneys from the past three generations. In addition, LEX was supported by a research staff that kept it constantly abreast of the latest developments within its area of expertise.

Based on the information Smith was able to obtain during the early phases of his consultation with LEX, Smith began to identify the primary causes of action available to his client, including a possible cause of action under an obscure statute that Smith had initially overlooked. Further, LEX knew its limitations—it was able to identify potential causes of action outside its primary area of expertise, suggesting that further consultations with appropriate attorneys or expert systems might be desirable.

Once Smith determined the claims he would pursue, LEX generated a draft complaint by combining information that it had already obtained about Smith's client with standard "boiler-plate" provisions for such claims. Additionally, LEX gave a detailed description of the normal procedures for bringing such claims, and generated a working draft of initial interrogatories that Smith might want to use in discovery. LEX also proposed a scheme for organizing information obtained in discovery.

After completing this consultation, Smith felt much more at ease about how he would handle his client's problem. Although he would have to do some research to confirm LEX's analysis, he now had a conceptual starting point in the case, a draft complaint, and a tentative discovery plan. Best of all, Smith was able to obtain a preliminary analysis of his client's problem with minimal effort and maximum efficiency. LEX did the work more quickly

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and at less cost than would have been incurred if the work had been done manually by attorneys on Smith's legal staff.[1]

Expert computer systems represent the future of legal practice. The attorney who best understands the benefits and limitations of such systems, while remaining undaunted by nagging fears of computers, will have a significant advantage in completing a wide variety of professional tasks.

An expert system is a type of computer program designed to emulate the analytic skills of human experts[2] — hence the name "expert

1. While the scenario described here is pure fantasy, it is not too far removed from present reality. For example, the JUDITH expert system assists attorneys in developing lines of legal reasoning by systematically reviewing the elements of various types of civil claims. *See infra* text accompanying notes 166-176. CORPTAX and Tax Advisor are systems that help attorneys recognize civil tax liability arising under narrow, but complex, provisions of the federal tax laws. *See infra* text accompanying notes 138-165. Another system estimates the settlement value of a given products liability case, taking into account not only the strength of the legal claims made, but also surrounding factors like the characteristics of the litigants and the identity of the judge in the case. *See infra* text accompanying notes 210-224. The ABF Processor and A-9 are two existing systems that assist in the assembly of legal documents based on user input. *See infra* text accompanying notes 226-243. LRS is a recently developed expert system which assists in the organization and retrieval of documents in a specialized legal area. *See infra* text accompanying notes 253-266.

LEX's primary advance over existing legal expert systems is that it combines more advanced forms of today's computer capabilities in a single well-integrated package. In the near future, the technology will develop to the point where a system can perform all of the functions mentioned in this "Computer Fantasy." Indeed, Donald Waterman, a scientist with the Rand Corporation and a leading analyst of expert systems, projects that new expert systems for legal document preparation, interpretation and prediction, scheduling and monitoring, and case management have great potential for success and will lead to revolutionary changes in the way legal work is performed. *See* D. WATERMAN, A GUIDE TO EXPERT SYSTEMS 224-26 (1986). Other leading computer researchers have also projected important roles for expert legal systems as both lawyers' tools and as research devices for studying how lawyers work and think. *See* R. SCHANK, THE COGNITIVE COMPUTER 220-21 (1984); Buchanan & Headrick, *Some Speculation About Artificial Intelligence and Legal Reasoning*, 23 STAN. L. REV. 40, 62 (1970).

2. *See, e.g.*, Duda & Shortliffe, *Expert Systems Research*, SCIENCE, Apr. 15, 1983, at 261; Hayes-Roth, *The Knowledge-Based Expert System*, IEEE COMPUTER, Sept. 1984, at 11.

Expert systems differ from conventional computer programs in the way they are organized, the way they incorporate knowledge, the way they execute, and the impression they give system users. *See* Hayes-Roth, *The Knowledge-Based Expert System*, IEEE COMPUTER, Sept. 1984, at 11. The most significant of these differences is the separation of general knowledge about a class of user problems (stored in a system's "knowledge base") from information about a current problem (contained in input data) and from methods for applying the general knowledge to the problem at hand (incorporated in a reasoning module sometimes called an "inference engine"). These separations not only permit system designers to achieve maximum performance in each of these areas, but also allow a system to be easily changed by adding a new knowledge or reasoning base. *See* Gevarter, *Expert Systems, Limited but Powerful*, IEEE SPECTRUM, Aug. 1983, at 39.

Expert systems and the technology underlying them are described in detail in P. HARMON & D. KING, EXPERT SYSTEMS (1985); F. HAYES-ROTH, D. WATERMAN & D. LENAT, BUILDING EXPERT SYSTEMS (1983); C. KULIKOWSKI & S. WEISS, A PRACTICAL GUIDE TO

systems."[3] Such systems are designed to undertake the same work as human experts, at least in narrow ranges of analysis.[4] Examples of existing expert legal systems include a system that uses client information to advise attorneys on the merits of alternative forms of bankruptcy filings[5] and a program that explores tax planning options based on information about a client's property holdings and tax goals.[6]

Less ambitious computer systems, sometimes called "knowledge systems," attempt to emulate only a small fraction of an expert's analytic powers, such as the ability to answer one complex question or to interpret a single type of specialized information.[7] Examples of current

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DESIGNING EXPERT SYSTEMS (1984); D. WATERMAN, A GUIDE TO EXPERT SYSTEMS (1986); Duda & Shortliffe, *Expert Systems Research*, SCIENCE, Apr. 15, 1983, at 261; Michaelsen, Michie & Boulanger, *The Technology of Expert Systems*, BYTE, Apr. 1985, at 303; Forsyth, *The Anatomy of Expert Systems*, in ARTIFICIAL INTELLIGENCE: PRINCIPLES AND APPLICATIONS 186 (M. Yazdani ed. 1986); Gevarter, *Expert Systems, Limited but Powerful*, IEEE SPECTRUM, Aug. 1983, at 39; Hayes-Roth, *The Knowledge-Based Expert System*, IEEE COMPUTER, Sept. 1984, at 11; Kinnucan, *Computers That Think Like Experts*, HIGH TECHNOLOGY, Jan. 1984, at 30.

3. *See* Duda & Shortliffe, *supra* note 2, at 261; *cf.* P. HARMON & D. KING, *supra* note 2, at 5 (the label "expert systems" reflects the use of knowledge drawn from human experts as a basis for system programming).

4. The degree of intelligence exhibited by expert systems is a matter of some debate. While admitting that computers have qualities that make them superior to human analysts in certain contexts, Professors Hubert and Stuart Dreyfus of the University of California argue that many intelligent tasks undertaken by humans involve complex "intuitive" insights that computers cannot match. They claim that true expert behavior depends heavily on unconscious processes whereby experts recognize that new situations are similar to remembered ones for purposes of analysis. *See* Dreyfus & Dreyfus, *Why Expert Systems Do Not Exhibit Expertise*, IEEE EXPERT, Summer, 1986, 86, 88.

While a valid warning about the limitations of early expert systems, the Dreyfus' thesis may be overstated. The types of intuitive analyses the Dreyfus' consider emblematic of expert behavior may soon be accomplished by computers through increased information processing capabilities available in the form of computers called "parallel processors." These computers will be able to simultaneously test for multiple similarities between new situations and circumstances stored in databases. With these new pattern recognition capabilities, the parallel processors should permit computer systems to approximate the "intuitive" linkages experts use to relate new problems to old solutions. *Cf.* D. MICHIE & R. JOHNSON, THE KNOWLEDGE MACHINE 29-34 (1985) (discussing the potential importance of parallel processors in artificial intelligence applications involving pattern recognition). Even with these technical advances, the implementation of the computer equivalent of intuition will depend on careful descriptions of what experiences experts typically bring to their work and what types of paradigm problem solutions those experiences have taught the experts to apply. *See* Dreyfus & Dreyfus, *supra* note 4, at 86-88.

5. *See* Boyd, *Choosing Between a Chapter 7 and a Chapter 13 Bankruptcy: An "Expert System" to Assist an Attorney in Making the Choice*, in COMPUTING POWER AND LEGAL REASONING 699 (C. Walter ed. 1985).

6. *See* Michaelsen, *An Expert System For Federal Tax Planning*, 1 EXPERT SYSTEMS, Oct. 1984, at 149.

7. For purposes of this Article, I will use the term "expert system" to refer to both traditional expert systems and knowledge systems. Knowledge-based systems apply a large body of human knowledge to solve particular problems, but also sometimes per-

knowledge systems include a program that analyzes corporate reorganizations to determine if they qualify for special income tax treatment under federal law[8] and a system designed to examine the tax consequences of operating foreign corporations as either a subsidiary or a division of a parent firm.[9]

Expert systems offer the promise of new accuracy and completeness in legal analyses.[10] Expertise captured in an expert system will be more permanent and comprehensive than its human counterpart; not only will it survive its original author, but it may also reflect the aggregate wisdom and experience of numerous experts in a particular specialty. The expertise contained in an expert legal system will also be easily transferable and reproducible, often through means as simple as copying a computer program or database. Further, where analysis is heavily dependent on numerical calculations or requires boring repetitions of a simple reasoning process, the tireless mechanical operation of expert systems may produce significantly more reliable results than human experts in a shorter amount of time. Relying on expert systems to perform these tedious tasks also frees human workers to perform more interesting and useful duties. Finally, the legal analysis performed by expert systems will be easy to evaluate, since computers can easily document their analytic steps and are not limited by human impatience with paperwork.

Although expert legal systems have many advantages, they also possess several drawbacks.[11] In general, current expert systems have a

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form applications for which there are no qualified experts or which are only a small part of a human expert's tasks. *See* Duda & Shortliffe, *supra* note 2, at 267 n.6; P. HARMON & D. KING, *supra* note 2, at 5. The discussions in this Article, although referring only to "expert systems," apply to "knowledge-based" computer systems as well.

Many analysts refer to large knowledge-based systems emulating the performance of human experts as "expert systems" and smaller, less capable systems as "knowledge systems." *E.g., id.*; *cf.* Duda & Shortliffe, *supra* note 2, 267 n.6. In much of the technical literature, however, this distinction is not observed and the terms "expert systems," "knowledge-based systems," and "knowledge systems" are used interchangeably. *E.g.*, P. HARMON & D. KING, *supra* note 2, at 5; Hayes-Roth, *supra* note 2, at 11; Kinnucan, *supra* note 2, at 30.

8. *See* McCarty, *Intelligent Legal Information Systems*, 9 RUTGERS COMPUTER & TECH. L.J. 265, 267-76 (1983); McCarty, *Reflections on TAXMAN: An Experiment in Artificial Intelligence and Legal Reasoning*, 90 HARV. L. REV. 837 (1977).

9. *See* Hellawell, *CHOOSE: A Computer Program for Legal Planning and Analysis*, 19 COLUM. J. TRANSNAT'L L. 339 (1981).

10. "[K]nowledge systems do not display biased judgments, nor do they jump to conclusions and then seek to maintain those conclusions in the face of disconfirming evidence. They do not have 'bad days'; they always attend to details, and they always systematically consider all of the possible alternatives. The best of them, equipped with thousands of heuristic rules, are able to perform their specialized tasks better than a human specialist." P. HARMON & D. KING, *supra* note 2, at 7.

11. For an evaluation of the weaknesses of expert systems when compared with human experts, see D. WATERMAN, *supra* note 1, at 13-15.

limited ability to translate complex factual information into ideas and concepts, meaning that information input into such systems must often be limited in scope. This consequently limits the scope of the program's analysis. Expert systems also tend to be overinclusive in that they blindly undertake useless or wasteful analyses which human experts are able to avoid through the use of common sense knowledge about everyday life. Expert systems also run the risk of being underinclusive because they are typically designed to take only specified factors into account in their analyses and to ignore some tangential factors that may affect those analyses. In addition, such systems are often unable to "learn" new information through their own efforts and are therefore heavily dependent upon human assistance to keep abreast of changing legal expertise. Finally, current expert legal systems lack the means to develop novel approaches to new problems through the use of analogies and other creative reasoning processes.

Primitive expert systems and knowledge systems have already been developed to assist with diverse legal tasks, ranging from law office automation[12] to estimation of the settlement value of products liability claims[13] to the formulation of criminal sentences.[14] Overall, however, the development of expert systems for legal analyses has lagged behind the extensive development of such systems in other professions,[15] such as medicine.[16] This Article evaluates expert systems for legal analysis and how they will affect legal practice. It is written in hopes of sparking new interest in expert legal system development. Consequently it

12. *See* Sprowl & Staudt, *Computerizing Client Services in the Law School Teaching Clinic: An Experiment in Law Office Automation*, 1981 AM. B. FOUND. RES. J. 699; Sprowl, *Automating the Legal Reasoning Process: A Computer That Uses Regulations and Statutes to Draft Legal Documents*, 1979 AM. B. FOUND. RES. J. 1.

13. *See* Waterman & Peterson, *Models of Legal Decisionmaking*, RAND CORP. INST. FOR CIV. JUST. REP. 2717-ICJ (1981) [hereinafter *Models of Legal Decisionmaking*]; Waterman & Peterson, *An Expert Systems Approach to Evaluating Product Liability Cases*, in COMPUTING POWER AND LEGAL REASONING 627 (C. Walter ed. 1985) [hereinafter *Evaluating Product Liability Cases*]; Waterman & Peterson, *Evaluating Civil Claims: An Expert Systems Approach*, 1 EXPERT SYSTEMS 65 (1984) [hereinafter *Evaluating Civil Claims*]; Waterman, Paul & Peterson, *Expert Systems for Legal Decision Making*, 3 EXPERT SYSTEMS 212, 217-18 (1986) [hereinafter *Legal Decision Systems*].

14. *See* DeMulder & Gubby, *Legal Decision Making by Computer*, 4 COMPUTER L.J. 243 (1983).

15. Several observers have been surprised by the relatively small amount of recent research done in regard to expert legal systems given their vast potential for success. *See* D. WATERMAN, *supra* note 1, at 224; Hellawell, *A Computer Program for Legal Planning and Analysis: Taxation of Stock Redemptions*, 80 COLUM. L. REV. 1362, 1365 n.5 (1980). For an analysis of the problems facing designers of expert legal systems, see *Legal Decision Systems*, *supra* note 13, at 213-15.

16. For a broad review of expert systems in medicine and the development efforts behind them, see READINGS IN MEDICAL ARTIFICIAL INTELLIGENCE (W. Clancey & E. Shortliffe ed. 1984).

describes features which future expert legal systems should possess to meet the special needs of attorneys. The extent to which attorneys should rely on such systems is analyzed as well.

The Article first briefly summarizes the history of expert systems and describes in lay terms how a typical expert system operates. The Article then analyzes the needs of attorneys and formulates the characteristics of an "ideal" expert legal system with these needs in mind. Finally, existing expert legal systems are analyzed in light of the characteristics of this ideal expert system.

I. A BRIEF HISTORY OF EXPERT SYSTEMS

Efforts to program computers to act more like humans are almost as old as computers themselves. Since World War II, computer decision-making systems, robotics devices, and speech recognition techniques have been extensively studied by computer scientists.[17]

Collectively, these and other computerized systems designed to emulate intelligent human behavior are called "artificial intelligence" devices. The term "artificial intelligence" refers to the goal of enabling computers to behave in ways that humans recognize as "intelligent."[18] Designing artificial intelligence programs typically involves two types of problems. The first is determining the nature of intelligent behavior in a particular context. The second is analyzing how to program a computer to approximate that behavior.[19]

A key breakthrough in artificial intelligence research occurred in the early 1950's with the creation of computers having sufficient information processing capacity to allow them to solve problems posed in symbolic rather than mathematical terms.[20] This capacity was significant because it permitted computers to emulate a broader range of human analyses in fields where humans work by manipulating symbols and expressions.[21] Expert tasks based on symbol processing are important in many fields:

17. The early history of artificial intelligence research is recounted in P. JACKSON, INTRODUCTION TO EXPERT SYSTEMS 2-10 (1986) and P. MCCORDUCK, MACHINES WHO THINK (1979).

18. *See* E. FEIGENBAUM & P. MCCORDUCK, THE FIFTH GENERATION 312 (rev. ed. 1984); R. SCHANK, THE COGNITIVE COMPUTER 25-38 (1984); Lenat, *Computer Software for Intelligent Systems*, SCIENTIFIC AMERICAN, Sept. 1984, at 204, 204-207; *cf.* Buchanan & Headrick, *supra* note 1, at 40-41 (artificial intelligence research includes efforts to design computer information processing to perform legal reasoning).

19. *See* E. FEIGENBAUM & P. MCCORDUCK, *supra* note 18, at 34-38, 81-91.

20. Duda & Shortliffe, *supra* note 2, at 261; *see generally* COMPUTERS AND THOUGHT (E. Feigenbaum & J. Feldman eds. 1963).

21. *See* B. RAPHAEL, THE THINKING COMPUTER 4-5, 18-19 (1976); Newell & Simon, *Computer Science as Empirical Inquiry: Symbols and Search*, 19 COMM. ACM 113, 119 (Mar. 1976).

for example, editors work with words, a city planner sketches diagrams of roads or utility lines, and a lawyer works with both words and legal principles.[22]

A number of specialized computer programming languages have been developed to perform symbolic manipulations.[23] The most frequently used is LISP (LISt Processor), a language which facilitates computer handling of information lists.[24] For example, using a list of facts about a given object, the presence of that object can be determined by testing for the presence of the listed attributes. PROLOG (PROgramming in LOGic) is another symbolic programming language often used to create artificial intelligence programs.[25] Unlike most programming languages, which require a programmer to tell the computer how to perform its tasks, PROLOG permits a programmer to define facts and rules about a given problem and then allows the computer to attempt to find solutions to the problem on its own. Since the heart of a PROLOG program is a series of declaratory statements about factual and inferential expertise governing a given type of problem, such a program is often much easier to understand than a program in a general-purpose programming language where expert knowledge may be hidden in numerous procedural specifications.

Initial expectations for the potential power of artificial intelligence programs were extremely high. Experts tried to develop a machine that would think and reason like a human being, thereby making it adaptable to any type of analysis in any particular field. Some initial successes led artificial intelligence researchers to expect that computers could extend the abilities of problem-solving machines to most, if not all, challenging mental activities.[26] However, further attempts to provide computers with general analytic powers—and thereby create intelligent machines with broad problem-solving capabilities—were dismal failures. Most of these programming efforts were premised on the expectation that a few formal rules underlie most intelligent activity and analysis, and that these rules, once identified, could form the basis for general problem-solving by a computer.[27] However, these broadly applicable analytic rules were

22. *See* B. RAPHAEL, *supra* note 21, at 18-19.

23. For analyses of several symbolic programming languages and their advantages in artificial intelligence projects, see E. RICH, ARTIFICIAL INTELLIGENCE 389-408 (1983).

24. *See* J. ALLEN, ANATOMY OF LISP (1978); E. RICH, *supra* note 23, at 393-95; P. WINSTON & B. HORN, LISP (1981). For an assessment of how LISP can be used to create expert systems, see P. HARMON & D. KING, *supra* note 2, at 85-87.

25. W. CLOCKSIN & C. MELLISH, PROGRAMMING IN PROLOG (1981); E. RICH, *supra* note 23, at 401-02 (1983). Applications of PROLOG in expert system development are discussed in P. HARMON & D. KING, *supra* note 2, at 87-89.

26. *See* E. FEIGENBAUM & P. MCCORDUCK, *supra* note 18, at 36-37; Duda & Shortliffe, *supra* note 2, at 261.

27. *See, e.g.*, E. FEIGENBAUM & P. MCCORDUCK, *supra* note 18, at 36-37.

seldom found, rendering useless many early studies premised on the existence of such rules.[28] The reason for these failures lay in the inability of computer scientists to realize the paramount importance in problem-solving of "domain-specific" analysis rather than general analytic powers. Researchers often discovered that general methods of analysis, as opposed to methods tailored to a particular kind of problem, could not address the complex combinations of information necessary to complete useful analyses. General problem-solving techniques designed to apply to imprecisely stated problems, uncertain facts, and unreliable axioms produced results that were meaningless or erroneous.[29] Consequently, contemporary researchers began to place new significance on "domain-specific" analysis as a basis for problem solving. "Domain-specific" analysis concentrates the computer's powers on solving a specific problem given a limited range of facts, rather than on trying to design a general program to solve a diverse set of problems. New understanding of human problem-solving in narrow expert domains formed the basis for early efforts to develop practical expert systems.[30]

In developing "domain-specific" systems, researchers carefully studied the manner in which human experts approached and solved various types of problems. These studies revealed that experts applied two fundamentally different types of knowledge in fashioning a solution to a given problem. They often relied on not only substantive principles from their field of expertise, but also on practical knowledge and "rules of

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28. Roger Schank of Yale University observed this disappointment in another artificial intelligence field — research involving natural language processing.

> Work on natural language processing began in the 1950's, but those initial attempts bear almost no resemblance to our approach today. These researchers, whether they happened to be in computer science or linguistics, started out by attempting to find the formal rules that might underlie language itself. . . . Early research concentrated on the outer *form* of language rather than on the *content* of communication, and focused on getting a computer to break a sentence down into its parts of speech rather than into its elements of meaning.
>
> These early researchers first attempted to build a *parser*. They wanted the computer to *parse* or convert sentences into grammatical structures according to standard grade-school rules . . . . These investigators hadn't really given any thought to what would come after that. They never succeeded in writing down all the grammar rules, and found themselves with a lot of unanswered questions about how to get the computer to use language effectively.

R. SCHANK, *supra* note 18, at 135.

29. *See* Duda & Shortliffe, *supra* note 2, at 261; Stefik, Aikins, Balzer, Benoit, Birnbaum, Hayes-Roth & Sacerdoti, *Basic Concepts for Building Expert Systems*, in BUILDING EXPERT SYSTEMS 59, 66 (F. Hayes-Roth, D. Waterman & D. Lenat eds. 1983) [hereinafter *Basic Concepts*].

30. *See* Duda & Shortliffe, *supra* note 2, at 261-62; *cf.* Buchanan & Headrick, *supra* note 1, at 45-46 (noting the importance of studies determining how lawyers break problems down into subproblems and identifying the decision rules attorneys apply in solving problems as prerequisites to the development of artificial intelligence devices capable of legal reasoning).

thumb." [31] For example, in solving problems in specialized areas like law, engineering, or medicine, experts must apply "know-how" about their given field. Such know-how is comprised of detailed substantive knowledge of their specialty and a certain amount of common-sense knowledge usually gained through experience. For lawyers, know-how consists of a combination of formal substantive training in law school and a history of accumulated experience obtained in actual practice. In other fields, such as medicine, clinical or apprenticeship methods of training are a standard part of a minimum education. These clinical or apprenticeship experiences are designed to help students obtain expertise in the practical or common-sense aspects of their field—expertise that is essential to successful work as an expert, but difficult if not impossible to teach in a classroom.

Application of expert knowledge or know-how is essential in programming successful expert systems because of the characteristics of the problems such systems are expected to solve. Most of the difficult and interesting problems addressed by experts do not have algorithmic solutions; they originate in complex social or physical contexts and therefore resist precise description and mathematical analysis. Consequently, expert systems designed to solve these types of problems must go beyond algorithmic solutions and apply detailed substantive and procedural know-how.[32] Thus, artificial intelligence "researchers learned that high IQ doesn't make a person expert; specialized know-how does. To make a fast and consistent symbol processor perform as well as a human expert, someone must provide it specialized know-how comparable to what a human expert possesses."[33]

The discovery of techniques for capturing expert knowledge and for representing it in forms that can be used by computer systems has consequently become a primary goal of expert systems research.[34] Such

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31.

> An expert is a person who, because of training and experience, is able to do things the rest of us cannot; experts are not only proficient but also smooth and efficient in the actions they take. Experts know a great many things and have tricks and caveats for applying what they know to problems and tasks . . . .

Johnson, *What Kind of Expert Should a System Be?*, 8 J. MED. & PHIL. 77 (1983). *See also* E. FEIGENBAUM & P. MCCORDUCK, *supra* note 18, at 67; P. HARMON & D. KING, *supra* note 2, at 32-33; Hayes-Roth, *supra* note 2, at 12.

32. *See* E. FEIGENBAUM & P. MCCORDUCK, *supra* note 18, at 36-37, 82-83; Duda & Shortliffe, *supra* note 2, at 219-20.

33. Hayes-Roth, *supra* note 2, at 12.

34. *Basic Concepts*, *supra* note 29, at 59; Stefik, Aikins, Balzer, Benoit, Birnbaum, Hayes-Roth & Sacerdoti, *The Architecture of Expert Systems*, in BUILDING EXPERT SYSTEMS 89 (F. Hayes-Roth, D. Waterman & D. Lenat eds. 1983) [hereinafter *Architecture of Expert Systems*]; Buchanan, *Expert Systems: Working Systems and the Research Literature*, EXPERT SYSTEMS, Jan. 1986, at 32.

Expert systems development is a peculiarly commercial branch of artificial intelligence

"knowledge engineering"[35] has been successfully undertaken in a number of fields to produce expert systems that perform a variety of important tasks. The following are some examples of tasks performed by expert systems:

Chemistry

Identifying Chemical Compounds from Laboratory Data [36]

Decoding and Synthesizing DNA Sequences[37]

Medicine

Diagnosing Bacterial Infections[38]

Recommending Cancer Treatments[39]

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research which contrasts with an earlier emphasis on theoretical studies. These earlier studies were initiated to test theories of mental processes and were close in spirit to prior philosophical, linguistic, and psychological inquiries into cognitive behavior. Most recent expert system research has instead been aimed at producing computer system products with problem solving abilities to meet the demands of particular industries. *See* R. SCHANK, *supra* note 18, at 32-34.

35. Stanford Professor Edward A. Feigenbaum defines "knowledge engineering" as follows:

> The knowledge engineer practices the art of bringing the principles and tools of [artificial intelligence] research to bear on difficult applications problems requiring experts' knowledge for their solution. The technical issues of acquiring this knowledge, representing it, and using it appropriately to construct and explain lines-of-reasoning, are important problems in the design of knowledge-based systems.

Feigenbaum, *The Art of Artificial Intelligence: Themes and Case Studies of Knowledge Engineering*, 5 PROC. INT'L JOINT CONF. ON ARTIFICIAL INTELLIGENCE 1014, 1014 (1977). For more detailed descriptions of the work of knowledge engineers, see E. FEIGENBAUM & P. MCCORDUCK, *supra* note 18, at 86-91; Buchanan, Barstow, Bechtal, Bennett, Clancey, Kulikowski, Mitchell & Waterman, *Constructing an Expert System*, in BUILDING EXPERT SYSTEMS, 127, 127-67 (F. Hayes-Roth, D. Waterman & D. Lenat eds. 1983). For an analysis of practical problems arising in knowledge engineering of an expert legal system, see Newquist, *The Making of a Tax Expert*, AI EXPERT, Mar. 1987, at 57.

36. DENDRAL identifies the molecular structure of unknown compounds based on mass spectral and nuclear magnetic resonance measurements. *See* R. LINDSAY, B. BUCHANAN, E. FEIGENBAUM & J. LEDERBERG, APPLICATIONS OF ARTIFICIAL INTELLIGENCE FOR ORGANIC CHEMISTRY: THE DENDRAL PROJECT (1980).

37. MOLGEN assists geneticists in designing genetics experiments by taking the user's gene-splicing goals and refining them into a set of specific laboratory procedures. *See* Stefik, *Planning With Constraints (MOLGEN: Part 1)*, 16 ARTIFICIAL INTELLIGENCE 111-139 (1981); Stefik, *Planning and Meta-Planning (MOLGEN: Part 2)*, 16 ARTIFICIAL INTELLIGENCE 141-69 (1981).

38. MYCIN assists physicians in treating blood and meningitis infections. It uses information about patient symptoms to first suggest the likely identity of an infection and then to recommend a corresponding program of drug therapy. *See* B. BUCHANAN & E. SHORTLIFFE, RULE-BASED EXPERT SYSTEMS: THE MYCIN EXPERIMENTS OF THE HEURISTIC PROGRAMMING PROJECT (1983).

39. ONCOCIN aids in the development of chemotherapy treatments for cancer patients. It recommends a particular patient's therapy by analyzing information about a patient's diagnosis, previous treatments, and laboratory tests and comparing this information to chemotherapy models based on past experience with therapeutic benefits and toxic side effects of similar treatments. *See* Shortliffe, Scott, Bischoff, Campbell, Van

Diagnosing Internal Disorders [40]

Industry

Configuring Computer Systems[41]
Identifying Computer Malfunctions[42]
Diagnosing Oil Drilling Problems[43]
Analyzing Mineralogic Data[44]

II. AN INTRODUCTION TO EXPERT LEGAL SYSTEMS: THE BASIC COMPONENTS

There is no one way to program a computer to act like a human expert. However, because such systems are intended to undertake the same types of analyses as do human experts, the mental steps that human experts go through in solving problems or giving advice delineate

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Melle & Jacobs, *ONCOCIN: An Expert System for Oncology Protocol Management*, in PROC. SEVENTH INT'L JOINT CONF. ON ARTIFICIAL INTELLIGENCE 876-81 (1981).

40. CADUCEUS and INTERNIST are the first and second versions respectively of an expert system that uses patient histories, symptoms, and laboratory results to suggest diagnoses of internal medicine disorders. *See* Miller, Pople & Myers, *INTERNIST-1: An Experimental Computer-Based Diagnostic Consultant for General Internal Medicine*, in READINGS IN MEDICAL ARTIFICIAL INTELLIGENCE 190 (W. Clancey & E. Shortliffe eds. 1984).

41. XCON, previously called R1, is an expert system developed by the Digital Equipment Corporation ("DEC") to configure computer systems for customer locations. The system uses customer orders and information about the characteristics of DEC computer products to identify additional components that must be added to the orders to create operational systems. It also lays out the spacial relationships for placement of the ordered equipment upon installation. *See* P. HARMON & D. KING, *supra* note 2, at 155-59 (1985); McDermott, *R1: A Rule-Based Configurer of Computer Systems*, 19 ARTIFICIAL INTELLIGENCE 38-88 (1982); McDermott, *R1: The Formative Years*, 2 AI MAGAZINE 21-29 (1981).

42. A proprietary expert system developed at Stanford University for the IBM Corporation uses information about a computer failure to identify which major component of the computer is malfunctioning. Once identified, the malfunctioning component (typically a circuit board) can be replaced by field repair personnel and brought to an IBM facility for a more complete diagnosis. *See* S. WEISS & C. KULIKOWSKI, A PRACTICAL GUIDE TO DESIGNING EXPERT SYSTEMS 63-67 (1984); E. FEIGENBAUM & P. MCCORDUCK, *supra* note 18, at 75; Kinnucan, *supra* note 2, at 39.

43. DRILLING ADVISOR helps drilling supervisors diagnose and remedy the most likely causes of oil drill sticking in boreholes. It uses information about the geologic formations at a drill site and observed drilling symptoms to identify likely causes of sticking and to recommend actions to prevent reoccurrences. Hayes-Roth, *supra* note 2, at 21-23.

44. PROSPECTOR analyzes geologic data about a region and estimates the probability of finding specific types of minerals there. *See* Gaschnig, *PROSPECTOR: An Expert System for Mineral Exploration*, 10 MACHINE INTELLIGENCE 301-23 (J. Hayes, D. Michie & Y.H. Pao eds. 1982); Duda, Gaschnig & Hart, *Model Design in the PROSPECTOR Consultant System for Mineral Exploration*, in EXPERT SYSTEMS IN THE MICRO-ELECTRONIC AGE 153-67 (D. Michie ed. 1979). PROSPECTOR is reportedly responsible for a molybdenum find in the State of Washington worth as much as $100 million. E. FEIGENBAUM & P. MCCORDUCK, *supra* note 18, at 78-79.

the basic capabilities a complete expert system should posess. Consideration of the mental processes of human experts also aids expert system designers in understanding what makes expert analyses difficult, thereby focusing design attention on critical analytic steps.[45]

A. Components of Problem-Solving by Human Experts

Although techniques used by human experts to complete analyses and solve complex problems vary widely depending on the type of analyses or problems involved, all such techniques involve some combination of perception, memory, information processing, and response.[46] These elements of human analyses serve as a basis for subsequent discussions of their counterparts in expert legal systems.

Every expert begins his analysis by first discovering the facts which have caused a problem to arise. Information can be retrieved from a variety of sources such as the inspection of a scene or article, special measurements of the physical features of an object, or verbal descriptions by a client. Once information about a problem is obtained, it is stored in the analyst's memory. Two major types of memory activities are generally involved in problem-solving—short-term memory and long-term memory.[47] Typically, little of the detailed information an expert collects and manipulates will stay in the analyst's memory after the problem is solved. Thus, memory activity in the immediate course of the investigation and resolution of a problem is sometimes called short-term memory to distinguish it from an expert's long-term retention of basic expertise.

An example from legal practice should make the distinction between short-term and long-term memory clear. If an attorney were to examine a client's affairs for tax planning purposes, factual information about the client's business and personal circumstances would be assembled in the attorney's short-term memory as she examined different planning options. The attorney would also draw knowledge of relevant tax law principles from her long-term memory in order to analyze the client's activities. Once recalled, these principles would be kept in the attorney's short-term memory and manipulated in combination with the client's factual information to produce an expert analysis.[48]

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45. *See Basic Concepts*, *supra* note 29, at 82.

46. For a brief overview of the human problem solving processes underlying expert behavior (and, hence, defining the basic objectives of expert system development), see P. HARMON & D. KING, *supra* note 2, at 22-33. *See generally* P. LINDSAY & D. NORMAN, HUMAN INFORMATION PROCESSING: AN INTRODUCTION TO PSYCHOLOGY (1972); A. NEWELL & H. SIMON, HUMAN PROBLEM SOLVING (1972).

47. P. HARMON & D. KING, *supra* note 2, at 22-25 (1985).

48. *Cf.* Buchanan & Headrick, *supra* note 1, at 52-53 (observing that legal reasoning typically involves a combination of direct applications of memorized legal rules and rea-

Information processing by human experts involves the manipulation of factual information to make rational inferences which can then be used in further analyses.[49] This inference process typically involves repetition of the following pattern of information manipulation in an expert's short-term memory: (1) information regarding facts and relevant principles is gathered and grouped in short-term memory; (2) when enough information is present, an inference or conclusion will be made based upon these facts and principles.

An expert's response to a client or other party after completing an analysis involves the communication of the results of that analysis in a form that is useful to the recipient. Rather than simply describing the primary conclusions reached in the analysis, the expert's response might include an explanation of how the conclusion was reached, as well as what factors would have produced a different outcome. In addition, where the outcome of an expert analysis forms the basis for related work, such as the creation of legal documents necessary to carry out an attorney's recommendation, the expert's response to her client may include this related work-product.

B. Components of Expert Systems

An example drawn from legal practice will illustrate how cognitive tasks undertaken by an attorney might be replicated in the components of an expert legal system. In assessing the legal implications of a client's activities, a lawyer typically does the following:

(1) consults the client and gathers facts about the client's problem;
(2) recalls substantive knowledge in the appropriate legal field and performs legal research to identify relevant legal standards and precedents;
(3) makes inferences, based on these precedents and standards, which predict probable legal implications of the client's problem;
(4) explains this outcome to the client and recommends appropriate client action.

An expert system capable of useful legal interpretations of client behavior would need to accomplish all of these tasks. Typically, the computer programming steps necessary to complete each of these separate tasks are grouped into distinct segments or "modules." A modular approach allows a sytem developer to easily change one portion of the system without the need for altering other modules.[50] Under this

soning by analogy from memorized rules or cases).

49. *See* P. HARMON & D. KING, *supra* note 2, at 25-26.

50. *See* Duda & Shortliffe, *supra* note 2, at 266; Gevarter, *supra* note 2, at 39.

approach, an expert legal system designed to accomplish the legal tasks described above would include four modules.[51] The input module would gather information about the problem from the attorney-user and translate the attorney's responses into a form that the expert system could utilize. The knowledge-base module would store expert knowledge, such as judicial precedents or other expert know-how relevant to a client's problem. The inference module utilizes this knowledge to formulate legal conclusions. Finally, the output module communicates to the attorney the system's conclusions and explanations of how they were reached.

These system components are examined individually in the remainder of this Section to give the reader a better sense of how a typical expert legal system might operate. This framework is also used in the following Section of this Article to analyze the goals of expert legal system design.[52]

1. *Input Modules*

Attorneys usually begin their analyses by gathering a detailed set of facts about a problem to be solved. They initially ask extensive questions of the client concerning the problem and may interview or depose many individuals in order to discover more facts. Later, as preliminary steps in the analysis are completed, attorneys will come back to the client with further questions dictated by the particular direction the analysis has taken.

Unfortunately, difficulties in understanding human languages have prevented computers from gathering information from spoken or written

51. While the four expert system modules described here are certainly not the only units that an expert legal system might be divided into, they are typical of the types of programming modules found in most expert systems. *See* E. FEIGENBAUM & P. MCCORDUCK, *supra* note 18, at 81; *cf.* Forsyth, *The Anatomy of Expert Systems*, in ARTIFICIAL INTELLIGENCE: PRINCIPLES AND APPLICATIONS 186 (M. Yazdani ed. 1986) (four essential components of a fully-fledged expert system are a knowledge base, an inference engine, a knowledge-acquisition module, and an explanatory interface); Hayes-Roth, Waterman & Lenat, *An Overview of Expert Systems*, in BUILDING EXPERT SYSTEMS 3, 16-19 (F. Hayes-Roth, D. Waterman & D. Lenat eds. 1983) [hereinafter *Overview of Expert Systems*] (ideal expert system would contain seven modules: knowledge base, "blackboard" for holding intermediate system results, interpreter, analysis scheduler, consistency enforcer, result justifier, and language processor).

52. Not every system will contain all these system modules. The wisdom of dividing a system into these or other modules depends greatly on factors like the programming techniques used to create the system and the types of legal analyses the system will perform. However, whether a system is divided into modules or not, it must accomplish the types of tasks outlined above. Thus, with some allowance for differences associated with greater or lesser system integration, the discussion of system characteristics and design goals in this Article is relevant to the operation of all expert legal systems.

words in the manner a human would.[53] Some of the most sophisticated expert systems now include language interpreters or "natural language" subsystems that translate a restricted set of human statements into information understandable by other portions of the expert system.[54] However, because of the inherent ambiguity of language, the importance of context in establishing the meaning of many words and phrases, and the vast range of ideas and concepts that a complete natural language subsystem would need to recognize, no expert system capable of understanding unconstrained human communication now exists. Indeed, it is doubtful that a computer capable of understanding the content of a significant number of randomly selected human language statements will be available soon.

These limitations do not create insurmountable barriers to information gathering by expert systems. The key to making computers understand human statements is to limit the range of statements which the computers must recognize.[55] This can be done in several ways. One method involves using a structured series of questions (with acceptable responses limited to a few easily recognized choices such as "Yes" or "No") or a numbered list of possible answers. An alternative method involves programming a computer to directly understand a restricted vocabulary. The system user is then required to translate his communications into this truncated language. Both of these communication approaches are already used in expert legal systems.[56]

2. *Knowledge Bases*

a. Types of Information

Knowledge bases in expert systems serve a function similar to long-term memory in human experts.[57] They both must retain two

53. The problems surrounding natural language understanding by computer systems are described in I THE HANDBOOK OF ARTIFICIAL INTELLIGENCE 223-361 (A. Barr & E. Feigenbaum eds. 1981) [hereinafter HANDBOOK]; B. RAPHAEL, *supra* note 21, at 177-210 (1976); R. SCHANK, *supra* note 18, at 90-109; Winograd, *Computer Software for Working With Language*, SCIENTIFIC AMERICAN, Sept. 1984, at 130.

54. P. HARMON & D. KING, *supra* note 2, at 137-39.

55. *Id.*.

56. *Compare* Hellawell, *supra* note 15, at 1363 (CORPTAX system in which information is gathered through Yes/No answers and number input) *with* McCarty, *Reflections on TAXMAN*, *supra* note 8, at 837 (TAXMAN system based on input of user information through a restricted vocabulary).

57. Long-term memory refers to that portion of an expert's memory which is used to retain information that has been learned through years of experience or education and that is subject to recall for use in expert analyses. It contrasts with an expert's short-term memory, which only temporarily retains facts and analyses about a particular problem. *See* P. HARMON & D. KING, *supra* note 2, at 22-25. Legal knowledge held in a lawyer's long-term memory comes in many forms, from basic legal standards like the

different types of information used in expert analyses.[58] The first is the substantive knowledge commonly shared by human experts in a particular legal field.[59] For an expert legal system, this type of knowledge would be roughly equivalent to the contents of a leading treatise in a specialized legal field. The second major category of expert information is heuristic knowledge or "heuristics"[60] — that is know-how or rules of thumb usually gained by an expert through years of practice which expedite the expert's search for solutions to problems.[61]

The following example illustrates the distinction between these two types of knowledge. An attorney has a client who purchased goods

provisions of statutes and regulations, to patterns of case results suggesting common law legal rules and practical algorithms for legal analysis and problem solving. Knowledge bases in expert legal systems should incorporate all of these types of information.

58. *See* E. FEIGENBAUM & P. MCCORDUCK, *supra* note 18, at 82; P. HARMON & D. KING, *supra* note 2, at 5; D. WATERMAN, *supra* note 1, at 16-17.

59. One group of commentators has called this type of information "public knowledge" since it "includes the published definitions, facts, and theories of which textbooks and references in the domain of study are typically composed." *Overview of Expert Systems*, *supra* note 51, at 4. Another describes the substantive knowledge in expert systems as "the widely shared knowledge, commonly agreed among practitioners, that is written in textbooks and journals of the field, or that forms the basis of a professor's lectures in a classroom." E. FEIGENBAUM & P. MCCORDUCK, *supra* note 18, at 82.

60. "Heuristic" derives from the same Greek root as "eureka" and refers to a branch of philosophy dealing with methods and rules of discovery and invention. HANDBOOK, *supra* note 53, at 29; E. FEIGENBAUM & P. MCCORDUCK, *supra* note 18, at 86. Artificial intelligence specialists have used "heuristic" as a term of art to refer to several different concepts. HANDBOOK, *supra* note 53, at 28-30. Several authors have used "heuristic" to refer to a device or rule that improves the efficiency of an artificial intelligence system's analyses, but which does not guarantee that the analyses will lead to a correct answer. As one group of commentators described this usage:

> A heuristic (heuristic rule, hueristic method) is a rule of thumb, strategy, trick, simplification, or any other kind of device which drastically limits search for solutions . . . . Heuristics do not guarantee optimal solutions; in fact, they do not guarantee any solution at all; all that can be said for a useful heuristic is that it offers solutions which are good enough most of the time.

E. FEIGENBAUM & J. FELDMAN, *supra* note 20, at 6. Unfortunately, some authors have used the term "heuristic" to refer to processing rules that increase a system's analytic efficiency *or* that do not carry a guarantee of success, but that do not necessarily have both these characteristics. *See* Newell, Shaw & Simon, *Empirical Explorations With the Logic Theory Machine: A Case History in Heuristics* in COMPUTERS AND THOUGHT 6 (E. Feigenbaum & J. Feldman eds. 1963); Minsky, *Steps Toward Artificial Intelligence*, in COMPUTERS AND THOUGHT 407 (E. Feigenbaum & J. Feldman eds. 1963).

61. This is equivalent to saying that a rule of thumb in form contract cases directing early attorney attention to possible warranty disclaimers is not guaranteed to produce a definitive answer regarding breach of warranty relief available to a buyer. If time were of no concern, a more thorough assessment of the strength of a client's warranty claims could be reached by systematically reviewing possible sources of warranty liability and corresponding seller defenses. However, in real practice settings, lawyers constantly structure their analyses to address first what experience has taught them is the issue most likely to produce a definitive answer for their client.

under a form contract and later received goods which the client felt were below the general quality of like goods in the industry. In order for the attorney to advise the client about possible contractual remedies, the attorney will probably employ two different types of knowledge. First, the attorney will draw on substantive knowledge about the Uniform Commercial Code and, particularly, the implied warranty of merchantability.[62] Second, the attorney might draw on his personal experience with form contracts and related disputes and might decide that he should first address issues such as the possibility of a valid warranty disclaimer in the contract.[63] While focusing on disclaimer issues may turn out to be a waste of time because there may not be a valid disclaimer in the contract, this ordering of analytic tasks will ensure an efficient use of the time of both the attorney and his clients over the long run. In calling upon his experience with prior cases rather than upon any recorded factual information regarding the likelihood of a disclaimer, the attorney would be using heuristic knowledge to best solve the client's problems.

b. Knowledge Representation in Knowledge Bases

Whether knowledge is drawn from traditional substantive sources or is heuristic, it must be recorded in the knowledge base of an expert system in a usable format. The most useful knowledge representation format in a particular system depends on the type of information involved and the way it is to be used by the system.[64] Information utilized in expert legal analyses can often be expressed in terms of relationships reflecting taxonomic, causal, definitional, or empirical associations between one set of facts and another.[65] For example, a typical statute

62. *See* U.C.C. § 2-314 (1977).

63. *See* U.C.C. §§ 2-316(2), 2-316(3)(a) (1977).

64.

> [A] knowledge representation formalism should (i) represent the concepts and intentions of [an] expert faithfully, (ii) be able to be interpreted by the program correctly and effectively, (iii) support explanations that convey a line of reasoning that the human observer can understand and critique, (iv) facilitate the process of finding gaps and errors in the knowledge base, and (v) allow separation of domain knowledge from the interpretation program so that the knowledge base can be enlarged or corrected without the need for reprogramming the interpreter. These criteria place conflicting demands on the system designer. The first two (fidelity and effectiveness) lead toward complex representations specific to each situation, whereas the other three favor a single, uniform formalism that is simple to interpret.

Duda & Shortliffe, *supra* note 2, at 266; *see also* E. RICH, *supra* note 23, at 201-02; Buchanan & Headrick, *supra* note 1, at 45-47.

Debate about the best means for representing expert knowledge in knowledge bases assumes that experts' problem solving methods can be articulated and captured in decision rules. *See id.* at 45-46. Some analysts have argued, however, that this is a fundamental error since truly expert behavior depends on intuitive processes that cannot be defined in decision rules. *See* Dreyfus & Dreyfus, *supra* note 4, at 86-88.

65. Descriptions of such relationships are key parts of knowledge bases in all types of expert systems. *See Overview of Expert Systems*, *supra* note 51, at 12. A variety of sym-

might require that if an individual undertakes activity "X," the individual must also undertake activity "Y" to protect public safety. The statute therefore establishes a relationship between activities X and Y which can be recorded and stored for future use by an expert system.

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bolic mechanisms are available for recording relationships in expert systems. The following are examples of the knowledge recording formats most commonly used to date:

1. *Rules in an IF-THEN Format*:

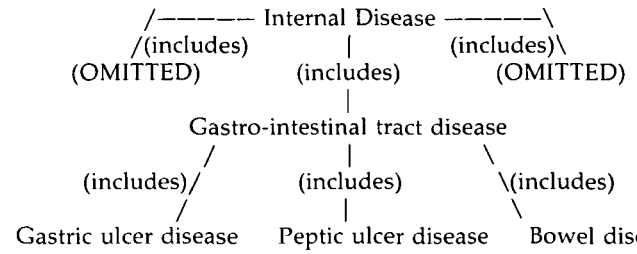
The following is a typical example of an "IF-THEN" rule drawn from the MYCIN expert system for diagnosing infections:

IF: (1) the infection requiring therapy is meningitis, and
(2) the type of infection is fungal, and
(3) organisms were not seen on the stain of the culture, and
(4) the patient is not a compromised host, and
(5) the patient has been in a region where coccidiomycoses are endemic, and
(6) the race of the patient is black or Asian or Indian, and
(7) the cryptococcal antigen in the csf was not positive

THEN: there is suggestive evidence that the cryptococcus is not one of the organisms which might be causing the infection.

2. *Semantic Nets*:

Semantic nets are charts representing relationships between objects or concepts by links between nodes. The following is a portion of a semantic net categorizing internal medicine disorders:



3. *Frames*:

Frames are generalized record structures used to store a given set of data for a number of similar objects. The following is a frame that might be used in an expert system used to analyze racehorse gambling:

Frametype:	Racehorse.
Name:	Fat Chance.
Age-in-years:	2.
Date-of-birth:	1983.
Owner:	Aga Khooker.
Last-Finish:	7.
Form-Rating:	47 out of 100.
Dam:	Mare's Nest.
Sire:	Speedy Gonzales.

4. *Horn Clauses*:

Horn clauses are statements used in predicate logic analyses to define relationships. The following is a predicate logic statement of the notion that person X is the parental grandmother of Z, if X is the mother of person Y and Y is the father of person Z:

paternal grandmother (X,Z):-
mother(X,Y), father(Y,Z).

See Forsyth, *supra* note 51, at 189-91.

The simplest way to represent relationship knowledge in an expert system is through statements or "production rules" reflecting links between a state of facts and the implications of these facts to an expert.[66] These production rules can often be expressed in terms of IF-THEN statements, as follows:[67]

> IF victim's use of product was foreseeable and reasonable, AND victim was injured by product, AND product was defective, AND defendant manufactured product, THEN consider a strict liability claim.

Using the above "IF-THEN" rule, a system would decide when to conduct a detailed strict liability analysis. Such production rules can easily form the basis for a "recognize-act" expert system.[68]

A variety of more sophisticated knowledge representation schemes can also be incorporated into expert legal systems. Several existing systems are based on predicate calculus,[69] a formal logical system in which knowledge is represented in terms of "predicates"—i.e., statements about the characteristics of objects.[70] For example, the federal tax rule that ownership of N shares of Corporation C by person W will be attributed to W's spouse H can be expressed in the following predicate calculus statement:[71]

num-con-own(H,N,C):-spouse(H,W), owns(W,N,C).

where:

"num-con-own(H,N,C)" means "N shares of C Corporation stock constructively owned by H"

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66. *See* HANDBOOK, *supra* note 53, at 190-99; P. HARMON & D. KING, *supra* note 2, at 25-26, 42-44.

67. This production rule is similar to those used in an existing computer system that models attorneys' settlement behaviors. *See Models of Legal Decisionmaking, supra* note 13, at 14-21.

68. *See* P. HARMON & D. KING, *supra* note 2, at 25.

69. *See* McCarty, *Reflections on TAXMAN, supra* note 8, at 861-62 (1977); Schlobohm, *Tax Advisor: A Prolog Program Analyzing Income Tax Issues*, DR. DOBB'S J., Mar. 1985, at 64.

70. For descriptions of predicate calculus and how it is used in designing knowledge bases, see HANDBOOK, *supra* note 53, at 160-71; P. HARMON & D. KING, *supra* note 2, at 46-48.

71. This representation is part of Tax Advisor, an expert system that interprets constructive stock ownership under § 318 of the Internal Revenue Code. Tax Advisor is written in PROLOG, a computer programming language based on predicate calculus principles. *See* Schlobohm, *TA—A Prolog Program Which Analyzes Income Tax Issues Under Section 318(a) of the Internal Revenue Code*, in COMPUTER POWER AND LEGAL REASONING 765 (C. Walter ed. 1985); Schlobohm, *supra* note 69, at 64.

":-" means "if"
"spouse(H,W)" means "W is H's spouse"
"," means "and," and
"owns(W,N,C)" means "W owns N shares of C Corporation stock."

Additional knowledge representation schemes used in expert systems link objects and information about those objects in more complex ways.[72]

3. *Inference Systems*

Inference strategies must also be developed to determine how an expert system accesses and applies its available knowledge.[73] These strategies or "metaknowledge"[74] define how an expert system will retrieve

72. *See* HANDBOOK, *supra* note 53, at 160-222; P. HARMON & D. KING, *supra* note 2, at 34-48; E. RICH, *supra* note 23, at 201-242.

73. Inference strategies control such basic expert system tasks as the selection of a line of reasoning that leads to the solution of a problem or the formulation of a body of consultative advice. Contrary to popular belief, inference strategies may be structured in a relatively simple manner. For example, the syllogism "IF X implies Y and IF Y implies Z, THEN X implies Z" is an example of such a strategy. *See* E. FEIGENBAUM & P. MCCORDUCK, *supra* note 18, at 125; P. HARMON & D. KING, *supra* note 2, at 49-50; Stefik, Aikins, Balzer, Benoit, Birnbaum, Hayes-Roth & Sacerdoti, *Basic Concepts for Building Expert Systems* in BUILDING EXPERT SYSTEMS 59, 64-66 (F. Hayes-Roth, D. Waterman & D. Lenat eds. 1986).

For even the simplest expert systems based solely on "IF-THEN" production rules, an inference control schema must address the following problems:

(1) *Selection*—choosing what inference rules should be applied next in a given analysis. The strategy underlying how these selections are made may be trivial (e.g., all potentially applicable rules can be applied at every step in a system's analyses) or very sophisticated (e.g., criteria can be developed to eliminate from consideration rules that are unlikely to lead to a problem solution);

(2) *Matching*—comparing selected inference rules against the facts present in the problem at hand;

(3) *Scheduling*—where the antecedents of more than one potentially applicable inference rule are factually supported, deciding which satisfied rule should be utilized for subsequent steps of the analysis;

(4) *Execution*—modifying data to reflect the conclusions of factually relevant inference rules.

See Michaelsen, Michie & Boulanger, *The Technology of Expert Systems*, BYTE, Apr. 1985, at 303, 307.

74. "Metaknowledge" means "knowledge about knowledge." Lenat, Davis, Doyle, Genesereth, Goldstein & Schrobe, *Reasoning About Reasoning*, in BUILDING EXPERT SYSTEMS 219, 220 (F. Hayes-Roth, D. Waterman & D. Lenat eds. 1983). In the context of expert systems, metaknowledge includes *strategic information* about how system inference rules should be applied; *descriptive information* about the inference rules themselves (e.g., how fast the rule can be applied, what the rule derives from, etc.); *explanatory information* about which rules were applied to reach a system result (for use in explaining that result or in confirming system accuracy); and *systemic information* concerning the structure and retention of knowledge in the system (for facilitating updates and revisions). *See id.* at 219-38.

information from its knowledge base, how it will combine that retrieved information with data on a particular problem, and how it will draw inferences from this assembled information. Because the information retrieval and assembly process "drives" the expert system in completing its analyses, this portion of an expert system is sometimes referred to as an "inference engine."[75] In comparison with human processes, the operation of an inference engine corresponds to an analyst's accumulation of information needed for problem-solving in short-term memory and manipulation of this information to reach rational conclusions.

The most efficient inference strategy in an expert system will depend largely on the characteristics of the expert knowledge the system must apply.[76] Determinative characteristics include not just the magnitude of knowledge involved, but also the level of uncertainty associated with the knowledge and whether the knowledge can be organized in abstract terms.[77] A brief description of several computer inference strategies and the types of knowledge that can be utilized efficiently with them illustrates the significance of these factors.[78]

a. Inference Rules for Small Knowledge Domains

The simplest expert systems are based on a very narrow range of knowledge involving no uncertainty.[79] A system can apply such narrow knowledge through a search strategy that is exhaustive in the sense that all of the knowledge relationships contained in the system are considered in every one of its analyses.[80] The inference relationships found

75. *E.g.* P. HARMON & D. KING, *supra* note 2, at 49; E. RICH, *supra* note 23, at 41; Kinnucan, *supra* note 2, at 32.

76. Some problem solving approaches involve efficient ways of searching among all possible problem solutions. Other problem solving methods focus on finding ways to narrow the search for solutions to smaller, manageable subsets of all possible solutions. Gevarter, *supra* note 2, at 41.

77. *See Basic Concepts*, *supra* note 29, at 66-72.

78. For more comprehensive descriptions of the problem solving strategies used in expert systems, see HANDBOOK, *supra* note 53, at 21-139; B. RAPHAEL, *supra* note 21, at 55-176; E. RICH, *supra* note 23, at 25-112; *Architecture of Expert Systems*, *supra* note 34, at 89-126.

79. Hayes-Roth, *supra* note 2, at 17; *Architecture of Expert Systems*, *supra* note 34, at 90-93.

80. Systems that comprehensively search for problem solutions can apply inference rules in either a forward "data-driven" manner or a backward "goal-driven" sequence. *See, e.g.*, HANDBOOK, *supra* note 53, at 198; P. HARMON & D. KING, *supra* note 2, at 55-57; E. RICH, *supra* note 23, at 56-60.

In a forward reasoning system, premises of inference rules are examined to see whether or not a user's facts match. Where a match is found, the conclusions derived from the rule are added to the facts "known" to the system. The system then reassesses the premises of its inference rules to determine if any additional ones are matched. By repeatedly following this pattern, the system pieces together a line of reasoning from the initial facts presented to a set of expert conclusions. Professor James Sprowl's ABF Pro-

to be factually supported can then be used to define the system's expert conclusions.[81]

If a knowledge domain contains uncertain information or if the facts which a user submits to the system are uncertain, a more complex search strategy is necessary. Some expert systems handle this problem by applying numeric certainty factors to facts and rules, with such factors reflecting the possibility that a certain fact or conclusion is correct.[82] For example, where a clear split of authority is present and there is only a sixty percent chance that a contract with certain characteristics will be enforceable, a rule could be built into an inference process to discount the certainty of the expert system's conclusion to sixty percent. If a further analysis suggested that, if enforceable, there is only a fifty percent chance of recovery from the party asserted to have breached the contract, these two discounting percentages could be combined to yield an overall probability of thirty percent for recovery under the contract.[83] In this fashion, expert systems can produce a derived certainty factor for their final conclusions. Another way expert systems deal with unreliable data is to initially treat the data as reliable, reach an expert conclusion,

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cessor, which collects facts about a client and then interprets this information to generate appropriately tailored form documents, is an example of a forward reasoning system. *See* Sprowl, *supra* note 12, at 1; Sprowl & Staudt, *supra* note 12, at 699.

By contrast, a backward reasoning system completes its analyses by examining potential problem solutions and determining which of those solutions are factually appropriate. A medical diagnosis system, for example, might reason backward from all the diseases it knows, considering first the disease within its knowledge that is most likely to occur. It would then review the symptoms of the patient under study to determine if they are consistent with that disease. If an inconsistency were found, the system would consider the next most common disease. Through backward reasoning, the system will either identify a disease that matches the patient's symptoms or determine that none of the diseases about which the system has knowledge are applicable. MYCIN, a system for assisting physicians in diagnosing and treating infections, is a leading example of a backward reasoning expert system. *See* Davis, Buchanan & Shortliffe, *Production Rules as a Representation for a Knowledge-Based Consultation Program*, in READINGS IN MEDICAL ARTIFICIAL INTELLIGENCE 98 (W. Clancey & E. Shortliffe eds. 1984); P. HARMON & D. KING, *supra* note 2, at 15-21, 61-75 (1985). Professor Robert Michaelsen's Taxadvisor system (derived in part from MYCIN) is a good example of a backward reasoning expert legal system. *See* Michaelsen, *supra* note 6, at 149, 154.

81. A simple example of an expert legal system based on a small knowledge domain and a comprehensive inference strategy is Professor Hellawell's CORPTAX program in which an unvarying analytic process is used to systematically review and apply the stock ownership attribution rules under Internal Revenue Code § 318. *See* Hellawell, *supra* note 15, at 1363.

82. P. HARMON & D. KING, *supra* note 2, at 50-52; Hayes-Roth, *supra* note 2, at 14; *Architecture of Expert Systems*, *supra* note 34, at 93-96.

83. A similar numerical "discounting" process is currently used in the Legal Decision-making System for valuing product liability case settlements. *See* Waterman & Peterson, *An Expert Systems Approach To Evaluating Product Liability Cases*, *supra* note 13, at 632-39.

and then ask the system user for further information which will confirm whether the system's tentative conclusion is correct.[84]

Expert systems require different analytical techniques in order to take changes in circumstances over time into account. This is usually accomplished by representing knowledge in terms of processes which transform a situation with particular characteristics at time 1 into another situation at time 2.[85] For example, an expert legal system designed to determine if a corporate reorganization meets federal requirements for tax-free treatment might contain a knowledge base composed of pairs of "before" and "after" factual states, with each pair corresponding to a version of a tax-free reorganization. By determining whether the characteristics of a reorganization matched one of these pairs, the system could render an opinion regarding the tax-free status of an already completed reorganization. It could also give recommendations on how to achieve tax-free status when a reorganization is in the planning stages.[86]

b. Inference Rules for Large Knowledge Domains

As the domain of knowledge a system applies grows larger, more sophisticated search strategies are necessary to produce expert systems that are fast enough to be useful.[87] Various advanced search strategies are necessary to avoid useless analyses.[88] Since the minimum set of

84. For example, a system could tentatively assume that a liability rule applicable only in some jurisdictions would apply to a case under scrutiny. It could then determine if the requirements for liability under that rule were met. The system would then ask the user if the liability rule would be followed in the case at hand.

85. Professor L. Thorne McCarty's TAXMAN system is an example of an expert system that tests for transitions in factual states having important legal implications, such as changes in stock ownership that will cause a corporate reorganization to qualify for special tax treatment. *See* McCarty, *Reflections on TAXMAN*, *supra* note 8, at 837 (1977); McCarty, *Intelligent Legal Information Systems*, *supra* note 8, at 267-276.

86. Professor McCarty's TAXMAN system incorporates models of before and after factual states corresponding to corporate reorganizations receiving favorable tax treatment. *See* McCarty, *Reflections on TAXMAN*, *supra* note 8, at 864-76. The system is capable of determining whether a particular reorganization qualifies for such treatment. Although a planning mode was not a part of the original implementation of TAXMAN, its developer recognized that this would be a feasible and advantageous extension of the system. *See id.* at 885-86.

87. Slow speed can significantly detract from the usefulness of an otherwise desirable expert system. This problem arises even where the computer being used is large and the programming system employed is particularly tailored for the design of expert systems. For example, the TAXADVISOR expert system for estate and gift tax planning, although developed for large mainframe computers using the EMYCIN expert system shell, operated at a very slow pace until it was reprogrammed to eliminate analyses unlikely to lead to pertinent tax planning advice. *See* Michaelsen, *supra* note 6, at 149.

88. There are two types of approaches to minimizing the analyses a system must undertake to reach a problem solution. The first involves finding ways to search among possible solutions more efficiently; for example, by considering the most likely solutions first. The second involves finding ways to narrow a system's analyses to small, manage-

analyses necessary to solve a particular type of problem depends greatly on the nature of the problem itself, there is no optimal minimizing strategy that is best in all cases. However, a repertoire of useful techniques has been developed for use in solving particular types of problems.

Some of these techniques include: (1) generating the most likely answers that a system might reach, testing these against the facts at hand, and rejecting answers which do not fit the facts until an acceptable answer is found;[89] (2) partition problem analyses — the division of the problem into subproblems depending on the characteristics of the problem itself;[90] (3) guessing between analytic alternatives that seem equally or similarly desirable, coupled with later analysis of whether the guess has led to an acceptable answer;[91] (4) parallel reasoning in which

able sets of possible solutions. *See* Gevarter, *supra* note 2, at 41.

89. This form of expert system problem solving is sometimes referred to as a "generate and test" strategy. *See Architecture of Expert Systems, supra* note 34, at 99-102; E. RICH, *supra* note 23, at 73-75. The operation of DENDRAL is perhaps the most successful expert system to use the generate and test method. DENDRAL's ultimate objective is to identify unknown compounds from physical measurements such as mass spectrographic data. It accomplishes this by applying heuristic "rules of thumb" developed by human analysts to interpret the spectrographic data and project the most likely molecular structures involved. DENDRAL then generates those molecular structures and simulates the spectrographic data each would produce. The set of simulated data most closely matching the actual measurements is identified and the corresponding structure is chosen to identify the unknown compound. *See* Buchanan & Feigenbaum, *DENDRAL and Meta-DENDRAL: Their Applications Dimension*, 11 ARTIFICIAL INTELLIGENCE 5 (1978); P. HARMON & D. KING, *supra* note 2, at 134-137.

90. This approach to problem partitioning is useful where fixed partitioning would be inefficient because variations in problem circumstances would cause numerous subproblems to be addressed unnecessarily. *See Architecture of Expert Systems, supra* note 34, at 104-06. The partitioning using this technique occurs through a "top-down" process. The system first tests for the presence of the most abstract characteristics of potential problem solutions and then selects subsequent analytic tasks based on the solution characteristics initially found. For example, a system might require that the attorney specify the types of relief his or her client is seeking. This input can then be used by the system to structure the particular areas of the law the system will analyze. The JUDITH system for assisting lawyers in case analyses follows just such an approach. *See* Popp & Schlink, *JUDITH, A Computer Program to Advise Lawyers in Reasoning a Case*, 15 JURIMETRICS J. 303, 304 (1975).

Partitioning can also be founded on the use of an abstractions test. *See* E. RICH, *supra* note 23, at 272-275 (1983); *Architecture of Expert Systems, supra* note 34, at 106-10. Under this approach, the order of tasks is based on whether sufficient information exists in the system to complete those tasks. Put another way, under the least commitment principle, an analysis is deferred until the system has enough information to complete the analysis properly. In an expert legal system, for example, if the infliction of physical harm is a requirement for liability under an infliction-of-emotional-distress theory, the system could postpone analysis of whether the injuries involved in a particular case met this requirement until a full description of the injuries involved was obtained from the system user. *See* W. PROSSER & W. KEETON, PROSSER AND KEETON ON THE LAW OF TORTS 64 (5th ed. 1984).

91. *Architecture of Expert Systems, supra* note 34, at 110-15. It may be more efficient for the system to guess which is the proper alternative rather than attempt to obtain

multiple representations of a particular reasoning path are maintained at different levels of abstraction;[92] (5) the use of multiple knowledge sources, each accessed by its own inference module;[93] and (6) restructuring the knowledge base used by a system to store knowledge in a way that it can be more efficiently accessed.[94]

4. Output Module

Once its inference rules have been applied to the facts of a problem, an expert system must be capable of describing its expert advice or interpretations to the system user. The output of an expert legal system can take three basic forms: summary conclusions; explanations of how the system performs its activities; or advice as to the proper course of conduct to be taken by the user. The first form of output is simply a statement of the system's results. For example, a system determining whether a particular transaction meets statutory criteria for special tax treatment might produce a positive or negative output response.[95]

Because understanding a system's reasoning is often as important as the system's ultimate conclusions,[96] an expert system often can provide

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enough additional information to decide between alternatives. Once it makes its guess, the system can proceed with its analyses until it reaches a conclusion that is inconsistent with known facts about the problem under scrutiny. However, computer "guessing" will only be appropriate when the computer is programmed to recover from wrong guesses. *See id.* at 110-11.

92. *Architecture of Expert Systems, supra* note 34, at 115-16. Where little detail is needed to move the analysis forward, a summary definition of the analytic path is utilized to direct the system's reasoning, thereby avoiding consideration of unnecessary information. Yet, where detailed characteristics make a difference, a more complex problem representation is available in the form of a parallel representation.

93. *Architecture of Expert Systems, supra* note 34, at 116-19. In such an approach, knowledge bases and analytic processes are accessed as needed by a higher-level coordinating module. This coordinating or "scheduling" module selects the sequence in which other analyses are invoked based on preprogrammed rules dictating the types of analyses most likely to produce a successful result given the partial analytic results already obtained.

94. *Architecture of Expert Systems, supra* note 34, at 120-23. One simple data structuring technique is to store the most frequently accessed data in the most readily available locations. A more sophisticated technique is to locate data that would probably be accessed contemporaneously in adjacent storage locations. Such data storage considerations can be implemented directly in the structuring of knowledge bases, or can be handled by special programs which set up or "compile" knowledge bases from raw data submitted by system developers. Eventually, advanced system compilers may be able to analyze the characteristics of knowledge data, determine the most efficient storage format for that data, and then rearrange the data in the format deemed most efficient.

95. *See, e.g.*, McCarty, *Reflections on TAXMAN, supra* note 8, at 879-81.

96.

> By offering to explain how they reached their conclusions, [knowledge] systems convey to the user an impression of reasonableness. To construct an explanation, they transform the expert heuristic rules and assertions into lines of reasoning. A line of reasoning shows how a starting set of assumptions and a collection of heuristic rules produce a particular conclu-

a second form of output which explains its inference activities.[97] This output can consist of three different types of explanations. The first type is a description of the inference rules used by a system in reaching a result and the manner in which these inference rules were applied to the problem at hand. This type of explanation is similar to the response a human expert would give if a client asked how the expert reached a particular conclusion.[98] A second type of explanation given by some expert systems is a description of the significance of a question asked by the system. Such explanations address the manner in which the answer to the system's question will be used in the system's analyses, and thus correspond to the answer an expert might give when asked why he or she needs certain information.[99] A third form of explanation available in some systems is a definition of terms used in the system's inquiries or responses.[100]

The final form of system output, available primarily in systems which are designed for planning purposes, is advice on the best future conduct of the system user in light of the system's expert conclusions. For example, in addition to providing an expert opinion about whether an individual's estate planning desires and property holdings are well matched, a system designed to assist in estate planning might recommend establishing trusts or taking other steps that would minimize the estate taxes which would otherwise be imposed upon the client's demise.[101]

III. MAN MEETS MACHINE: SATISFYING THE NEEDS OF ATTORNEYS

Useful expert legal systems must meet complex design requirements.[102] An ideal expert legal system should at once be easy to use, inspire user confidence, utilize computer resources efficiently, and, above

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sion. End-users generally find these explanations as plausible as the rules themselves. Hayes-Roth, *supra* note 2, at 14.

97. *See* E. RICH, *supra* note 23, at 201-242; D. WATERMAN, *supra* note 1, at 90-91; P. HARMON & D. KING, *supra* note 2, at 62-63.

98. For an example of an expert legal system that includes the ability to explain how it reaches its conclusions, see Schlobohm, *supra* note 71, at 782-83; Schlobohm, *supra* note 69, at 70-72.

99. For an example of an expert legal system that is capable of explaining why it needs information, see Schlobohm, *supra* note 69, at 72.

100. Professor Hellawell's expert legal system dealing with stock redemptions which qualify for special tax treatment includes the capability to define and explain to users a number of the terms used in the system's questions. Hellawell, *supra* note 15, at 1364.

101. *See* Michaelsen, *supra* note 6, at 149.

102. For an early assessment of basic design criteria for computer systems capable of legal problem solving, see Buchanan & Headrick, *supra* note 1, at 45-47, 53-60.

all, perform useful tasks.[103] In order to define these design objectives more completely, this section will identify features of expert legal systems that attorneys would find desirable.

A. Functional Needs of Attorney Users

Attorney users will tend to utilize expert legal systems to make suggestions on how to solve a particular problem or to help organize information. Using systems in this fashion, attorneys will usually supplement the systems' analyses with their own expertise, conceptual insight, and research.[104] Beyond just possessing accurate and complete knowledge bases, an ideal system will also need to be capable of sophisticated analyses. The ability of attorneys to perform many simple legal analyses in a very short time means that the work of an expert legal system must rise above this "trivial" level to be of interest to attorney-users.

Furthermore, attorneys typically demand that they know why a question has been asked, the reasoning behind a given conclusion, and even what the terms of art in a given question mean as a matter of law. In order to inspire user confidence and assist an attorney's analysis, an ideal system would possess a comprehensive explanatory ability. An expert legal system used by an attorney will not need to explain basic concepts like "negligence" or "mens rea" since attorney users will already be familiar with such nomenclature and concepts. However, where a system is designed to assist an attorney in a specialized field, explanatory and definitional capabilities concerning that field must exist within the system.

The average attorney's expectations of expert computer systems will be shaped by the ways the attorney now interacts with human experts. For example, an attorney might hope to use an expert system as a partial substitute for consulting another attorney. The attorney-user will, therefore, expect the system to perform many of the same functions that its

103. Overall, a desirable expert system is one in which the costs of use, measured broadly, are outweighed by the benefits of that use. The factors mentioned in the text weigh heavily in this cost/benefit balance. *See* Liebowitz, *Useful Approach for Evaluating Expert Systems*, EXPERT SYSTEMS, Apr. 1986, at 86 (evaluation of an expert system should focus on its "utility" in light of the costs and benefits of its use).

104. The JUDITH system, which helps attorneys build lines of reasoning regarding various types of civil liability, is a good example of an expert legal system designed to assist an attorney by organizing legal knowledge for systematic consideration by the user. *See* Popp & Schlink, *supra* note 90, at 304-06. A somewhat different interactive approach is utilized in the ABF Processor system in which attorneys provide information requested by the system, the system generates a first draft of a legal document (e.g., a will or a trust agreement), and the document is then subject to further editing by the attorney-user to insure completeness and accuracy. *See* Sprowl & Staudt, *supra* note 12, at 704-10.

human counterpart performs. In addition, attorney users might expect even more accurate and effective performance from expert systems because of the highly accurate long-term memory and rapid computational methods available in those systems.[105]

Recognizing that the activities of human experts provide a design benchmark for expert legal systems brings a few basic design requirements for such systems into focus. Stylistically, expert legal systems should interact with users in ways similar to the ways attorneys might interact with each other.[106] As when consulting another attorney, an attorney seeking computer assistance in completing an analysis will wish to actively participate in the development of that analysis to a high degree rather than passively receive bare analytic results.[107] Attorneys having an inherent distrust of the analytic capabilities of computers or a dislike of how computers operate will be much more comfortable accepting the results of analyses they have played a primary role in shaping rather than results essentially dictated to them by a computer system. Furthermore, the use of a participatory approach in which computer resources are used to complement the analytic strengths of the system user can produce a synergistic effect resulting in legal analyses beyond the capabilities of either attorney or computer working alone. This effect could be achieved, for example, if computer resources were used in areas like information recall or numeric calculation where computer capabilities are particularly strong. An attorney could then control portions of the analysis such as reasoning by analogy or similar analytic processes which are weakly handled by computers.

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105. For example, a computer system for comparing the outcome of two calculations having legal significance could perform this task more quickly and accurately than a human counterpart, permitting an attorney relying on the system to examine a wider variety of planning options in a more efficient manner than if he made the calculations by hand. *See, e.g.*, Hellawell, *supra* note 9, at 342.

106. Since they take place under the severe time pressures common to practice environments, attorney interactions provide a good model because they represent relatively efficient modes of communication. At the same time, they are necessarily tailored, given the underlying purpose of consultation, to convey information to solve legal problems.

107. At a minimum, this participation would require that an expert legal system have the ability to explain how it reached partial or final results and why it needs specific types of information. *See, e.g.*, Hellawell, *supra* note 9, at 356; Schlobohm, *supra* note 71, at 781-84; *cf.* Brachman, Amarel, Engelman, Engelmore, Feigenbaum & Wilkins, *What Are Expert Systems?*, in BUILDING EXPERT SYSTEMS 31, 42 (F. Hayes-Roth, D. Waterman & D. Lenat eds. 1983) (explanations by expert systems "reassure a human observer of the validity of a chain of inference steps"). For an example of an expert legal system with these capabilities, see Schlobohm, *supra* note 71, at 765; Schlobohm, *supra* note 69, at 64.

Finally, an attorney seeking assistance through an expert legal system must have great confidence in the accuracy of the system.[108] The overall quality of an expert legal system should be demonstrable through favorable comparisons of system outputs with the analyses of human experts where both the system and the experts have been given identical problems to resolve.[109] Furthermore, the accuracy of both the expertise captured in a system's knowledge base and the inferential reasoning processes used in a system should be manifest to attorney-users. Finally, the ability of a system to appreciate the limitations of its expertise and inform a user that a different source of assistance should be consulted will also be an important factor in establishing confidence in the system among attorney-users.

B. Characteristics of an Ideal Expert Legal System

This section will apply the functional requirements of attorney-users in order to formulate specific design goals for expert legal systems.[110]

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108. An attorney using an expert legal system to shape his advice, or directly incorporating the results of a system's analyses into his advice, risks liability for negligence in selecting the system or perhaps strict liability for system errors. *See* Nycum & Fong, *Artificial Intelligence and Certain Resulting Legal Issues*, COMPUTER LAW., May 1985, at 1, 5; Nycum, Bowen & Van Arsdale, *Selected Legal Issues Applicable to Computerized Data Bases and Expert Systems*, COMPUTER LAW., Aug. 1986, at 8, 8-10; Willick, *Professional Malpractice and the Unauthorized Practice of Professions: Some Legal and Ethical Aspects of the Use of Computers as Decision-Aids*, 12 RUTGERS COMPUTER & TECH. L.J. 1, 14-15 (1986). Furthermore, attorneys will not use a computer system until they are confident of the system's accuracy and are familiar with its process. *See* Berring, *Full-Text Databases and Legal Research*, 1 HIGH TECH. L.J. 27, 38-39 (1986).

109. In determining the success of artificial intelligence programs, "the best test is usually just whether the program responded in a way in which a person could have." E. RICH, *supra* note 23, at 19. This can be determined from various kinds of experiments and protocol analyses. *Id.* At least one expert legal system has been tested or "validated" under this standard. *See* Michaelsen, *supra* note 6, at 164-65.

Some computer experts, however, have argued for a broader set of criteria for assessing expert systems. *See, e.g.*, Liebowitz, *supra* note 102, at 86 (proposing that expert systems be evaluated based, *inter alia*, on their ability to be updated, their ease of use, the range of compatible computer hardware, cost-effectiveness, output comprehensiveness, output quality, and design time).

110. While it is impossible to predict precisely what types of expert legal systems may be developed in the future, intelligent activities that might be incorporated into future expert legal systems fall into four categories:

> *Association* — processes that associate a particular user input with a rigid pattern of output without any intervening conceptual analysis;
> *Simple Formal* — processes applying formal analytic concepts that are completely defined and used in a way that is situation independent;
> *Complex Formal* — similar to simple formal processes, except that the way analytic concepts are applied in complex formal processes is somewhat situation dependent;
> *Nonformal* — processes that depend on concepts that are not formally definable,

1. Input

An attorney will generally hope to communicate with an expert computer system in the same way he might talk to a human expert. Thus, an expert legal system would ideally satisfy the famous, and as yet unsatisfied, "Turing test," which is whether a user placed in communication with the expert system would be able to tell from the system's questions or answers that a computer was on the other end of the communication link rather than a human expert.[111]

Even relatively minor differences in communication style may not be easily tolerated. For example, many persons feel far less comfortable communicating with a computer by typing on a keyboard than they would in relating the same information verbally to a human listener. More serious limitations, such as the inability of a computer system to understand more than a severely limited vocabulary of words or symbols, will cause an expert legal system to fall even further short of the desires of attorney-users.

At the input stage, an ideal expert legal system should be capable of the sorts of communication that a human expert would undertake in the course of fact gathering. For example, the expert system should provide definitions of legal terms of art either on request or, if a definition is counterintuitive, in the first instance where such a term is used.[112]

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such as reasoning by analogy or recognition of a type of controversy based on knowledge of a paradigm case.

These categories of intelligent activities are drawn from H. DREYFUS, WHAT COMPUTERS CAN'T DO 203-17 (1972).

111. In the early 1950's, artificial intelligence researcher Alan Turing proposed the following test as a standard for determining whether a computer could think: a person and a computer are placed in two separate rooms. A second person acts as an interrogator and communicates with the two rooms by typing questions on a communication device and by receiving typed answers. The interrogator can ask questions of either the person or the computer, but is only told that the answers came from Room A or Room B. If the computer is able to fool the interrogator into thinking its room is the one occupied by the person, then Turing would conclude that the machine passed an empiric test of thinking behavior. *See* Turing, *Computing Machinery and Intelligence*, in COMPUTERS AND THOUGHT (E. Feigenbaum & J. Feldman eds. 1963). No computer has yet met this standard; some researchers argue that it is an aspirational standard that will never be satisfied. *See* E. RICH, *supra* note 23, at 18-19.

The test described in the text is actually a modified form of the Turing test since, in order to be mistaken for a human expert giving advice, an expert system would only need to be capable of dialog in the applicable field of expertise. The elimination of any need to address randomly chosen topics significantly reduces the amount of knowledge a system needs to incorporate and apply in order to simulate intelligent behavior. *See id.*

112. This assistance could be provided in either of two ways. The first time a system asked a question or made a statement containing an important term of art, that term could be defined in an accompanying sentence. Alternatively, the same definition could be given in response to a user request for help from the system. The latter approach is, of course, only useful where a user realizes that he or she needs help. *See* Schlobohm,

Similarly, the system should be able to explain the importance of a given question.[113] It should also be able to complete partial analyses in response to partial information about a problem, and should be able to indicate how additional facts would affect the outcome of the system's conclusions.[114] Finally, factual information, once provided to the system, should be easily alterable both to permit easy correction of erroneous data entries and to allow the "what if" analyses that often form the basis of legal planning.[115] In addition to these considerations, the attorney should have complete confidence that all relevant information is being considered by the system in producing a given legal analysis. In part, the scope of information sought by a system depends on the completeness of its knowledge base, an issue addressed below. However, to provide an independent means to gauge the thoroughness of its fact gathering, a system should inform users of the range of input information actually relied upon in a particular system analysis.[116]

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supra note 71, at 784-85.

113. This amounts to explaining "why" a given question has legal significance. *See id.* at 783-84.

114. One way to convey this information is for the system, upon inquiry by a user, to display the reasoning path it is following along with the reasoning steps it has already confirmed. This approach is illustrated by the following portion of a Tax Advisor consultation session (user responses are italicized):

> Is the client willing to relinquish possession and enjoyment of assets and power to alter, amend, revoke, or terminate any trust in which the assets are placed?
>
> *WHY?*
>
> This will aid in determining whether the client should make permanent gifts. It has already been established that client has an estate that is substantial enough, given his present age and health, that he can afford to forego the income from gifted assets, and to pay the expenses associated with making gifts. Therefore, if . . .
>
> > A: Client is willing to relinquish possession and enjoyment of assets and power to alter, amend, revoke or terminate any trust in which the assets are placed, or
> >
> > B: is willing to transfer term life insurance, or whole life that is borrowed up, to an irrevocable trust, . . .
> >
> > then client should explore permanent inter vivos gifts.

See Michaelsen, *supra* note 6, at 158.

115. For example, a system capable of analyzing whether one business form is preferable to another from a tax standpoint could be programmed to operate in a planning mode. In this mode, the system would permit users to describe a projected business operation, obtain a tax characterization from the system, modify part of the description of that operation, and immediately receive a recharacterization of the modified operation. Through this process, the system can assist the user in formulating business plans by testing various alternatives. *See* Hellawell, *supra* note 9, at 344-45, 346.

116. This type of information can be disclosed when a system reviews how it has reached a particular conclusion or piece of advice. For example, one existing expert system lists the sequence of inferences drawn by the system when a user asks how the system reached a result. *See* Schlobohm, *supra* note 71, at 782-83.

2. Knowledge Bases

Obviously, a knowledge base should be as comprehensive as is necessary to serve the specific goals of a system. A thorough knowledge base serves both to increase an expert system's analytic strengths and to inspire user confidence. The knowledge base should be easily alterable so that new knowledge can be added and old knowledge deleted as legal standards change or develop. In this respect, new knowledge might involve revision of existing inference rules or merely the specification of new exceptions to previously unqualified rules. Corresponding sets of term definitions will also need to be added to the database as inference rules are altered.

An ideal expert legal system would also retain information about problems and related expertise in the same forms and groupings that an attorney-counterpart would. Where such information ordering is not compatable with computer processing, information should be organized in a way that is at least understandable to attorneys seeking to reconstruct the information used by the system.[117]

Clearly understandable information storage serves several functions. Attorneys will be able to determine what information has been used by a system in reaching a particular conclusion, and will thus be able to easily hypothesize about which circumstances, if changed, might produce different results. Further, attorneys can readily examine the inference rules being used by a system to determine whether important considerations have been left out.

3. Inference Processing

As with the other components of expert systems, reasoning processes in an ideal expert system should approximate those of attorneys. Attorneys then will be able to examine and understand the reasoning underlying a particular conclusion to determine if it warrants his or her confidence. Moreover, system designers will be able to periodically compare the logic of a system with that used by attorneys in addressing new problems in order to determine if new inference programming of the system is necessary.

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117. In constructing a knowledge base:

> notational convenience is a virtue because most expert systems applications require the encoding of substantial amounts of knowledge, and this task will not be an enviable one if the conventions of the representation language are too complicated. The resulting expressions should be relatively easy to write and to read, and it should be possible to understand their meaning without knowing how the computer will actually interpret them.

P. JACKSON, *supra* note 17, at 30.

The inference processing components of expert legal systems should thus meet several criteria. Of course, the reasoning approach in a particular system (as chosen from among the available computer reasoning schemes discussed in Section II) should be an efficient match for the characteristics of the system's knowledge base and the problems the system must resolve.[118] In addition, where the most efficient means for a computerized system to reach a solution to a problem do not parallel the way an attorney would solve the same problem, the system should at least be able to justify the correctness of its answer in a manner that an attorney would find understandable and persuasive. For example, an expert legal system designed to assist in solving a particular type of tax planning problem might have sufficient processing speed to simply generate and test a variety of potential problem solutions rather than to initially attempt to identify the one solution that is acceptable. On the other hand, an attorney might be more likely to attempt to develop a single solution through deductive processes.[119] Such a difference in problem solving approaches will not detract from the usefulness of an expert legal system if the system is at least able to "defend" its answer by describing why the answer meets the tax planning objectives at stake.

Finally, in addition to being able to manipulate substantive legal rules, the inference processing of an ideal expert legal system should incorporate many practical considerations or "rules of thumb" that influence the steps taken by the system in solving problems. For example, in the interests of efficiency an expert system must determine which tax planning vehicle or type of factual information to examine first in trying to reach a particular planning goal. A "rule of thumb"

118. Obviously, the accuracy of the inference process in performing a particular type of analysis is one important measure of the suitability of that process. However, other features are also important, such as how easy the process is to understand, modify, use, and transport to other computers. *See* Liebowitz, *supra* note 102, at 86.

Efficiency, as used here, is a measure of the system's overall performance in all of these areas. An inference process that is not well tailored to solving a particular type of problem may still produce accurate results, but often at an unacceptably slow rate. Such a system is much less efficient than a system incorporating a more carefully designed inference process that minimizes the unnecessary analyses performed by the system and thereby reaches successful results in less time. *Cf.* Michaelsen, *supra* note 6, at 163-64 (discussing steps taken to reprogram an expert legal system to make it more efficient).

119. For example, a system for planning corporate reorganizations might begin with a description of a corporation's shareholders and the characteristics of the desired post-reorganization pattern. The system could then generate combinations of possible reorganization steps that would lead from the initial circumstances to the desired final result. Each of these combinations of steps could be tested to determine if they qualify for favorable tax treatment. Through this mechanism, such a system could perform an analysis equivalent to that which an attorney might perform by deduction directly from the applicable tax law. *See* McCarty, *Reflections on TAXMAN*, *supra* note 8, at 886 n. 117.

concerning types of information most commonly leading to useful tax planning advice would be needed to tell the system which among several good alternatives to examine first.

4. *Output*

An ideal expert system would describe its expert conclusions in understandable terms and would be capable of reconstructing and explaining the logic underlying those conclusions.[120] In addition, an expert system's response should be as practical and comprehensive as possible. For example, rather than just describing what tax planning options would be desirable based on a person's income or property holdings, an expert system might create an initial draft of trust agreements or other documents necessary to implement the desirable options.[121]

A sophisticated system might also be programmed to provide a follow-up response as the expertise which formed the basis for the system's past advice evolved or changed.[122] For example, in the tax planning system described above, this could be achieved by programming the computer to keep records of the advice given in response to an attorney's inquiry and the tax law provisions relied upon. When a tax law provision is changed, the system could review its records, identify each client given advice based on the old provision, and draft a letter suggesting that these clients may need a new tax plan in light of the changes in the law. In this way, a legal expert system could keep track of a client's legal status and could monitor when a client should come in for a legal "checkup."

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120. Explanation is an important feature of any expert system because "[t]he consumers of automatic advice need to be convinced that the reasoning behind a conclusion is substantially correct, and that the solution proposed is appropriate to their particular case." P. JACKSON, *supra* note 17, at 207.

121. *Cf.* Boyd & Saxon, *The A-9: A Program for Drafting Security Agreements Under Article 9 of the Uniform Commercial Code*, 1981 AM. B. FOUND. RES. J. 639, 652 (program creating security agreements complying with Article 9 of the Uniform Commercial Code is capable of simultaneously generating ancillary documents like financing statements and continuation statements).

122. An expert legal system:

> could monitor legal data bases for the purpose of identifying clients affected by law changes. For example, clients given legal help with estate planning, wills, or business contracts would want to be notified when laws were enacted that nullified key provisions in those documents. These systems would work by setting up links between particular documents and the pieces or types of legislation that could affect them and then notifying the attorneys when the linked legislation was changed.

D. WATERMAN, *supra* note 1, at 225; *see also* Gray, *Law & Technology Conference Expert System Workshop Report*, in COMPUTING POWER AND LEGAL REASONING 621, 624 (C. Walter ed. 1985) (proposing a similar system).

IV. EVALUATION OF EXISTING EXPERT LEGAL SYSTEMS

This section contains a review of the history, objectives, operation, and merits of some existing expert legal systems.[123] This review serves several purposes. It serves to describe the many functions that existing systems can perform, thereby demonstrating the potential breadth of future applications for expert legal systems.[124] It also illustrates the wide

123. The expert legal systems discussed in this Section are organized by the type of legal analysis they perform.

124. This breadth is illustrated by the following list of potential uses of expert legal systems developed by expert system designers at a recent workshop:

1. Aiding legislative drafting by testing a draft against a legal database and linguistic standards, and having the computer make appropriate suggestions;
2. Researching legal databases such as WESTLAW and LEXIS on the basis of a statement of facts or concepts (conceptual retrieval as opposed to the current key word searches);
3. Generating ideas and advising the attorney of arguments for and against a proposition, and also how to strengthen the arguments in a particular case;
4. Advising an attorney on strategy and tactics in negotiations;
5. Evaluating a case as to settlement or legal worth;
6. Evaluating the consistency with prior decisions of a proposed administrative decision in a discretionary area;
7. Aiding document drafting of contracts, wills, and other documents by testing for consistency with existing law, internal consistency, and consistency with linguistic standards;
8. Assisting decision making in which little or no discretion is involved;
9. Planning transactions, such as business mergers, with tax and other legal consequences by presenting alternative scenarios and identifying their legal consequences;
10. Predicting consequences of proposed legislation or draft contracts;
11. Finding legal authority which is inconsistent with proposed laws;
12. Evaluating the effectiveness of existing laws and identifying laws which may need to be modified;
13. Training and disseminating information on the law;
14. Interviewing clients for information relevant to identification of the nature of their legal problem;
15. Informing people of the legal consequences of particular acts in order to enable non-attorneys to know the legality of proposed acts or past acts, and if communication with an attorney is required to obtain a complete answer;
16. Preserving institutional expertise;
17. Reviewing a legal database against new laws or cases and modifying it to keep it current;
18. Identifying clients whose legal affairs may have been affected by changes in the law so that an attorney can determine whether to contact them regarding the change.

Id. at 622-24; *cf. Legal Decision Systems, supra* note 13, at 223-24 (primary application areas for expert legal system development include case management, monitoring, legal interpretation, and document generation).

range of programming and design approaches now available for creating expert legal systems. Moreover, by evaluating the advantages and disadvantages of present systems, it provides design guidelines for developers of future legal expert systems.

A. Interpretation

Applying legal rules to produce legal interpretations of factual circumstances lies at the heart of many lawyering tasks, from assessing a client's potential civil liability for past actions to identifying the probable tax consequences of present client conduct. Several computer systems have been developed to make expert legal interpretations in limited factual circumstances[125] or to assist attorneys in making such interpretations.[126]

1. *TAXMAN*[127]

Developed during the early 1970's by Professor L. Thorne McCarty, TAXMAN deals with the classification of corporate reorganizations for federal income tax purposes. Specifically, TAXMAN is capable of determining whether a particular corporate transaction is a Type "B," "C," or "D" reorganization within the meaning of Internal Revenue Code section 368(a).[128] This area of law was chosen as the focal point of the TAXMAN project for several reasons.[129] First, the rules for distinguishing among these types of transactions are succinctly set out in the

125. For example, the CORPTAX system examines stock redemption patterns in corporate reorganizations to determine if the reorganizations have characteristics specified in the Internal Revenue Code that will cause them to receive special tax treatment. *See* Hellawell, *supra* note 15, at 1363.

126. For example, the JUDITH system assists an attorney in developing a chain of legal reasoning. It does so by presenting the attorney with a series of reasoning options through a conversational process. *See* Popp & Schlink, *supra* note 90, at 304-06.

127. McCarty, *Intelligent Legal Information Systems*, *supra* note 8, at 267-76; McCarty, *Reflections on TAXMAN*, *supra* note 8, at 837.

128. Section 368(a) of the Internal Revenue Code describes categories of corporate reorganizations which may be conducted without taxable gain or loss. *See* I.R.C. §§ 354, 361(a), 368(a) (1982). These categories of reorganizations are known colloquially by the letter of the subsection of § 368(a)(1) in which they are defined. Thus, the three types of reorganizations analyzed by TAXMAN are:

> B TYPE—"the acquisition by one corporation, in exchange solely for . . . [the] voting stock . . . of another corporation," if immediately thereafter the acquiring corporation has control of the other corporation. I.R.C. § 368(a)(1)(B).
>
> C TYPE—the acquisition by one corporation of "substantially all of the properties" of another corporation, again in exchange "solely for . . . voting stock" of the acquiring corporation. I.R.C. § 368(a)(1)(C); *see also* I.R.C. § 368(a)(2)(B).
>
> D TYPE—the transfer of assets by one corporation to another corporation of which the transferor immediately thereafter is in control. I.R.C § 368(a)(1)(D).

129. *See* McCarty, *Reflections on TAXMAN*, *supra* note 8, at 842-50.

Internal Revenue Code and accompanying IRS regulations.[130] Second, where these statutory or regulatory standards are unclear, detailed case law explicitly resolves most of the ambiguities. Consequently, answers to questions in this area of law depend heavily upon analyses which are highly structured in accordance with the underlying statutory scheme, yet fairly complex because of the presence of judicial interpretations of that scheme.

TAXMAN records knowledge in terms of relationships between factual states and concepts. The objective of this design was to identify and record legal relationships in a workable approximation of the way knowledge in this area is represented in the human mind.[131]

An example of how TAXMAN represents a particular legal rule illustrates this design technique. The statutory definition of a Type B reorganization is as follows:[132]

> the acquisition by one corporation, in exchange solely for all or a part of its voting stock . . . of stock of another corporation, if, immediately after the acquisition, the acquiring corporation has control of such other corporation . . . .

A translation of this definition into logical rules might read as follows:

> If (1) there exists an ACQUISITION OF STOCK in exchange for VOTING STOCK, and (2) there exists a CONTROL relationship following the acquisition, then there exists a B TYPE REORGANIZATION.

In this definition each of the capitalized terms (except "B TYPE REORGANIZATION") represent a factual state or relationship which TAXMAN must identify as being present or absent. "B TYPE REORGANIZATION" is a factual state considered present if both parts (1) and (2) of this test are satisfied.

TAXMAN represents the definition of a B TYPE REORGANIZATION as follows:[133]

```
(ACQUISITION  ACQ1
              <acquirer (CORPORATION C1>
              <acquired prop
              (STOCK S1
                    <issuer (CORPORATION C2)>)>
              <transferred prop
```

130. *See* I.R.C. §§ 268, 354, 355, 356 (1982).
131. *See* McCarty, *Reflections on TAXMAN*, *supra* note 8, at 850-62.
132. I.R.C. § 368(a)(1)(B) (1982).
133. McCarty, *Intelligent Legal Information Systems*, *supra* note 8, at 274.

```
(STOCK S2
        <issuer (CORPORATION C1)>
        <voting YES>)>
<time1 (STATE T1)>
<time2 (STATE T2)>)
     (CONTROL CON1
<controller (CORPORATION C1)>
<controlled (CORPORATION C2)>
<time (STATE T2)>)
```

The ACQUISITION language of the program corresponds to part (1) of the Internal Revenue Service rule, while the CONTROL language corresponds to part (2) of the rule. Both standards must be met for the system to conclude that a B type reorganization is present. These definitions of ACQUISITION and CONTROL are not complete since each depends on definitions of lower-level concepts. For example, CONTROL depends on the definition of the relationship "OWN" and a determination whether CORPORATION C1 "owns" 80% or more of the STOCK of CORPORATION C2 at time T2.[134] This illustrates how relatively complex legal tests can be implemented in computer systems by building upon earlier definitions of basic concepts.

The TAXMAN system is an early example of an expert legal system based on semantic information processing. Such an implementation involves the specification within a domain of knowledge of significant "things" and "relations," with the latter typically being represented as a network of links between instances of the former. Using such semantic networks, McCarty stored representations of certain legally significant transactions in TAXMAN. The system was then able to characterize user actions by applying pattern recognition techniques to determine if the relationships present in the user's facts corresponded with patterns known to the system.

Although a useful prototype, TAXMAN has several limitations as an expert system. First, information must be presented to the system in a rigid format, making TAXMAN, as its developer noted, "inaccessible to most potential users."[135] Second, it deals with a very narrow field of law.[136] Third, TAXMAN was designed to characterize completed corporate transactions, and thus it provides only awkward assistance to parties wishing to plan future corporate activities to achieve a predetermined tax consequence. Finally, TAXMAN's requirement that the full factual circumstances of a transaction be entered into the system before

134. *Id.*
135. McCarty, *Reflections on TAXMAN*, *supra* note 8, at 882.
136. *Id.*

it begins its analysis fails to utilize user time as efficiently as a system that accepts a partial factual description, produces a partial analysis, and then asks the user for only the information needed to complete the analysis.[137]

Despite these limitations, TAXMAN was a provocative early work, illustrating how semantic information processing techniques could be applied to legal knowledge and how legal knowledge could be formalized to accommodate those techniques. TAXMAN remains one of the most fully realized "deep knowledge" systems in the legal field.[138]

2. *Tax Advisor (Schlobohm)*[139]

Tax Advisor is another expert system designed to produce legal interpretations in the tax field. Developed by Dean Schlobohm, Tax Advisor was created to demonstrate to attorneys the usefulness of expert legal systems implemented on microcomputers. Potential system users were presumed to have little or no understanding of computers. Consequently, much of the development effort centered not on the incorporation of broad analytic powers into the system, but on designing an "interface" between the system and attorney-users which would allow attorneys to use Tax Advisor without understanding the computer language in which it is written.[140]

Tax Advisor's expertise concerns the constructive ownership of stock for income tax purposes. Its knowledge base is derived from the ownership attribution rules in Internal Revenue Code section 318.[141] Under these rules, stock ownership is attributed to persons other than the individuals or entities holding title to the stock. For example, the rules provide that an individual is considered to be the owner of shares directly or indirectly owned by his or her spouse, children, grandchildren and parents.[142] The rules in sections 318 are unambiguous, but tedious to apply. Part of this tedium stems from their recursive nature—that is,

137. *See id.* at 885 n.114.

138. TAXMAN is a "deep knowledge" system because its expert conclusions are derived from an internally recorded model of legal standards, in contrast to a rule-based or "shallow knowledge" system in which narrow judgmental rules are used to produce expert conclusions. *See* Michaelsen, Michie & Boulanger, *supra* note 73, at 305-10. TAXMAN's author, Professor L. Thorne McCarty, believes that deep conceptual models are generally preferable as bases for expert legal systems, primarily because a conceptual model developed for a legal analysis and planning system could also form the foundation for a legal materials retrieval system in the same substantive area. *See* McCarty, *Intelligent Legal Information Systems*, *supra* note 8, at 265.

139. Schlobohm, *supra* note 71, at 765; Schlobohm, *supra* note 69, at 64.

140. *See* Schlobohm, *supra* note 71, at 767.

141. I.R.C. § 318 (1982).

142. I.R.C. § 318(a)(1) (1982).

the need to apply the rules repeatedly to produce a complete analysis. This recursiveness follows from the provision of the attribution rules that where that an individual's stock ownership is attributed to a second party under section 318, that second party's ownership can be attributed to a third party through an additional application of the section.[143]

Tax Advisor is written in PROLOG, a computer programming language popular among creators of expert systems.[144] PROLOG permits easy definition of the knowledge bases that are at the heart of most expert systems.[145] PROLOG also promotes efficient expert system development by permitting a system author to define tests initially and then to refer to them by shorthand labels thereafter.[146] For example, assume "spouse(H,W)" is PROLOG shorthand for a test that gives a positive response if H is married to W, and "owns (W,N,C)" denotes that individual W actually holds legal title to N shares of stock in C corporation. These terms can now be used to define more complex tests. For example, since section 318 provides that a husband constructively owns his spouse's shares,[147] the number of shares constructively owned by H under section 318 due to marriage ("num-con-own(H,N,C)") can be defined in PROLOG by the following statement:[148]

num-con-own(H,N,C):-spouse(H,W), owns(W,N,C).

In addition to being an easier way to write programs, these shorthand terms make the programs easier to understand and modify.

Tax Advisor has several other features which make it easy to operate. One such feature is the system's ability to explain many of the terms it uses in its questions. This is accomplished through a "Help" command. For example, one of the questions asked by Tax Advisor is:

Does your client have a spouse?[149]

If the word "help" is given in response, Tax Advisor explains:

> A spouse does not include one who is legally separated from [the client] under a decree of divorce or separate maintenance. Section 318(a)(1)(A)(i).[150]

While this is not a complete definition of the term "spouse," it contains important information on the ways the legal definition of this word

143. For example, if a trust owns 50% of the stock of corporation X, stock of corporation Y owned by corporation X which is attributed to the trust may be further attributed to the beneficiaries of the trust. *See* Treas. Reg. § 1.318-4(a) (1968).

144. *See supra* note 25 and accompanying text.

145. *Id.*

146. *Id.*

147. I.R.C. § 318(a)(1) (1982).

148. *See* Schlobohm, *supra* note 71, at 766-67.

149. *See id.* at 784.

150. *Id.*

differs from common usage.[151]

A second type of explanation given by Tax Advisor is a description of the reason it is asking a user for a piece of information. For example, when Tax Advisor asks,

Is [the client] an individual?[152]

and the user types "why," Tax Advisor supplies the following explanation:

> An individual is deemed to own the stock owned by his family. Section 318(a)(1).[153]

A third type of explanation is available from Tax Advisor if a user has doubts about how the system reached its conclusions or if the user wishes to identify facts that were the basis for a given answer. Tax Advisor can review the analytic rules it utilized, the tentative conclusions it reached, and the reasoning path it followed in formulating a final conclusion. A simple reasoning explanation given by Tax Advisor might contain the following:

> The number of shares of Corporation X stock constructively owned by [the client] as a result of section 318(a)(1) is 1,000, determined as follows:[154]
>
> An individual is deemed to own the stock owned by his family. Section 318(a)(1).
>
> FACT: [The client] is an individual.
>
> A spouse is a family member. Section 318(a)(1)(A)(i).
>
> FACT: [W] is the spouse of [the client].
>
> FACT: [W] actually owns 1,000 shares.
>
> FACT: The client has no more family members.[155]

Like the other expert legal systems described in this Article, the success of Tax Advisor stems from its reliance upon the analytic strengths of computers. Tax Advisor is successful primarily because the rules in section 318 are well defined and not subject to varying interpretations by numerous cases.[156] The principal difficulties involved in applying these rules concern the extremely repetitive nature of this process. Human

151. Of course, the usefulness of this explanation capability is limited by the need for a Tax Advisor user to ask for help before any explanation is given. In the instance quoted in the text, for example, a user of the system might simply assume that the term "spouse" includes any person the taxpayer is still legally married to, regardless of legal separation. Unless the user knew to ask for help, he or she might simply overlook the correct meaning. *Id.* at 784-85.

152. *See id.* at 783-84.

153. *Id.*

154. *See id.* at 782-83.

155. *See id.* at 782-83.

156. *Id.* at 785.

repetition of such analyses takes significant amounts of time and can lead to error; by contrast, computers can handle this task quickly and accurately.[157]

Tax Advisor represents several advances over the other expert legal systems described in this Article. Its explanation capability is far more sophisticated than that of most of the other systems. Further, Tax Advisor demonstrates that an effective expert legal system can be implemented with relative ease through use of PROLOG or similar programming languages specially designed for representing and applying symbolic knowledge.[158] Specialized computer programming languages like PROLOG offer excellent opportunities for attorneys and legal academics lacking extensive computer programming training to author expert systems.[159]

Tax Advisor's limitations derive largely from the specific design goals used in creating the system. Tax Advisor's knowledge base was not expanded beyond the narrow subject matter of attribution issues under section 318 because it was intended primarily as an experimental system demonstrating the extensive explanatory capabilities possible in an expert legal system implemented on a microcomputer.[160] Furthermore, the limited processing power of the microcomputer and the version of PROLOG used to create Tax Advisor imposed significant design constraints. Because an overall limit was placed on the processing power available to the analytic and explanatory portions of Tax Advisor, greater explanatory capabilities could often be achieved only by limiting some of the analytic power of the system.[161] To accommodate this trade-off, Tax Advisor was implemented in two versions, one in which the full range of section 318 analyses were implemented but with little explanatory capability, and a second version in which only a few of the section 318 attribution rules were carried out but which had the full explanatory capabilities described above.

Fortunately, these limitations can be overcome in subsequent implementations of Tax Advisor and similar systems. The two existing versions of Tax Advisor illustrate, albeit in separate systems, how to

157. *See id.* at 779-80.

158. For overviews of computer programming languages commonly used in expert system development, see P. HARMON & D. KING, *supra* note 2, at 79-89; E. RICH, *supra* note 23, at 389-406.

159. A number of legal experts have authored expert legal systems in their own areas of expertise. *See e.g.*, Hellawell, *supra* note 15, at 1363; Boyd, *supra* note 5, at 699. For an assessment of the problems a legal expert may encounter in this authoring process, see Hellawell, *supra* note 15, at 1364-65.

160. Schlobohm, *supra* note 71, at 767.

161. *See id.*

implement both analytic breadth and explanatory capabilities. All that is needed to combine these capabilities in a single system is either a larger target computer or a more efficient microcomputer implementation of the PROLOG language. The former is available at a price; the latter has recently become available in the form of several new PROLOG language products for microcomputers.[162]

3. *CORPTAX*[163]

CORPTAX is a computer program developed by Columbia University Professor Robert Hellawell to demonstrate four important functions computers can perform for attorneys: (1) the orderly and comprehensive accumulation and arrangement of facts relevant to a problem, (2) the completion of mathematical calculations and logical deductions necessary to solve a problem, (3) the retention of data on complex legal standards in forms that can guide problem solving, and (4) the description of alternative analyses in controversial legal areas, along with arguments and precedents supporting each. CORPTAX analyzes a specific corporate taxation question: does a stock redemption qualify for favorable tax treatment under the provisions of Internal Revenue Code section 302(b)(2) and the related attribution rules under section 318? These provisions determine whether a purchase of a shareholder's stock by an issuing corporation will be treated as a sale of the shares, with the consequent gains potentially subject to capital gains treatment, or as a dividend with gains taxed at ordinary income rates.

CORPTAX differs from TAXMAN and Tax Advisor in several significant ways. One fundamental difference is the lack of a formal knowledge representation scheme in CORPTAX. Tax rules are implicitly represented in CORPTAX's programming through the sequence of questions the program asks the user and the series of tests that are applied to the user's answers.

A portion of a typical CORPTAX session will illustrate this approach. CORPTAX begins by asking the user a variety of questions,

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162. For example, Turbo PROLOG, a new version of PROLOG for use with IBM personal computers and compatibles, can work with considerably more computer memory than the version of PROLOG used to develop the Tax Advisor. This, in turn, should permit much more elaborate expert systems to be implemented on these small computers.

163. Hellawell, *supra* note 15, at 1363. The usefulness of CORPTAX has been eclipsed by the 1986 Tax Reform Act, in which capital gains and ordinary income are taxed at the same rate. *See* Tax Reform Act of 1986, Pub. L. No. 99-514, § 301(a) (repealing provisions of I.R.C. § 1202 previously providing for special capital gains treatment).

almost all requiring either a "yes" or "no" answer or a numerical response. Here are some samples:[164]

> Does REDCORP [the corporation redeeming its stock] have outstanding more than one class of voting stock? Answer Yes or No. If you would like information on the meaning of voting stock—type XXX.
>
> Does REDCORP have outstanding more than one class of common stock? Answer Yes or No. If you would like information on the meaning of common stock—type XXX.
>
> How many types or classes of REDCORP voting stock are outstanding? Program will accept up to 5.

CORPTAX goes on to ask additional questions about the circumstances of the redemption transaction of the user. It then reaches the following types of conclusions:[165]

> Redemption passes the voting power tests of I.R.C. Sec. 302(b)(2)(B) and (C).
>
> Redemption does not qualify under I.R.C. Sec. 302(b)(2). Although it passes the 50% voting stock test and the 80% voting stock test it flunks the value test found in the last paragraph of I.R.C. Sec. 302(b)(2)(C).
>
> If third parties have common shares redeemed worth —$119,929.00 (which your answers indicate) then to pass the value test of Sec. 302(b)(2)(C) the minimum value of common shares that must be redeemed from the total of shares actually owned by taxpayer plus any shares attributed to taxpayer is—$57,998.00.

These examples illustrate both the strengths and weaknesses of CORPTAX. CORPTAX's principal strengths derive from the fact that it is very easy to use. The user need only answer a carefully sequenced series of relatively simple questions. Each question asks for a limited factual assessment that can be made by someone having little legal sophistication. For users who are not familiar with the terms of legal art included in some of the questions, an explanation of the terms is available as an optional supplement to each question.

Unfortunately, the careful sequencing of CORPTAX's questions also reflects one of the weaknesses of the system: it is not easily updated or expanded. The programming statements which cause the system to ask direct questions and which control how the responses are processed are carefully crafted and intertwined to serve their analytic purpose in CORPTAX's original design and thus cannot be easily removed or changed without fundamentally altering the program itself.

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164. *Id.* at 1370.
165. *Id.* at 1374.

Furthermore, the relationship between the legal rules governing the interpretation of stock redemptions and the actual programming of CORPTAX is far from obvious.[166] That relationship will only be clear to a person with both tax law and programming expertise who takes time to study the program's design. This means that a user without both these types of knowledge must rely wholly upon the expertise of the system developer (or subsequent system modifiers) for the accuracy and completeness of the legal analyses produced by CORPTAX. Because user confidence is a key prerequisite to the utility of an expert system,[167] many persons may be hesitant to use systems like CORPTAX because the analytic methods in these systems are inaccessible to users.

4. *JUDITH*[168]

Developed by German researchers Walter Popp and Bernhardt Schlink of the Universities of Heidelberg and Darmstadt, JUDITH was created to demonstrate the usefulness of an interactive system in which a chain of legal reasoning is built up step-by-step through a dialog between lawyer and computer. Rather than producing expert interpretations itself, JUDITH guides attorneys in analyzing the probable scope of a party's civil liability for past actions. The system's expertise lies in its structured records of criteria for civil liability and the systematic presentation of those criteria for review by lawyers using the system.[169]

JUDITH applies a backward-reasoning, goal-driven approach to guide an attorney through the analysis of a case.[170] An attorney using JUDITH is first presented with a range of possible remedies and must select one acceptable to his or her client. Based on that selection, JUDITH then displays all areas of the law where the chosen remedy is available (e.g., contracts, torts, property). Once one of these areas is chosen, the system presents a list of the types of causes of action in that field.[171] The user selects one cause of action (e.g., negligence) and the system displays its elements. Each of these elements has corresponding

166. For example, in CORPTAX's programming, the variable recording the number of voting shares being redeemed is labeled as "TPVOTSHSRED." *See id.* at 1394. While this label would be sufficient to remind the programmer of the system what it referred to, it would be unlikely to be intelligible to someone examining the program for the first time.

167. To some extent, this limitation is mitigated by the textual explanations CORPTAX gives of some of its answers. *See id.* at 1376-81. However, many of the analytic steps undertaken by CORPTAX are not explained and could only be understood upon close inspection of the system's programming. *See id.* at 1393.

168. Popp & Schlink, *supra* note 90, at 303.

169. *See id.* at 304-09.

170. *See id.* at 304-05.

171. *Id.*

sub-elements. For example, under the topic of breach of duty, the system addresses statutory duties, special duties defined by common law, and the reasonable man standard.[172] The user can request that these sub-elements be broken down further into lesser elements.

Once a user has progressed downward along a chain of concepts, he or she can ascend or descend another analytic chain. For example, after multiple levels of information on breach of duty are explored, the user can examine other elements of negligence liability (such as probable cause) and the analytic chains associated with those elements.[173] Thus, JUDITH resembles an automated outline of liability considerations that assists an attorney-user in focusing attention on portions of the outline that are relevant to the attorney's particular controversy.

JUDITH was implemented in FORTRAN, a general purpose programming language most often used for numerical analyses.[174] The program utilizes two types of data. The first, contained in a "construction file," includes the core of JUDITH's knowledge in a logical structure representing the hierarchy of topics the system addresses.[175] The second, contained in a "premises file," includes descriptions of the topics addressed by the system along with numerical identifiers used throughout the system to denote each topic.[176] Each of these files is indexed, so that any record in them can be found easily, and the order of the records does not significantly affect system performance.[177]

The splitting of JUDITH data into these two files involves several design advantages.[178] Separating the premises file from the construction file allows a particular topic to be incorporated easily at several places in either hierarchy. In addition, due to changing case law or statutory definitions, JUDITH is able to change the description of a topic without altering its hierarchical relationships to other topics. Alternatively, additions can be made to the analytic hierarchy without any need to change existing topic descriptions.

Finally, the splitting of knowledge hierarchies from topic descriptions permits controversial topics to be the subject of two or more duplicate topic descriptions, allowing the system user to apply each to determine if differences in the descriptions will affect the outcome of his or her case. For example, if it was unclear under existing precedents in a given jurisdiction whether a knowing misrepresentation of fact (rather

172. *Id.*
173. *Id.* at 305-06.
174. *Id.* at 311.
175. *Id.* at 306-07.
176. *Id.*
177. *Id.* at 307.
178. *Id.*

than a negligent one) was necessary to establish fraud,[179] JUDITH could incorporate two parallel descriptions of the elements of fraud, one including a requirement of intentional misrepresentation and the other specifying the lesser negligence standard. A user interested in a complete analysis of a potential fraud action could utilize both these fraud descriptions to determine whether the differences between them affected the analytic outcome in the particular case under scrutiny.

JUDITH has several severe limitations as an expert system. First, it is only useful in fields which can be adequately represented in a formal hierarchy of topics. Second, utilization of JUDITH will be worthwhile only where the hierarchy of information needed to analyze a case is complex, yet familiar enough to the attorney-user so that he or she can make a proper analysis once given prompts by JUDITH. Third, the implementation of JUDITH in the FORTRAN language severely handicaps the system since this language handles text and knowledge processing relatively poorly.[180] Fourth, the representation of knowledge as links between multiple topic identifiers in JUDITH construction files may make these construction files difficult for unsophisticated users to interpret, thus limiting user confidence in the system. Finally, although JUDITH does have some capacity to explain itself, the system cannot provide explanations at intermediate stages of its operation regarding what additional information will be necessary to finish its analyses and why that further information will be significant.

B. Planning

Expert planning systems attempt to determine the best course of future action, usually within specified constraints.[181] Planning client actions within legal restrictions or to achieve certain legal benefits is a common practice activity for many attorneys. Several existing expert legal systems attempt to assist lawyers in these planning roles.

179. *See* W. PROSSER & W. KEETON, PROSSER AND KEETON ON THE LAW OF TORTS, 741-65 (5th ed. 1984).

180. As a scientific programming language designed primarily to manipulate and analyze numeric data, FORTRAN originally included almost no means for manipulating character data. While such capabilities have been implemented in some later versions, text handling remains a poorly realized afterthought in FORTRAN. *See, e.g.*, BARRON, AN INTRODUCTION TO THE STUDY OF PROGRAMMING LANGUAGES 114 (1977).

181. *See* D. WATERMAN, *supra* note 1, at 35-36; *Overview of Expert Systems, supra* note 51, at 14-15.

1. *TAXADVISOR (Michaelsen)* [182]

The most sophisticated example of a legal planning system to date is TAXADVISOR, an expert system that gives estate planning advice. The similarity of its name to Dean Schlobohm's PROLOG-based Tax Advisor is merely coincidental—the two systems are unrelated and address different tax questions.[183] Developed by Robert H. Michaelsen of the University of Nebraska, TAXADVISOR was created to test the usefulness of a skeletal expert system base or "shell" in implementing expert legal systems.[184] The shell used by Michaelsen, EMYCIN,[185] had previously produced successful expert systems in a number of fields.[186]

EMYCIN[187] contains modular programming that controls aspects of expert system operations, but does not contain production rules related to any particular subject matter.[188] To create an expert system using EMYCIN, a developer need only add "IF-THEN" rules. Consequently, the developer can concentrate on creating accurate, complete inference rules without having to worry about the task-independent aspects of the system.

The "IF-THEN" production rules in TAXADVISOR relate factual circumstances to appropriate estate planning advice. The system provides advice by examining a number of potentially advantageous estate planning actions and determining which of the factual predicates recommending these actions are present. It gathers factual information by

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182. Michaelsen, *supra* note 6, at 149.

183. Schlobohm's system addresses stock ownership attribution rules under federal income tax laws. *See* Schlobohm, *supra* note 71, at 767-71, 776-80. In contrast, Michaelsen's system concerns a range of tax planning issues under federal gift and estate tax laws. *See* Michaelsen, *supra* note 6, at 152.

184. A skeletal system or expert system "shell" is simply a stripped-down expert system—that is, a system that has had all domain-specific knowledge removed, leaving its inference engine and other support facilities. *See* P. JACKSON, INTRODUCTION TO EXPERT SYSTEMS 107 (1986); D. WATERMAN, *supra* note 1, at 83.

185. EMYCIN and related skeletal expert systems are described more fully in Barstow, Aiello, Duda, Erman, Forgy, Gorlin, Greiner, Lenat, London, McDermott, Nii, Politakis, Reboh, Rosenschein, Scott, van Melle & Weiss, *Languages and Tools for Knowledge Engineering*, in BUILDING EXPERT SYSTEMS 283, 286-301 (F. Hayes-Roth, D. Waterman & D. Lenat eds. 1983) [hereinafter *Languages and Tools*]; D. WATERMAN, *supra* note 1 at 112-18.

186. *E.g.*, Aikins, Kunz, Shortliffe & Fallat, *PUFF: An Expert System for Interpretation of Pulmonary Function Data*, in READINGS IN MEDICAL ARTIFICIAL INTELLIGENCE 444 (W. Clancey & E. Shortliffe eds. 1984) (describing an expert medical system designed using EMYCIN).

187. EMYCIN stands for "Essential MYCIN" and is a distillation of MYCIN, an expert system capable of diagnosing infections.

188. *See Languages and Tools*, *supra* note 185, at 287-91; van Melle, Shortliffe & Buchanan, *EMYCIN: A Knowledge Engineer's Tool for Constructing Rule-Based Expert Systems*, in RULE-BASED EXPERT SYSTEMS 302 (B. Buchanan & E. Shortliffe eds. 1984).

asking the system user detailed questions about the user's plans and property. Although they are all specified in the traditional "IF-THEN" format, some of the production rules in TAXADVISOR are quite complex. For example, the rule governing whether the system will recommend that a short-term trust be utilized as an estate planning device is as follows:

IF:
1) The client and/or spouse does wish to shift property income to another (not for support), etc. for at least ten years or until the death of the beneficiary,
2) The client and/or spouse does desire to eventually reclaim control of this property (for retirement, estate liquidity, etc.),
3) The client and/or spouse are in a higher income tax bracket than the beneficiary,
4) The client and/or spouse is willing to relinquish control of the beneficial enjoyment of the property,
5) The client and/or spouse are able to provide for their living needs without this income, even in the event of disability or unemployment,
6) The client and/or spouse does not plan to have the trust income used to pay life insurance premiums on his/her life without the consent of an adverse party,
7) The client and/or spouse does not plan to use the trust for a lease back of assets, *and*
8) A: The client and/or spouse have a person (e.g., a parent) they are supporting without legal obligation with this property income (will lose a dependent if trust is formed),
B: The client and/or spouse have a child, not a minor, that they will be putting through college with this property income (can set up early and accumulate income without tax problems), or
C: The client and/or spouse are using some of their after-tax income for the benefit of some other taxpayer (child's marriage and/or home purchase, etc.),

THEN: It is definite (1.0) that client should transfer assets to a short-term trust.[189]

Information concerning the predicate portions of TAXADVISOR's "IF-THEN" rules is elicited from system users through a series of questions. If a user does not understand the need for or significance of information sought, she can type "WHY" as a response to a question and receive an explanation. That explanation not only describes the "IF-THEN" production rule being applied, but also recaps the information already gathered about the predicates of that rule.

189. Michaelsen, *supra* note 6, at 156.

To validate the system, advice given by TAXADVISOR was compared with the advice of several certified public accountants ("CPAs").[190] TAXADVISOR and the CPAs were given the same client information and the advice given by each was submitted to additional CPAs for judging without identifying which advice came from which source.[191] Although the recommendations reached by TAXADVISOR and its human counterparts were not identical, the judges assessing these recommendations found them equally acceptable.[192]

TAXADVISOR serves to illustrate some of the advantages of using an expert system shell as a programming tool. Its developer devoted his primary attention to defining and revising detailed "IF-THEN" rules in eight major estate planning areas, and consequently the result is a system that has substantive breadth comparable to that of practicing CPAs. Once these rules were formulated, other key operating features of the system were controlled by the EMYCIN shell. Thus, no further programming was necessary to implement TAXADVISOR's capacity to ask questions of users in ordinary English (including explanations of terms where necessary), to explain why it is seeking a given piece of information, or to recommend estate planning actions.

The use of the EMYCIN shell also led to some problems, however. Early in the development of TAXADVISOR, users had difficulties completing analyses within a reasonable time. Investigations revealed that TAXADVISOR was undertaking too many analyses of tax planning options that were irrelevant to the particular client whose plan was being developed.[193] In part, this stemmed from blind reliance on the EMYCIN shell and its comprehensive scrutiny of system rules. Later versions of TAXADVISOR where designed with "IF-THEN" rules that helped speed system operations by determining at an early stage that a given tax planning option (e.g., *inter vivos* gifts) was not of interest and should therefore be dropped from consideration. Even so, complete TAXADVISOR consultations generally took longer than 30 minutes.

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190. The CPAs involved in this study each had at least two years full-time experience in estate planning. *See id.* at 164.

191. *Id.*

192. The CPAs serving as judges of the tax planning recommendations made the following assessments:

Source of Recommendations	Recommendations Rated Equivalent To Judge's Own	Recommendations Rated Acceptable	Recommendation Rated Unacceptable
Taxadvisor	6 (55%)	5 (45%)	0 (0%)
Human Analysts	10 (55%)	5 (33%)	0 (0%)

See id. at 165.

193. *Id.* at 163-64.

Another possible disadvantage of TAXADVISOR is that its consultation sessions do not produce final tax planning advice, but instead result in lists of planning devices that may be useful to a client. The specific combination of devices that will maximize the wealth the client transfers at death and the financial feasibility of that combination must be determined through calculations performed outside the system.

2. *CHOOSE* [194]

CHOOSE, another computer program developed by Professor Hellawell, is designed to assist attorneys in answering a narrow legal tax planning question: whether federal tax considerations favor a branch office or a foreign subsidiary as a means for conducting a foreign mining operation.[195] The program was designed for use by lawyers knowledgeable in this area of the law and thus its capability for giving textual explanations of applicable law is very limited. Its aim was instead to save tax specialists' time and to insure accuracy in making a set of highly complex computations.

As a basis for its computations, CHOOSE elicits a variety of information from the user, ranging from data on the income and deductions of the firm involved to corporate tax rates in both the United States and the foreign jurisdiction where the mining will occur. Based on this information, CHOOSE evaluates the merits of branch and subsidiary operations by computing the relative tax advantages of depletion deductions (available to branches of United States concerns) over tax deferrals (available through the use of a subsidiary).[196] The following example drawn from a typical CHOOSE consultation session illustrates the types of factual information the system collects, retains, and manipulates in completing its analyses. For purposes of clarity, user responses are italicized; all other text is generated by CHOOSE.[197]

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194. Hellawell, *supra* note 9.

195. The choice between a having a branch office and a foreign subsidiary for foreign mining operations involves a trade-off between the percentage depletion deductions available through branch operations and the total exclusion from United States taxation of foreign source earnings by a foreign subsidiary. If a branch office is used, the domestic firm that creates it will include the branch's net income in the firm's taxable income, but will be able to utilize depletion deductions arising out of the branch's activities to offset that income. *See* I.R.C. § 61(a) (1954 and West Supp. 1985); Treas. Reg. § 1.11-1(a) (1960). If a subsidiary is used, the foreign subsidiary will pay income tax in its home country, but only earnings paid to its domestic parent will be subject to United States taxation. However, the benefit of potential depletion deductions will be lost. Hellawell, *supra* note 192, at 340-42.

196. *See id.* at 342-45.

197. *Id.* at 347-48.

THIS PROGRAM WILL HELP YOU DECIDE THE FORM TO USE FOR A FOREIGN DIRECT INVESTMENT. WHEN YOU PROVIDE IT WITH DATA ABOUT THE INVESTMENT, IT WILL COMPARE THE TAX CONSEQUENCES OF A BRANCH TO THOSE OF A FOREIGN SUBSIDIARY. THE PROGRAM IS PARTICULARLY ADAPTED TO MINING INVESTMENTS.

WOULD YOU LIKE TO SEE THE GENERAL DIRECTIONS? ANSWER YES OR NO. THEN PRESS CARRIAGE RETURN.

? *N*

THE CALCULATIONS MAY COVER UP TO TWENTY YEARS. FIRST, STATE THE STARTING YEAR (E.G. 1 OR 1980; DO NOT NUMBER A YEAR ZERO). THEN STATE THE ENDING YEAR.

STARTING YEAR—? *1982*

ENDING YEAR—? *1986*

FIRST I WILL ASK FOR INFORMATION RELATING TO FOREIGN TAXES.

STATE THE ENTERPRISE GROSS INCOME, COMPUTED UNDER THE FOREIGN TAX RULES, FOR THE FOLLOWING YEARS— 1982?

1200000

IF ANSWER FOR ANY YEAR AND FOR ALL REMAINING YEARS IS THE SAME AS FOR THE PRECEDING YEAR TYPE 1.

IF ANSWER FOR ANY YEAR IS THE SAME AS FOR THE PRECEDING YEAR TYPE 2.

1983 ? *1700000*

1984 ? *2200000*

1985 ? *1*

FOR A SUBSIDIARY: STATE THE FOREIGN CORPORATE INCOME TAX RATE AS A DECIMAL (E.G. .45 OR .36) FOR THE FOLLOWING YEARS —

1982 ? *.32*

Like CORPTAX, CHOOSE is somewhat inflexible and hard to understand because its expertise is embodied in computer programming statements instead of in a separate knowledge base. Furthermore, even within the narrow area of expertise it was designed to address, CHOOSE does not cover all factual circumstances that may arise.[198] However, the excluded circumstances are rare and the user is warned in advance that the system will not address them.[199]

198. For example, CHOOSE assumes that: (1) dividends will never exceed the earnings of the current year; and (2) no income from the proposed mining project will be a capital gain. *See id.* at 365.

199. *See id.* at 347-48 n.19, 356.

While it may not have all the flexibility or explanatory characteristics of more sophisticated expert systems, CHOOSE does share one important feature of most successful systems—it relies upon and utilizes the computer's special analytic strengths. The tax problem addressed by CHOOSE requires extensive numerical analyses. In planning situations, these numerical analyses must be repeated many times in order to assess the tax implications of different circumstances. In addition, relatively large amounts of numerical data must be retained and made immediately available when needed in the analyses. Computers are highly efficient at performing these computational and data handling tasks.[200] Consequently, expert systems like CHOOSE can exceed in both speed and accuracy the capabilities of human analysts acting alone.

It is also important to emphasize the extent to which CHOOSE was designed to interact with users.[201] For example, it permits a user to select the level of detail it uses in reporting the results of its calculations. More significantly, it permits portions of the data about a mining situation to be changed easily for repeat analyses, thus facilitating the use of the program in planning situations where the impact of modifying an action often needs to be assessed.

3. *A Bankruptcy Planner* [202]

An expert system developed by Professor William Boyd of the University of Arizona (and as yet unnamed) assists attorneys in answering two bankruptcy planning questions: (1) whether a client should file bankruptcy; and (2) if so, whether the client should seek a "liquidation" bankruptcy under Chapter 7 of the federal Bankruptcy Act[203] or a "rehabilitation" bankruptcy under Chapter 13.[204] Boyd devised the expert system by first examining how he would respond to a complex bankruptcy planning problem. He then captured the legal and practical inference rules he considered and grouped them in sets to be systematically applied by the computer system.[205]

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200. The business question that CHOOSE addresses involves rather complex numerical analyses of the interplay between two types of tax calculations. If different structuring approaches are to be analyzed, these two sets of calculations must be repeated again and again. CHOOSE was designed to undertake the burden of these calculations not only to insure their accuracy, but to allow lawyers to test the effects of a wider variety of facts in assessing alternate forms for foreign mining operations. *See id.* at 342.

201. *See id.* at 345-46.

202. Boyd, *supra* note 5, at 699.

203. Bankruptcy Reform Act of 1978, 11 U.S.C. §§ 701-766 (1982).

204. *Id.* at §§ 1301-1330.

205. Boyd, *supra* note 5, at 702.

Boyd's system begins a consultation session with an attorney-user by gathering information about the attorney's client and the client's spouse, such as their personal debts, continuing expenses, and income. Utilizing this information, it informs the user whether bankruptcy is advisable, and, if so, which type would be preferable. In determining whether to recommend bankruptcy at all, Boyd's system takes into account the client's overall financial circumstances, with particular emphasis on whether creditors are taking or threatening action which will cause the client to lose essential property and also whether the client is in a position to resolve the problem without resorting to the bankruptcy alternative. Since much of the information the system gathers at this stage is the same information it will need for determining which type of bankruptcy proceeding will be best for the client (if one is initiated), the system retains all necessary information in order to immediately provide further advice on the choice between Chapter 7 and Chapter 13 bankruptcies.[206]

In general, a Chapter 13 bankruptcy is more desirable than its Chapter 7 counterpart, since the debtor can usually retain more of his or her assets.[207] Thus, Boyd's expert system is directed primarily towards determining whether a client is eligible for a Chapter 13 proceeding and, if so, whether a Chapter 13 rehabilitation plan is feasible. The system is capable of examining a variety of eligibility criteria, depending on the nature of the client. Its feasibility assessments turn on a careful assessment of the client's monthly net income and expenses, as well as the possible advantages of liquidating certain assets where a plan would otherwise not be feasible. In addition, the system provides summary reports of important computational information it has gathered, such as descriptions of the debtor's assets that are subject to security interests and the surplus income the debtor is likely to have in excess of his continuing expenses.

A portion of a typical session conducted by Boyd's system will illustrate the type of questions asked by the system and the sorts of information gathered. The following session segment concerns one of several debts of a hypothetical couple named "JOHN" and "JANE," with user responses italicized:

206. *Id.* at 705.

207. For example, assets subject to valid security interests, which would be lost in a Chapter 7 liquidation, can be kept in a Chapter 13 proceeding. *See id.*

We need complete information as to each personal debt. Do not include here 'expenses' (i.e., obligations as to which there are no outstanding balances). Expenses are considered below. Do not include alimony and support payments. Do include arrearages as to such payments.

Is the debt the result of a sale(s), loan(l), or other(o)?

(Enter an 's,' an 'l,' or an 'o.')? *s*

Enter the creditor's name.

? *SAM KRAVITZ, INC.*

We need the creditor's complete address. Enter the creditor's street address.

? *200 S. PALO VERDE*

Enter the creditor's city and state.

? *TUCSON, AZ*

Enter the creditor's zip code.

? *85722*

What is the balance owing? Enter without a '$' or commas.

? *2200*

Is the debt payable in installments?

(answer y or n)? *y*

Enter the monthly payment without a '$' or commas.

? *105*

Are the payments current?

(answer y or n) ? *y*

Is the amount in dispute?

(answer y or n) ? *n*

Is the debt cosigned?

(answer y or n) ? *n*

Is the debt secured?

(answer y or n) ? *y*

How many items of collateral are there?

? *2*

Describe the collateral.

? *Furniture*

Enter the fmv of the collateral without a '$' or commas.

? *1500*

Is the security interest purchase money?

(answer y or n)? *y*

Is the security interest avoidable? See BRA 522(f), 545, and 547.

(answer y or n)? *n* [208]

Written in BASIC, Boyd's system resembles Professor Hellawell's CORPTAX and CHOOSE systems in that it uses algorithms embedded in the system's programming to control both the gathering of necessary facts and the analysis of those facts.[209] As with CORPTAX and CHOOSE, this embedding of analytic and information-gathering algorithms directly in computer programming statements tends to conceal the system's logic from users, thereby lowering its perceived trustworthiness and frequency of use. Apparently recognizing some of these limitations, Boyd has proposed a revised system that will contain explicit inference rules and will be written in a dialect of LISP,[210] a computer programming language well suited to expert system construction.[211]

C. Prediction

Prediction systems infer the likely consequences arising out of particular factual circumstances. Often predictions are based on models of real-world activity built into a system's knowledge base.[212] The system can then simulate real processes to generate scenarios that stem from particular circumstances specified by the system user.[213] Although no expert legal system is as yet capable of prediction in this sense, the basis for such a system exists in the Legal Decisionmaking System ("LDS").[214]

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208. *Id.* at 723-24.

209. *See id.* at 761 n.68.

210. *See id.* at 761 n.61.

211. *See supra* notes 23-24.

212. *See* D. WATERMAN, *supra* note 1, at 35; *Basic Concepts, supra* note 29, at 84.

213. For example, the LDS system incorporates a model of the process through which personal injury attorneys and insurance claims adjusters value personal injury claims. This model describes the settlement value of a particular claim in terms of the following formula:

VALUE = LOSS * LIABILITY * RESPONSIBILITY
* CHARACTERISTICS * CONTEXT

where:

LOSS = Dollar amount of plaintiff's loss;

LIABILITY = Probability of establishing liability;

RESPONSIBILITY = Percentage responsibility of defendant in comparative negligence jurisdictions;

CHARACTERISTICS = Adjustment for superficial aspects of the claim, such as characteristics of litigants, lawyers, and judges;

CONTEXT = Adjustments for matters of strategy, timing, or type of claim (e.g., auto accident or product defect).

Using this model and a variety of mechanisms for assigning figures to these variables, LDS analyzes a claim and predicts its settlement value. *See Evaluating Product Liability Cases, supra* note 13, at 627-28.

214. *See Evaluating Civil Claims, supra* note 13, at 65-76; *Evaluating Product Liability Cases, supra* note 13, at 627; *Legal Decision Systems, supra* note 13, at 217-18.

LDS is an expert legal system that emulates settlement analyses undertaken by litigators and insurance company claim adjusters in products liability cases. Created by D.A. Waterman and Mark A. Peterson of the Rand Corporation, LDS was developed to explore the feasibility and usefulness of computer prediction models in making legal decisions. In considering whether a meaningful computer model of settlement decisions could be formulated, Waterman and Peterson addressed such novel issues as how the system should interpret imprecise legal standards, what techniques would probably include uncertainty in analyses, and how a system based on a prediction model should explain its analyses.[215]

LDS is a rule-based system, meaning that it is implemented solely in terms of "IF-THEN" rules connecting premises to expert conclusions. It is written in ROSIE, a knowledge representation language designed to facilitate the development of large expert systems using English-like syntax.[216] The "IF-THEN" rules underlying LDS form chains that represent the inference processes involved in settlement analyses. The conclusion of one rule may be an intermediate result which is one of the premises of another rule.[217] Similarly, the conclusion of that second rule may correspond to the premise of yet a third.[218] Using ROSIE, the authors of LDS have estimated that several thousand rules would be necessary to implement a system to *fully* analyze product liability settlements, even where the settlements are restricted to a narrow factual setting such as traffic accidents.[219]

The facts of each problem presented to LDS determine which "IF-THEN" rules will be invoked and, consequently, the inference path that LDS will follow, with each of the "IF-THEN" rules in LDS containing a complicated set of premises. For example, the "IF-THEN" rule in LDS testing for the presence of strict liability includes the following:

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215. *See Models of Legal Decisionmaking, supra* note 13, at 13-27.

216. ROSIE is an example of a specialized language designed primarily to facilitate the recording of information in knowledge bases. Because ROSIE incorporates fragments of English in its syntax, it makes it easier for factual assertions to be created, manipulated, and accessed. For a description of ROSIE and other related knowledge representation languages used in expert system development, see Barstow, *supra* note 183, at 301-26; D. WATERMAN, *supra* note 1, at 118-23. For an illustration of the ways ROSIE can be used to construct an expert legal system, see *Legal Decision Systems, supra* note 13, at 216-17.

217. *Evaluating Product Liability Cases, supra* note 13, at 630-32.

218. *Id.*

219. *Models of Legal Decisionmaking, supra* note 13, at 38.

IF (the plaintiff is injured by the product)
or (the plaintiff does represent the decedent and the decedent is killed by the product)
or (the plaintiff's property is damaged by the product)
and the incidental-sale defense is not applicable
and (the product is manufactured by the defendant
or the product is sold by the defendant
or the product is leased by the defendant)
and the defendant is responsible for the use of the product
and (California is the jurisdiction of the case
or the user of the product is the victim
or the purchaser of the product is the victim)
and the product is defective at the time of the sale
and (the product is unchanged from the manufacture to the sale
or (the defendant's expectation is 'the product is unchanged from the manufacture to the sale'
and the defendant's expectation is reasonable and proper))
THEN assert the theory of strict-liability does apply to the plaintiff's loss.[220]

Waterman and Peterson utilized LDS primarily as a research tool in studying how settlement decisions were made, finding the format of rule-based computer models particularly advantageous for this purpose.[221] To develop a rule-based model for their system, Waterman and Peterson were required to catalog actual bases for settlement decisions, organize the full range of factors that might influence litigators' decisions in a coherent manner, and record a baseline of decision standards and strategies for use in studying the impact of changes in the law or negotiating techniques on settlement decisions. Each of these byproducts of the development of LDS led to significant research about how settlement decisions are made.

Although it was primarily designed as a research tool for the authors and not an expert system for attorneys,[222] LDS closely resembles

220. *Id.* at 38.
221. *See id.* at 35-36.
222. In part because of the lack of understanding of the criteria attorneys consider in settling cases, LDS was created as a means to systematically identify those criteria as a precursor to the creation of expert systems that would apply the identified criteria to assist litigators in predicting settlement values. *See Evaluating Product Liability Cases, supra*

an expert system capable of predicting successful settlement offers. The rule structure of LDS, if fully refined, would be able to simulate expert interpretations of the strength and value of product liability claims, and hence could hypothesize about the size of an offer which would be necessary to settle a given case. Such predictions would be useful to settlement negotiators in structuring the starting point and sequence of their offers.[223] Furthermore, LDS is capable of extensive explanations of its actions, including the ability to describe which of its "IF-THEN" rules led to a given deduction and why those rules were applicable.

Even with these sophisticated features, LDS has limitations as an expert system. Although the developers recognized that a litigator's analysis of whether to settle a particular case would turn on broad considerations, LDS only attempts to include legal rules governing strict products liability and rules concerning the calculation of damages.[224] Other factors which would be considered in an attorney's settlement analysis, but which are not incorporated in LDS, include rules concerning the interpretation of indefinite legal standards (e.g., general principles for determining whether or not an act was reasonable or undertaken with due care)[225] and rules that reflect attorneys' expectations about likely jury or judicial responses to the facts or parties involved in a particular case (e.g., predictions of jury reactions to sensational injuries or sympathetic qualities in the parties).[226] Thus, the range of analysis of LDS is significantly limited.

D. Design

A number of expert systems carry out design processes in which specifications are developed for an object or item that must satisfy certain functional requirements.[227] Existing expert legal systems assist attorneys in design tasks ranging from the drafting of complex legal documents to the specification of criminal sentences.

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note 13, at 627-28.

223. *See Models of Legal Decisionmaking, supra* note 13, at 24.

224. *Id.* at 14-16.

225. *See id.* at 4, 15. Waterman and Peterson have implemented explanatory features in a more recent expert system concerning asbestos exposure claims that would help attorney-users interpret unclear legal standards. *See Legal Decision Systems, supra* note 13, at 218-23.

226. *Models of Legal Decisionmaking, supra* note 13, at 4, 15. For a discussion of recent developments regarding the incorporation of such litigation characteristics into LDS, see *Legal Decision Systems, supra* note 13, at 217-18.

227. *See* D. WATERMAN, *supra* note 1, at 35; *Basic Concepts, supra* note 29, at 66-72.

1. *ABF Processor*[228]

The ABF Processor is an expert legal system with a narrow, but important, design function. Developed by James A. Sprowl of the American Bar Foundation, the ABF Processor creates what might be termed "smart documents"—that is, special versions of form documents like wills, trust agreements, and probate filings which are assembled through computer analyses of factual information about particular clients.[229]

The ABF Processor operates in two phases. First, a form document is typed into the system, with special variables or "space holders" placed in locations where variable information, such as a client name or alternative clauses, may be added. At this stage, the developer of one of the system's smart documents can specify the conditions under which particular text will be included in the document.

For example, if certain clauses are to be included in a will only if the decedent's estate may be probated without a court appearance, the creator of an ABF Processor document would type in the appropriate optional text preceded by the following command:

> [IF the death taxes ARE to be paid out of the res of the estate INSERT].[230]

Another portion of the ABF Processor transforms this "IF" statement into the following question which will be presented to the system user each time the automated will is prepared: "[a]re the death taxes to be paid out of the res of the estate?" If the document developer wished to specify criteria for determining when death taxes will be paid out of the res of the estate, he could do so simply by inputting the criteria in "IF-THEN" form, and this new information would in turn be transformed into a corresponding set of questions to to be asked of users of the system.[231]

In the second phase of its operation, the ABF Processor assembles a document using forms created in the first phase. Often, the user of the system may not be the party who created the automated document, but rather another attorney or office assistant who merely answers the factual questions posed by the system.[232] Based on information about a particular client, the system assembles a version of the form document

228. Sprowl & Staudt, *supra* note 12, at 699, 701; Sprowl, *supra* note 12, at 1. A partial implementation of the ABF Processor for use in familiarizing law students with the capabilities of such systems is described in P. MAGGS & J. SPROWL, COMPUTER APPLICATIONS IN THE LAW 68-103 (1987).

229. For a brief description of the origins and history of the ABF Processor, see *id.* at 10-17.

230. *Id.* at 23-24.

231. *Id.* at 24.

232. *Id.*

tailored to that client's needs. In this way, the system applies the expertise of the document's originator regarding the suitability of special document terms to frequently encountered circumstances. A document generated in this way will still need to be scrutinized by an attorney to accommodate unusual client problems or to address subject matter outside of the system's expertise.

Although it is limited to document preparation and does not provide expert interpretations in a traditional sense, the ABF Processor does seem to perform document preparation tasks very thoroughly. It has been tested by law students and attorneys in a variety of legal contexts. In one test, a group of law students was able to create a system in twelve hours that automated the completion of income tax form 1040A.[233] Larger development efforts have produced much more elaborate preparation systems for divorce, will, and trust documents.[234]

The ABF Processor does have several important limitations, however. First, completion of the initial stage of document preparation —in which alternative clauses and the conditions for their inclusion are specified—requires the document developer to understand a complex, specialized command language used only by the ABF Processor.[235] Second, when it assembles documents, the ABF Processor asks questions in a manner determined by the order in which optional clauses arise in the document being prepared.[236] This order may often not be the most logical or efficient sequence for gathering information.[237]

2. *A-9*

A-9 is another program that assists attorneys in preparing specialized legal documents. This system produces security agreements complying with Article 9 of the Uniform Commercial Code.[238] A-9 is capable of creating security agreements dealing with many different types of collateral, including any combination of consumer goods, equipment, and fixtures. It also accommodates transactions in which shares of stock are used as additional collateral.[239] Professors William E. Boyd of the

233. Sprowl, *supra* note 12, at 60-61.

234. For descriptions of field tests of the ABF Processor in a variety of practice settings, see Sprowl & Staudt, *supra* note 12, at 723-27.

235. *See generally* Sprowl, *supra* note 12, at 17-50.

236. *See* Sprowl, *supra* note 12, at 23-25.

237. *See* Boyd & Saxon, *supra* note 120, at 644, 645 (document preparation system in which all factually related questions are asked in one session or interval and responses are used to determine proper terms in several documents).

238. *See* U.C.C. § 9-203 (1978). A-9 can also complete financing statements corresponding to each security agreement that it generates. *See* U.C.C. §§ 9-401, 9-402 (1978).

239. Boyd & Saxon, *supra* note 120, at 652.

University of Arizona and Charles S. Saxon of Eastern Michigan University created A-9 to assess the feasibility of implementing a useful legal document drafting system on a relatively inexpensive microcomputer.[240] They hoped such a system would be affordable by a wide range of attorneys, including sole practitioners.

A-9 operates much like the ABF Processor. "Smart" security agreements are created by A-9 through the use of a special document preparation language developed by Legal Management Systems, Inc. ("LMS"), a private vendor of law office computer systems.[241] Where the text in these documents will vary depending on the needs of a client, special symbols are entered to indicate where substitutions or changes should occur.[242] The material to be added when the document is ultimately assembled can be entered by the user of the A-9 program either as a response to a question or can be derived from other responses.[243] In addition, optional clauses expanding the basic security document can be included or excluded depending on the answers given to questions posed to a system user.[244]

A-9 offers some advantages over the ABF Processor. Unlike the ABF Processor—which only generates a completed document at the termination of its processing—A-9 allows a user to see the security agreement as it is being assembled. In addition, the LMS software which forms the basis for A-9 operates on smaller, less expensive computer systems than the original ABF Processor.[245] Finally, A-9 requires more active user involvement in the assembly of documents than the ABF Processor or other systems which only allow the user to fill in blanks or choose stock terms. The authors of A-9 claim this involvement is necessary to properly balance drafting art and text automation in the preparation of sophisticated security agreements.

Yet, A-9 also has two significant drawbacks. As with the ABF Processor, persons preparing new versions of security agreements incorporated within A-9 will need to understand the special programming language used in that system. Furthermore, at least in its initial version,

240. The system on which A-9 was implemented was available in 1981 for under $20,000. *See* Boyd & Saxon, *supra* note 120, at 640 n.9. A comparable system would be considerably less expensive today.

241. *See id.* at 645.

242. *Id.* at 646-47.

243. *Id.*

244. *Id.*

245. Later versions of the ABF Processor have also been implemented on relatively small computers. *See* Sprowl & Staudt, *supra* note 12, at 730 n.66. A partial implementation of the ABF Processor has recently been distributed for use with IBM-PC microcomputers. *See* P. MAGGS & J. SPROWL, COMPUTER APPLICATIONS IN THE LAW 68-103 (1987).

A-9 is aimed at a much more specialized type of document drafting, i.e., security agreements, than the general purpose ABF Processor system. The degree of additional programming necessary to transform A-9 into a general purpose document processor is unclear, but it may make a microcomputer implementation of the generalized system unwieldy.

3. *SENPRO*[246]

SENPRO is another expert system that assists in a specialized legal design task—the formulation of criminal sentences. It was designed as a prototype for a computer system capable of assisting experts with decision making in a variety of legal, social, and economic areas, with criminal sentencing merely an initial test application. Created by Richard V. de Mulder and Helen M. Gubby of Erasmus University in Rotterdam, Germany, SENPRO incorporates a model of ideal sentencing considerations developed at Erasmus University. This model consists of numerous rules concerning the goals underlying criminal sanctions and the means necessary to achieve those goals. Consideration is also given to the need to look outside the criminal justice system in order to resolve certain types of cases. Overall, the model defines a rationalized sentencing pattern, referred to by the system developers as a "tariff."[247]

Information about the sentencing decision in a particular case is solicited from system users through a series of multiple choice questions. The following portion of a SENPRO consultation session reflects typical questions asked of system users (user responses are italicized):

> We will now start the actual gathering of information in order to fix a tariff of the (category of) case(s) you have in mind.
>
> PRESS RETURN TO CONTINUE?
>
> CASE: Paul de Vries
>
> Case: drunken driving
>
> Informant: Richard de Mulder
>
> LEVEL OF INDIVIDUALIZATION
>
> The fact that sentencing decisions are made within an organization whose capacity is limited has certain consequences. Certain groups of decisions have to be made on a strongly categorized basis. The more that a punishment is individualized the heavier that the burden is of collecting and processing information. Therefore, one of the principal sentencing decisions that has to be made is what level of individualization is applicable to the sentencing process.

246. DeMulder & Gubby, *supra* note 14, at 243.
247. *See id.* at 254.

> A number of questions follow, the aim of which is to fix the level of individualization in the case presently under consideration.
>
> FIRST CRITERION FOR THE LEVEL OF INDIVIDUALIZATION
>
> The first criterion to be dealt with concerns the processing possibilities of the system.
>
> Will you now indicate whether or not the case with which you are concerned is the type of case which occurs frequently (e.g., minor traffic offenses)?
>
> 1. The case occurs frequently.
> 2. The case occurs infrequently.
> 3. The case occurs neither frequently nor infrequently.
>
> THE MOST SUITABLE ALTERNATIVE IS: ? 3
>
> . . .
>
> SECOND CRITERION FOR THE LEVEL OF INDIVIDUALIZATION
>
> The second criterion concerns the question of to what extent an intrusion of privacy would be justified in order to obtain the information necessary for a highly individualized decision.
>
> How far is such an intrusion justified?
>
> 1. In this case it is certainly justified.
> 2. In this case it is only justified to a certain extent.
> 3. In this case it is only justifiable at a low level.
> 4. In this case it is not justified.
>
> THE MOST SUITABLE ALTERNATIVE IS: ? 3
>
> . . .
>
> The extent to which an offense is regarded as "serious" should determine an upper limit to the intrusion of privacy and any other consequences of an inquiry into the case.
>
> In this case a fairly low level of individualization is indicated.
>
> The final sentencing decision will be of a generalized character; the following processing of information and the decision making will concern the "type" of case that is now submitted for a decision.[248]

Once basic information is obtained in this manner, sentencing goals and means to attain them are identified and the system suggests a tentative sentencing conclusion. The system then enters a second round of assessment in which the user gathers further information in order to refine the factual picture already obtained. If further factual information

248. *Id.* at 264-66.

is available, the system will repeat, correct, or supplement its earlier analyses as necessary.[249]

As the SENPRO analysis progresses, the user also has an opportunity to make several collateral decisions regarding sentencing options. For example, following the second assessment round, the user is presented with the system's sentencing recommendations in several categories, including fines, imprisonment, mental institutionalization, and forfeiture.[250] The user must then select which type of sanction is appropriate. Similarly, at a later stage in the system's operation, a cost-benefit analysis is initiated to determine if the means selected are suitable for realizing the aims of punishment in the case under scrutiny.[251] The system also assesses whether the means chosen for achieving one of the selected sentencing goals conflict with the means chosen to achieve another goal. At the conclusion of its analysis, SENPRO describes its conclusions and their bases. This description includes both a summary of the factual information considered by the system and the sentencing goals applied.

SENPRO is written in two parts: a program component which insures that sentencing considerations are addressed in the proper order, and a decision file which includes a list of information about sentencing considerations and their implications. With this split function, the decision file can be altered or updated without need for changes in the processing provisions of the program component.[252]

As with CORPTAX, CHOOSE and William Boyd's bankruptcy planning system, SENPRO is somewhat inflexible because it is written in the general purpose BASIC programming language.[253] Its expertise is necessarily masked by the complexity of BASIC to non-computer specialists.[254] Furthermore, although the separation of decision information from the other aspects of the program may facilitate easy change in decision information within the system, the unusual knowledge representation scheme used in SENPRO—stated in a peculiar combination of BASIC programming and a special representation format developed just for SENPRO—makes the system's knowledge base uninterpretable by most lay users and, hence, unmodifiable by them.

249. For a description of the sentencing model, see *id.* at 254-57.
250. *See id.* at 259.
251. *See id.* at 259-60.
252. *See id.* at 246-47.
253. *See id.* at 245, 298.
254. *See id.* at 247-54.

E. Control Systems: The Legal Research System[255]

Expert systems that carry out a control function adaptively govern the completion of a complex task.[256] For example, a computer system designed to monitor the progress of product assembly in an automated manufacturing plant and to adjust assembly activities accordingly would be a "control" system. In the legal field, a system which monitored a series of court filings in a particular case and organizing them in terms of an overall litigation plan would be an example of an expert legal system used for control purposes.[257]

The Legal Research System ("LRS") is an existing expert legal system that undertakes an important control activity—namely, the organization and maintenance of information on cases and statutes in a way that facilitates retrieval of such information by attorneys and other legal researchers.[258] Developed by Carole D. Hafner as a doctoral research project at the University of Michigan, LRS was created to study the types of information a useful legal research system would need to include and the ways that information could be structured to best facilitate information retrieval.[259] Expertise organized through LRS includes information on statutes and cases concerning negotiable instruments. Specifically, the system captures data on all of the statutes contained in articles 3 and 4 of the Uniform Commercial Code ("U.C.C."),[260] and on all of the cases cited in the section on negotiable instruments in White and Summers' influential hornbook on the U.C.C.[261] Overall, the LRS database contains knowledge about approximately 200 statutory provisions and 200 related cases.[262]

LRS specifies information on particular statutory provisions and cases in terms of the following eight criteria ("D" in each instance refers to a descriptive phrase):

> (PLAINTIFF D)—The plaintiff of a case was a "D." D must describe a party—for example, the payee of a check. (DEFENDANT D)—The defendant of a case was a "D."
>
> (CAUSE-OF-ACTION D)—The legal basis of a case was "D"—for example, negligence.

255. Hafner, *Representation of Knowledge in a Legal Information Retrieval System*, in INFORMATION RETRIEVAL RESEARCH 139 (R. Oddy, S. Robertson, C. van Rijsbergen & P. Williams eds. 1981).

256. *See* D. WATERMAN, *supra* note 1, at 38.

257. *See id.* at 226.

258. *See* Hafner, *supra* note 255, at 139.

259. *Id.*

260. U.C.C. art. 3 & art. 4 (1978).

261. J. WHITE & R. SUMMERS, UNIFORM COMMERCIAL CODE 486-549 (1972).

262. Hafner, *supra* note 255, at 139.

(EXAMPLE D)—The fact situation of a case was an example of "D"—for example, a forged promissory note.

(HYPOTHETICAL EXAMPLE D)—A case or statute describes a hypothetical situation that is an example of "D."

(CRITERIA D)—A case or statute defines criteria for a situation to be an example of "D."

(LEGAL-EFFECT D)—A case or statute describes the legal consequences of "D."

(RULE D)—A case ruled that the situation before the court was an example of "D."[263]

These criteria were chosen to reflect typical objects of research interest on the part of attorneys and other legal researchers. In terms of the above criteria, a typical case would have the following description in LRS:

(PLAINTIFF (DRAWER CHECK))

(DEFENDANT (IS A (DRAWER CHECK) BANK))

(CAUSE-OF-ACTION C-IMPROPER-DEDUCTION)

(EXAMPLE IMPROPER DEDUCTION)

(EXAMPLE (DRAWER'S SIGNATURE FORGED))

(EXAMPLE (NOT EXAMINED-PROMPTLY))

(LEGAL-EFFECT (DRAWER'S SIGNATURE FORGED))

(LEGAL-EFFECT IMPROPER DEDUCTION)

(LEGAL-EFFECT (DRAWER (NEGLIGENT (CONTRIBUTING TO UNAUTHORIZED)))

(LEGAL-EFFECT (NOT REASONABLE-CARE-TAKEN))

(RULE C-IMPROPER-DEDUCTION)

(RULE ((NOT REASONABLE-CARE-TAKEN) (IS A (DRAWEE CHECK) BANK)))

(RULE (DRAWER ((NOT NEGLIGENT) (CONTRIBUTING TO (DRAWER'S SIGNATURE FORGED)))))[264]

In English, this description corresponds to a suit by the drawer of a check against the drawee bank for improperly paying a check on which the drawer's signature was forged. Were the plaintiff to prevail, the bank would be required to re-credit the drawer's account for the amount of the check. The bank presented two arguments in its defense: first, that the plaintiff had been negligent in a way that contributed to the forgery and, second, that the plaintiff had failed to examine his monthly

263. *Id.* at 141.

264. Hafner, *supra* note 255, at 142. The case described is Jackson v. First National Bank of Memphis, 403 S.W.2d 109 (1966).

statement promptly and had consequently delayed in notifying the bank of the forgery beyond the time in which the bank could recover the funds paid. The court held that the plaintiff could recover the improper deduction, that the bank did not exercise reasonable care in handling the check and that the plaintiff was not negligent.

In order to retrieve information from LRS, a user would query the system with questions phrased in terms of the system's special terminology. For example, a query aimed at identifying cases involving a dishonored draft where the plaintiff was not a holder of the draft could be phrased as follows:

> FIND CASES (EXAMPLE DISHONORED) AND NOT (PLAINTIFF HOLDER)[265]

In response to requests such as this, LRS has some ability to deduce that a request for information about subject D implies a request for information about related subject D'. In addition to information about statutes and cases which are contained in the manner described above, LRS contains semantic knowledge about the relationships between many of the legal concepts referred to in the system.[266] More than 200 concepts were defined in terms of the following six basic concepts: PARTY, LEGAL-INSTRUMENT, LIABILITY, LEGAL-ACTION, ACCOUNT and AMOUNT-OF-MONEY.[267]

Clearly a research vehicle, LRS is nonetheless important as the first model of its kind for automating legal research. It demonstrates both a viable knowledge representation scheme for capturing and structuring data on legal source materials in a narrow legal field, and a rudimentary retrieval system capable of responding to carefully tailored inquiries about that data.

There are, however, obvious limitations to the employment of LRS as a useful retrieval system. First of all, it is not clear that the set of fundamental concept labels (e.g., "ISA (DRAWEE CHECK)") chosen by the creator of LRS's database are both unambiguous and comprehensively descriptive. Second, only a person well versed in the special definitions given these terms within LRS will be able to expand the system's database or formulate meaningful queries for information from the system. Finally, although it is capable of identifying cases or statutory sections relevant to particular negotiable instrument issues, LRS has no link to a computerized legal research system like WESTLAW or LEXIS[268] that

265. *See id.* at 146-47.

266. *Id.* at 144-46.

267. *Id.* at 145.

268. For a survey of four CALRs currently in existence, see Soma & Stern, *A Survey of Computerized Information for Lawyers: LEXIS, JURIS, WESTLAW, and FLITE*, 9 RUTGERS COMPUTER & TECH. L. J. 295 (1983).

would permit automated retrieval of the actual text of those cases and statutory sections.[269]

CONCLUSION

Expert systems represent a fundamentally new way of transferring know-how from experienced experts to others. Such knowledge transfers have long been at the heart of legal practice. Consequently, as computer technology improves and its costs decline, new applications of expert legal systems are ripe for development.

Increased reliance upon artificial intelligence contained in programs like expert legal systems will not be without significant social implications.[270] Some of the potential negative implications of increased reliance on such systems include the possibility of increased unemployment if human workers are displaced by corresponding expert systems,[271] the risk that users will tend to overestimate the capabilities of expert legal systems and therefore rely on the systems in situations beyond their range of expertise,[272] the possibility that persons relying heavily on analyses performed by computers will neglect the development of their own expertise,[273] and, finally, the possibility that increased use of computer analyses will decrease humanism in the work of experts like lawyers because of the new ease with which they can perform analyses lacking full individual attention.[274] While each of these problems is real, none is a

269. *See* Hafner, *supra* note 255, at 151.

270. For an overview of commentary to date on the social implications of increased use of artificial intelligence devices, see Partridge, *Social Implications of Artificial Intelligence* in ARTIFICIAL INTELLIGENCE: PRINCIPLES AND APPLICATIONS 315 (M. Yazdani ed. 1986).

271. *See id.* at 316-18; Nilsson, *Artificial Intelligence, Employment, and Income*, AI MAGAZINE, Summer 1984, at 5.

272. *See* Partridge, *supra* note 268, at 325-27.

273. *See* Dreyfus & Dreyfus, *supra* note 4, at 86, 90 (increased reliance on expert systems could "produce a generation of students and managers who have no faith in their own intuition and expertise").

274. *See* Partridge, *supra* note 268, at 319-22 (assessing the possibility that limited understanding of artificial intelligence programming by system users will force the consequences of incomplete computer analyses to be increasingly accepted by individuals with the explanation that "I'm sorry, but the computer doesn't allow us to do that").

For discussions of the contrary view that artificial intelligence devices do not threaten the dehumanization of society and may even promote humanism, see *id.* at 329-30 (describing applications of artificial intelligence computers that permit human processes conducted on a mass scale, such as educational procedures or manufacturing activities, to be customized to the needs of individual consumers); Boden, *Artificial Intelligence as a Humanizing Force* in 1983 PROC. EIGHTH INT'L JOINT CONF. ON ARTIFICIAL INTELLIGENCE 1197, 1197-98 (analysis of the humanizing impact of artificial intelligence devices on human occupations); Chance, *Intelligence, Artificial and Otherwise*, AI MAGAZINE, Winter 1985, at 22 (arguing that artificial intelligence devices need not be feared as a dehumanizing influence, but should rather be treated like any other human tool such as a hammer or a knife).

complete bar to the increased social benefits which can be gained from carefully constructed expert legal systems, used under constrained circumstances and in conjunction with related social programs (like retraining for displaced workers) that ameliorate negative externalities of expert legal system use.[275]

The reasons to pursue the development of these systems are compelling. Expert legal systems can preserve expert know-how, effectively distribute otherwise scarce expertise, reduce costs of mediocre or poor human analyses, and facilitate user access to information and computer capabilities.[276] Additionally, efforts to develop expert legal systems promise improvements in the systematization and codification of existing legal knowledge.[277] Finally, as regulatory schemes and the human endeavors they control become more and more complicated, reliance on the power of expert legal systems to retrieve and interpret complex legal standards may become a necessary means for attorneys to master and apply complex laws governing the equally complex technologies found in modern society.[278] With this breadth of potential benefits, few areas of legal research are as exciting or promising as the creation of new expert legal systems.

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275. *See* Partridge, *supra* note 268, at 319-22 (concluding that, although significant new social risks may be involved, "the potential benefits of artificial intelligence are . . . both dramatic and seemingly unlimited").

276. *See* D. WATERMAN, *supra* note 1, at 12-13; Hayes-Roth, *supra* note 2, at 28.

277. *See Overview of Expert Systems*, *supra* note 51, at 27-28; McCarty, *Reflections On TAXMAN*, *supra* note 8, at 839-41.

278. *Cf.* P. HARMON & D. KING, *supra* note 2, at 79-89 (describing the potential usefulness of expert systems in understanding and controlling various technological processes); D. MICHIE & R. JOHNSTON, *supra* note 4, at 9-11 (arguing that the development of computer systems based on artificial intelligence may be necessary for humans to maintain control over their increasingly complex technical environment); R. SCHANK, *supra* note 18, at 245-47 (projecting that artificial intelligence computers acting as servants, partners, and teachers will both help individuals deal with today's information overload and assist them in acquiring and interpreting new types of information).

Expert systems are already being used to insure that highly technical government activities conform to complex legal limitations. For example, the federal Environmental Protection Agency now uses an expert system to insure that its practices conform to both the information disclosure requirements of the Freedom of Information Act and the information confidentiality requirements of the Toxic Substances Control Act. *See* Feinstein, *A Knowledge-Based Expert System Used to Prevent the Disclosure of Sensitive Information at the United States Environmental Protection Agency*, in COMPUTING POWER AND LEGAL REASONING 661 (C. Walter ed. 1985); Feinstein & Siems, *EDAAS: An Expert System at the U.S. Environmental Protection Agency for Avoiding Disclosure of Confidential Business Information*, 2 EXPERT SYSTEMS 72 (1985).

AN ARTIFICIAL INTELLIGENCE APPLICATION IN THE LAW: CCLIPS, A COMPUTER PROGRAM THAT PROCESSES LEGAL INFORMATION

BY CARY G. DEBESSONET † AND GEORGE R. CROSS ††

INTRODUCTION

Technology has made a significant impact on the legal profession. Most lawyers know, for example, that commercial systems can retrieve cases and statutes from large databases by searching for key words supplied by the user.[1] In addition, activities such as client interviews, document preparation, and case file management can now be done by computer.

The legal profession cannot afford to ignore the potential that technology has to offer. Manifestations of technology will be finding their way into the practice of law in the not-too-distant future. Researchers are in the process of creating systems to perform conceptual retrieval tasks and to assist lawyers in arguing their cases. The hope is that these systems will be able to find relevant cases and statutes and suggest legal strategies based on the retrieved materials. To accomplish these goals, these systems will have to possess human-like reasoning capabilities.[2]

The general goal of artificial intelligence ("AI") research is to enable computers to interact with the world as ordinary humans do.[3] Humans perceive, reason, communicate, and engage in other intelligent activities

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1. Berring, *Full-Text Databases And Legal Research: Backing Into The Future*, 1 HIGH TECH. L. J. 27, 38 (1986).

2. *See* J. Campbell, *Principles of Artificial Intelligence*, in ARTIFICIAL INTELLIGENCE 17 (M. Yazdani ed. 1986).

3. *See* D. MICHIE & R. JOHNSTON, THE KNOWLEDGE MACHINE 86-87 (1985).

to interact with their environments. AI researchers are attempting to create enhanced simulations of these human activities. Researchers have already done quite a bit of work in the areas of pattern and speech recognition and speech production. One can expect to be able to feed information into a computer by oral means and have it respond in a like manner in the near future.[4] Other researchers are modeling computer processes after human cognitive processes such as remembering and daydreaming.[5] Even the cherished reasoning ability of human beings is being automated through diverse methods. In addition, in a field known as "automatic programming," computers are being taught how to program themselves.[6]

Being cognizant of the goals being pursued by AI researchers, it is quite natural for lawyers to speculate about how the new technology might affect the legal profession. This Article describes an AI application in law to give members of the legal profession a view of the AI field and a better perspective on how they might participate in it.

This Article discusses The Civil Code Legal Information Processing System ("CCLIPS"). CCLIPS is designed to retrieve relevant cases and statutes from a highly integrated and efficient data base containing, among other things, portions of the Civil Code of Louisiana.[7] In the near future, CCLIPS will digest facts presented to it, retrieve relevant cases and statutes, and determine legal effects that follow from the facts.

Section I of this Article introduces the concepts of knowledge representation and natural language parsing along with some other basic principles of AI. Section II describes the operations of CCLIPS, including the problems it faces. Section III describes the notational conventions used in CCLIPS to represent variables. Section IV describes the representation of facts and law, including the ways in which causality, goals, states of arousal, mental acts, and temporal schemes are represented in CCLIPS. Section V discusses some applications of AI techniques in the legal domain, and Section VI predicts the future of CCLIPS. The Appendices present technical information to support the

4. *See id.* at 23-28.

5. *See generally id.* at 15-36. For a description of this "cognitive modeling process," see *infra* text accompanying notes 69-71.

6. *See, e.g.*, P. JACKSON, INTRODUCTION TO EXPERT SYSTEMS 210 (1986).

7. CCLIPS is in an intermediate stage of development in which an original prototype is being enhanced to accommodate a new version of the programming language in which it is written. The inferencing powers of CCLIPS are also being enhanced to allow it to perform reasoning and other intelligent operations described in this Article. In addition, this Article describes some of the AI techniques used in CCLIPS to handle causality. Other aspects of CCLIPS, such as the way it handles property inheritance, quantification, denotative reference, and inferencing, will be described in future articles.

text and to provide more detailed information on the operation of CCLIPS.

I. PRINCIPLES OF ARTIFICIAL INTELLIGENCE

The aim of this section is to give the reader a general understanding of some important AI principles. Subsection A describes how knowledge can be represented for computers. Subsection B describes problems associated with automated language understanding and suggests ways to avoid some of these problems.

A. Knowledge Representation

Computers must have knowledge available to them to be able to engage in activities similar to human intelligence. A good portion of AI research and development is devoted to making knowledge available to the computer in a form it can understand. The field of "knowledge representation" deals with the problem of representing knowledge for the computer. In AI terms, a knowledge representation is a set of conventions describing something, whether it be an object, state, event, rule, procedure, or abstraction.

One of the most popular representation schemes used in AI is based on the notion that information can be packaged into conceptual units, sometimes called "frames." Frames contain slot-like components that bear role descriptions about the described object. The units can be cast into hierarchies to capture relationships between units. For example, a frame for a particular kind of owner would be placed under a frame for owners in general. A frame for owner might contain slots for the following: (1) the name of the owner; and (2) a description of the owned object.

There are many types of representation schemes that follow the general pattern described above. One example, "semantic nets," uses "nodes" (knowledge) as conceptual units. In this scheme the relations between units are represented by "arcs" that connect the units. The IS-A or A-KIND-OF arc, is often used to represent the hierarchical nature of a given relationship. The representation

OWNER
IS-A
OWNER OF LAND

indicates that an owner of land is a kind of owner because of the presence of the IS-A arc connecting the nodes. By arranging things in this way, it is easier to write programs to deal with matters such as property

inheritance by which subtypes inherit the properties of general types. Some software packages have property inheritance mechanisms built into them.

Once a knowledge structure has been developed to receive information, it can be "instantiated," that is, filled in with concrete information. When the same structure receives different contents on multiple occasions, each different instantiation may be considered an "instance" of whatever the structure represents. A program designed to operate on a knowledge structure independent of its contents can go about the business of manipulating knowledge without receiving new instructions. The knowledge structures function like data abstractions based on the particular needs of the user.

Manipulating knowledge structures to derive results in accord with what one might wish to infer is called "inferencing." Programming languages which have certain inferencing capabilities already built into them are called "logic programming languages." These languages do not require the programmer to write certain types of inferencing programs.

Computers have long been able to perform analytical operations on numbers, symbols, and structures. For example, if a computer is given the following rules in its vernacular, (Rule 1) if A, then B, and (Rule 2) if B, then C, it can deduce C from A. In this AI technique, called "forward chaining," the computer matches the antecedent of Rule 1, A, to obtain B. The computer would then take B and match it to the antecedent of Rule 2, yielding C as the consequent of that rule. Conversely, through a process of "backward chaining," the computer can determine which conditions or antecedents would have to be satisfied to reach result C. It would first look at the immediate antecedent of C in Rule 2 and find B. Thereafter, it would find B as a consequent of Rule 1. It would thus come up with A, the antecedent of Rule 1, as a condition that leads to result C.

A computer can carry out forward and backward chaining quickly and accurately. It can handle a sizable number of rules whose antecedents can vary in both number and complexity.

Forward and backward chaining can also be applied to sentence-level expressions. The symbols A, B, and C can be replaced with sentences without diminishing the deductive capabilities of the system. Suppose, for example, that the following substitutions were to be made:

A = (person is 21 years of age or older);
B = (person is a major); and
C = (person has contractual capacity).

The result would read:

Rule 1, if (person is 21 years of age or older)
then (person is a major).
Rule 2, if (person is a major)
then (person has contractual capacity).

A program that could deduce C when given A in the original example might have little difficulty in deducing "person has contractual capacity" when given that "person is 21 years of age or older". The problem is to make the computer treat expressions like "person is 21 years of age or older" as a unit like A. The parentheses enclosing the expressions make it easy for the computer to do this when a programming language like LISt Processor ("LISP") is used.[8]

LISP is one of the computer languages that has been developed to accommodate the many ways knowledge can be represented for computer processing.[9] It can be used to implement a general frame-based scheme like the one described above and has been used extensively in CCLIPS. LISP has a special syntax that must be followed to write programs. It contains a collection of primitive functions that perform basic operations on data. These functions can be combined into more elaborate functions to perform more intelligent operations. By using the tools available in LISP, knowledge can be represented in diverse patterns of knowledge structures, sometimes called "formalisms." Also, programs can be written to manipulate those patterns and their components in intelligent ways. The patterns can be tailored to meet specific needs and can range in sophistication from the very simple to the very complex.

AI researchers have developed a varied assortment of knowledge structures over the years to accommodate a wide range of information, including information about human activities such as planning and goal achievement. Although a system might be able to make the deduction described above when given the expression "person is 21 years of age or older," it might not be able to reach the same result when given "person

8. *See* J. MCCARTHY, P. ABRAHAMS, O. EDWARDS, T. HART & M. LEVIN, LISP 1.5 PROGRAMMER'S MANUAL (1962).

9. The models presented in this Article are written in a form that, with slight modification, can be processed directly in a LISP environment. The versions described are designed to operate in the FRANZ LISP environment of a VAX 11/780 running UNIX. Over the years systems have been developed, such as LOOPS and FLAVORS, that add objects to LISP. COMMON LOOPS is one of the most promising packages now becoming available that merges the strengths of LISP and object-oriented programming. *See* Bobrow, Kahn, Kiczales, Masinter & Stefik, *Common Loops: Merging Lift and Object-Oriented Programs*, 1986 OOPSLA PROCEEDINGS (to be published).

is 21 years old or older." The difficulty is caused because the two expressions are not identical; one uses the word "old" instead of the words "of age." This constitutes a significant limitation because the two expressions have the same meaning and should yield the same result. Unfortunately, many systems do not have the ability to recognize that similar, but not identical, expressions can have the same meaning. Systems that do have this ability possess some "natural language" understanding capabilities.

B. The Natural Language Barrier

The term "natural language" is used in AI to refer to ordinary language, such as that found in everyday written and oral discourse. Most expert systems that have been built in recent years have a very limited ability to understand this language. These systems are limited in their ability to determine when different representations have the same meaning in expressions like sentences, clauses, or phrases that must be uniformly represented.

AI researchers have achieved only limited success in enabling computers to understand an ordinary language such as English. Researchers refer to the difficulties involved in this endeavor as the "natural language barrier." Initially, some researchers were very optimistic about being able to achieve results quickly in this area. However, as time went on, it became apparent that the task was going to be much more difficult than was first imagined.

Natural language text contains many ambiguities. Some of those ambiguities can be resolved if the computer is able to classify the words it is processing. A word like hand, for example, is used both as a noun (to mean laborer, part of an arm, or part of a clock) and as a verb (as in the request, "hand me the book"). There are not as many verb senses of the word as there are noun senses. Therefore, if a computer knows that the word is used as a verb in a particular context, the computer will more easily deduce its meaning than if the word is used as a noun.

Natural language "parsing" is a process by which natural language text is analyzed for the purpose of classifying and otherwise treating its component parts. One might, for example, wish to determine what parts of speech appear in a text to understand how the words are used within the whole text.

There are many parsing techniques that can be employed. Some are syntactically-oriented in that they are based on the syntactic conventions of language, whereas others are semantically-oriented in that they are rooted in previously acquired knowledge of the meaning of the text or of the meaning of language in general. The application described in this Article combines these approaches.

CCLIPS avoids the natural language barrier by combining syntactically-oriented and semantically-oriented parsing in a language called Atomically Normalized Form ("ANF"). Instead of using natural language to represent legal information, ANF employs sets of formalisms, that is, structures or models that outline the essential features of concepts. Rules and factual information are written into the formalisms and are processed by programs that convert them into a highly integrated and efficient database.

Other researchers have tried to avoid the problems of natural language by creating systems that do not require natural language understanding capabilities. The prospects of overcoming the barrier in the near future appear to be so dim that a trend toward the creation of what are known as "expert systems" has emerged. An expert system is an automated system designed to give advice that an expert might give in a particular area.[10] Although it might seem that such a system would be more difficult to create than others, it turns out that expert behavior can be simulated to a useful extent without having extensive natural language capabilities.

Commercial tools are available to build expert systems and some researchers predict that law offices will soon build their own expert systems tailored to the legal vernacular. However, until more powerful natural language understanding technologies are available, the developers of AI systems will have to compromise their goals somewhat and adopt strategies that will avoid confrontations with the natural language barrier.

II. DESCRIPTION OF OPERATIONS

This Section describes some of the difficulties CCLIPS will have to overcome to be as intelligent as its developers hope it to be. Subsection A describes some of the text processing problems that other systems are facing and the attempts the developers of CCLIPS are making to avoid these problems. Subsection B gives some examples of the kind of descriptions CCLIPS will process in order to point out the problems the system now faces. Subsection C discusses the strategies being employed to enable CCLIPS to acquire a deep understanding of the information it reads.

10. For an extensive discussion of legal expert systems, see Gruner, *Thinking Like a Lawyer: Expert Systems for Legal Analysis*, 1 HIGH TECH. L.J. 259 (1986); Susskind, *Expert Systems in Law: A Jurisprudential Approach to Artificial Intelligence and Legal Reasoning*, 49 MOD. L. REV. 168 (1986).

A. Problems That CCLIPS Will Face

The original goal of CCLIPS was the creation of a conceptual retrieval system[11] that would incorporate some of the more promising artificial intelligence techniques that have emerged recently. Some of those techniques are described in this Article to give the reader a useful perspective from which to view CCLIPS.

By the time the development of CCLIPS was underway, it was already obvious that an advanced theory of knowledge representation would be needed to build a conceptual retrieval system to operate in the legal domain. The TAXMAN system[12] demonstrated that deep conceptual models would have to be used to perform conceptual retrieval tasks effectively. In the AI realm, the use of abstract constructs to represent conceptual content became popular in some circles in the late 1970's when object primitives,[13] scripts, plans, goals,[14] themes,[15] and the like began to be employed. Knowledge application, knowledge structure instantiation, and the use of multiple knowledge source domains emerged as the most prominent AI techniques in the text processing realm. A gradual recognition of how syntactically-oriented parsing[16] compliments semantically-oriented parsing[17] seems to have paved the way for significant advancement in automatic natural language parsing. This in turn has contributed much to the success achieved in the text processing realm.[18]

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11. *See generally* McCarty, *Intelligent Legal Information Systems: Problems and Prospects*, 9 RUTGERS COMPUTER & TECH. L. J. 265 (1983).

12. *See* McCarty, *Reflections on TAXMAN: An Experiment in Artificial Intelligence and Legal Reasoning*, 90 HARV. L. REV. 837 (1977); McCarty, *The TAXMAN Project: Towards a Cognitive Theory of Legal Argument*, in COMPUTER SCIENCE AND LAW 23 (B. Niblett ed. 1980); McCarty, *supra* note 11, at 265.

13. *See* Lehnert, *Representing Physical Objects in Memory*, in PHILOSOPHICAL PERSPECTIVES IN ARTIFICIAL INTELLIGENCE 81 (1979); Lehnert & Burstein, *The Role of Object Primitives in Natural Language Processing*, 1979 PROC. SIXTH INT'L JOINT CONF. ON ARTIFICIAL INTELLIGENCE 522.

14. R. SCHANK & R. ABELSON, SCRIPTS, PLANS, GOALS AND UNDERSTANDING (1977).

15. *See* Wilensky, *Why John Married Mary: Understanding Stories Involving Recurring Goals*, 2 COGNITIVE SCI. 235 (1978).

16. *See* Woods, *Transition Network Grammars for Natural Language Analysis*, 13 COM. ACM 591 (1970).

17. Wilks, *An Intelligent Analyser and Understander of English*, 18 COM. ACM 264 (1975).

18. For an overview of the current state of automatic natural language parsing, see K. JONES & Y. WILKS, AUTOMATIC NATURAL LANGUAGE PARSING 7 (1983).

BORIS[19] is a unified text processing system which incorporates memory search, instantiation, and inferencing into a unified parsing process that proceeds on a word-by-word basis.[20] BORIS attempts to acquire an "in-depth understanding"[21] of the narratives it reads by constructing a complete representation of the text, including all physical events, mental states, and causal connections. CCLIPS is being developed to employ similar techniques in performing more limited tasks. In this Article, the techniques used in BORIS are taken to be exemplars of modern AI strategy in the text processing realm and thus are described and referred to often.[22]

Researchers have maintained for some time now that an in-depth understanding of a narrative requires more than knowledge of fact and causality.[23] The point or significance of the narrative must also be grasped. Acquisition of this level of understanding depends upon the ability to recognize thematic patterns in a narrative. The process by which BORIS acquires this level of understanding is quite sophisticated. Thematic patterns cannot be recognized unless a number of processes interact properly. Consequently, BORIS has an impressive arsenal of AI techniques at its disposal, including indexing by content[24] and split-level

19. BORIS is a text processing system designed to read and understand narrative text. It is a highly integrated system in which memory search, instantiation, and inference tasks occur ancillary to a single, unified, word-by-word parsing process. BORIS constructs a complete representation of a narrative, processing all physical events and mental states, along with causal connections. M. DYER, IN-DEPTH UNDERSTANDING: A COMPUTER MODEL OF INTEGRATED PROCESSING FOR NARRATIVE COMPREHENSION 16-17 (1983).

20. *Id.* at 143. The integration of parsing with other processes has been popular in some AI circles since the creation of FRUMP. Instead of answering questions about a narrative or story, FRUMP displays its understanding of the story by summarizing it. FRUMP contains "sketchy" scripts that direct parsing strategies to extract data to form a summary or the "gist" of a story. FRUMP ignores words in text that do not trigger its program. *Id.* at 15; DeJong, *Prediction and Substantiation: Two Processes that Comprise Understanding*, 1979 PROC. SIXTH INT'L JOINT CONF. ON ARTIFICIAL INTELLIGENCE 217.

21. Understanding a narrative "in-depth" requires more than simply extracting the facts of a narrative and inferring causal connections between them. An in-depth understanding recognizes what was important about a narrative, what "episodes" were significant, and indexes the "episodes" in memory for future use in similar situations. M. DYER, *supra* note 19, at 16.

22. Artificial intelligence programs which model cognitive processes are usually very complicated. Due to their complexity, the only way to learn how a theoretical construct will work within a large processing framework is to construct a model and run it on a computer. Once the model is implemented and run on a computer, the successes and failures of the construct become clear. This serves as a valuable research tool. For CCLIPS, BORIS is such a tool. M. DYER, *supra* note 19, at 355-56.

23. M. DYER, *supra* note 19, at 10, 165, 299.

24. Kolodner, *Organization and Retrieval in a Conceptual Memory for Events or CON54, Where are you?*, 1981 PROC. SEVENTH INT'L JOINT CONF. ON ARTIFICIAL INTELLIGENCE 227, 231.

representation consisting of cognitive—and arousal—level representation.[25]

BORIS attempts to detect goals, goal failures, expectations, expectation failures, plans, and plan failures that are implied or given in the text it reads. It uses this information to activate rules, inferences, and other abstract constructions which, in turn, are processed and used as part of the unified parsing process to create a deep episodic memory that can be searched using questions and answers.

Thus, BORIS faces the problem of having to determine connections between events when those connections are not explicitly mentioned in the text. For example, in processing a narrative called DIVORCE-1, BORIS encountered a paragraph that described a situation in which a character named Paul was facing a divorce. The report indicated that Paul's wife, Sarah, not only wanted a divorce, but also the family car, house, children, and alimony. The paragraph went on to state:

> Paul wanted the divorce, but he didn't want to see Sarah walk off with everything he had. *His salary from the state school system was very small.*

BORIS had to interrelate all the information in the paragraph, including the italicized statement in this quotation. A human reader could recognize the connection between a small salary, alimony, and attorney fees. However, for BORIS, establishing this connection was no trivial task.

Neither the original nor the new version of CCLIPS[26] face problems of this complexity at the input level. The domain of CCLIPS is the Civil Code of Louisiana ("Civil Code"). The Civil Code is divided into books, titles, chapters, sections, and articles, all of which theoretically constitute an analytic whole. As CCLIPS reads input, it enjoys the luxury of already having available many explicitly represented connections between divisions. The import of the material processed by CCLIPS is easier to detect than the themes of ordinary narratives because the subject matter of a given code provision is often revealed by it structural position. Statutes seem to be instantiations of general formalisms that represent typical patterns, such as patterns for defining rights and for describing how rights are created, extinguished, and modified.[27]

25. M. DYER, *supra* note 19, at 29.

26. Currently, the developers of ANF are establishing a version of ANF indistinguishable in form from ordinary English. This new version will maintain all the precision of the current version of ANF. Considerable progress has been made in this endeavor. The examples presented in this Article often contain descriptions that appear to be written in ordinary English but which are written in this new version of ANF. In those instances, the descriptions are not identified as ANF representations because the scope of this Article does not include a description of this new version of ANF.

27. deBessonet, *An Automated Intelligent System Based on a Model of a Legal System*, 10 RUTGERS J. COMPUTERS, TECH. & L. 31, 35 (1983).

Therefore, it is usually easy to determine the point of a given segment of statutory information.

Despite the analytical quality of statutory material, CCLIPS at some point will have to face the kind of problems that BORIS now faces. CCLIPS must eventually be able to process information on at least two levels. First, it must be able to acquire an in-depth understanding of statutory material written in ANF. Second, CCLIPS must eventually be able to read and acquire an in-depth understanding of facts presented to it in ordinary English, a capability far more difficult to achieve.

It is ludicrous to think that attorneys would be willing to learn a language like ANF in order to be able to communicate with computers. That is why techniques similar to the ones used in BORIS have been under development in the CCLIPS project. Presently, the facts presented to CCLIPS are encoded in ANF. The hope is that, once ANF is developed fully, the interface between it and a selected subset of ordinary English will not be too difficult to establish. Users could then communicate with the system in English by presenting narrative facts.

The surface-level ANF representations in this Article, that is, the ANF counterparts of natural language descriptions, are actually knowledge structures or expansions. The connector HAS, for example, is used in various state descriptions, yet that connector does not flag the differences that distinguish one description from another. ANF offers numerous subtypes of the general connector HAS that can be used to flag the nature of the connection involved (e.g. HAS-POSSESS for possession and HAS-ATT for "having an attitude"). CCLIPS creates semantic depth by parsing top-level representations into lexicographical formalisms that are semantically richer than the surface-level representations.

The prototype of CCLIPS was set up to read and understand statutory material written in a simple version of ANF. The prototype was not capable of acquiring the kind of in-depth understanding of ANF representations that a system like BORIS acquires when it reads narratives. CCLIPS acquired an understanding of ANF sufficient to perform some conceptual retrieval tasks, but it did not generate an "in-depth" representation of the text. Part of the problem was rooted in ANF itself. As originally developed, ANF was not sufficiently flexible to handle the conceptual niceties that pervade the statutory realm.

Over the last two years substantial progress has been made toward giving ANF the representational power it needs to be an effective legal retrieval and reasoning system. The present goal of CCLIPS is to acquire an in-depth understanding of the ANF text. CCLIPS is being redesigned to proceed in a "bottom-up"[28] manner to construct a deep

28. *See* D. MICHIE & R. JOHNSTON, THE KNOWLEDGE MACHINE 107-08 (1985).

representational scheme that can be searched in the process of responding to presented facts. Once CCLIPS is able to read and understand ANF text, it will be able to access the resulting representational scheme held in memory when parsing facts written in English, or in a slightly formalized subset of English.

Any law student knows that a narrative description of facts can raise numerous legal issues and that the narration itself can be quite lengthy and complex. Nevertheless, the problems that CCLIPS will face in attempting to understand narratives may be less troublesome in some respects than those faced by a system like BORIS. In many cases, CCLIPS will be able to proceed in a simple "top-down"[29] manner to analyze facts presented to it because legal rules are but abstractions that await instantiation by relevant facts. BORIS accesses knowledge structures in memory when parsing new text and uses them to perform special tasks, such as disambiguation tasks.[30] What is already in memory can thus be used to analyze new text, and this technique should be especially effective in the legal domain because of the top-down nature of legal rules.

Although processing problems may be reduced because of the top-down nature of statutory material, this advantage may not be as great as one might imagine. One of the current dissatisfactions with key-word retrieval is the difficulty of choosing appropriate key words to be used in memory search.[31] In many respects a similar problem would exist even if lawyers were allowed to describe factual situations to the system in ordinary English because relevant facts might be omitted. It would be a mistake to assume that the researcher already knows how to state facts in a way that will enable the system to recognize all the relevant instantiations of the rules. A researcher may have no idea what rules are applicable to the facts and hence may not be able to tailor the facts to fit the rules. For this reason, CCLIPS must use AI techniques to convert the facts into a form that will fit the representational scheme held in memory.

B. Examples of Fact Descriptions that CCLIPS Will Process

CCLIPS is being designed to receive descriptions of facts written in ANF and to determine whether those facts are covered by the rules it has in memory. The most immediate goal is to enable CCLIPS to find rules relevant to the facts by using conceptual retrieval techniques.

29. *Id.*
30. M. DYER, *supra* note 19, at 180.
31. Berring, *supra* note 1, at 43-50.

Once it can do that effectively, an attempt will be made to implement some of the reasoning methods described later in this Article.

Perhaps the best way to understand how CCLIPS will operate is to consider some examples of the kind of material it is being designed to process. These examples are designed to illustrate the need for versatile expressive power in a representation language and to raise some points and issues that will be discussed later in more detail.

The first example deals with improvements made by a lessee to property under lease. It will be referred to as "EXAMPLE-1" throughout this Article. It is offered here to point out the need for an ability to represent event and state descriptions. EXAMPLE-1 reads:

> The lessee improved the property under lease, which pleased the lessor.

This sentence, when taken as a factual assertion, describes both an event, that is, the improvement of the property, and a human emotional state, that is, the pleased state of the lessor. It also describes a causal relationship. On its face, it directly implies that the event of improvement caused the emotional state of the lessor. Thus, the following knowledge components can readily be distinguished:

1) EVENT ——> [lessee improved leased property];
2) CAUSAL RELATION CONNECTOR ——> [caused];[32]
3) STATE ——> [lessor is pleased].

For CCLIPS to understand this example, it must recognize the presence and nature of the knowledge components outlined above. Since it does not have general natural language understanding capabilities, it must be given some means by which to make these determinations. ANF is designed to provide CCLIPS with much of the information it needs. It has special syntactical conventions for describing each type of knowledge component. CCLIPS detects descriptions of states, events, and relations by recognizing the special syntax used to represent them.[33]

Because the syntax of ANF is flexible, complex descriptions of facts can be conveniently represented. Thus, CCLIPS can digest facts and relate their knowledge components by recognizing friendly syntactical structures and by employing built-in combinative techniques. The

32. Note that the text implies the causal connection.

33. The following Sections of this Article give detailed descriptions of some of the more important aspects of this syntax. Structures used to represent emotional states are described in Section IV, *infra*. Structures used to represent events and causal relations are sometimes discussed individually, but at other times they are discussed together as part of a description of an inclusive process.

second example offered in this Section is such a complex description. Throughout this Article it is referred to as "EXAMPLE-2." It reads:

> John loved Mary and knew that she wanted to buy a lot he owned. He made her happy by telling her that he would consider selling it to her. He knew that Mary wanted to build a store on the lot and believed she would have the right to do so if she owned the lot. Mary's desire and belief served as the primary motivations for her purchasing the lot. She decided to buy it after John orally communicated an offer of sale to her. After buying the lot, she drove to the lot in a car and discovered a posted zoning regulation that would prohibit the construction of a store on the lot. Mary hired two lawyers who wrote a memo for her about her rights.

For CCLIPS to understand these facts well enough to perform conceptual retrieval and reasoning operations, it must recognize the differences between the events and relations described in the text. The love relationship described in the first sentence differs significantly from the act of communication referred to in the second sentence. Each of these knowledge components is treated differently in ANF.

Several other knowledge components in this example are worth mentioning. One of these is Mary's belief that caused her to enter into a contract of purchase—a belief causality. Another is the instance of decision making in which Mary decides to purchase the lot. The instance of making an offer, the instance of transportation by car, and the instance of preparing a memorandum are also knowledge components worthy of mention. All these acts and relations can be represented in a way that will enable CCLIPS to recognize them when they are encountered in parsing.

One of the most difficult tasks that the current version of CCLIPS will have to perform is to recognize legal issues presented by facts. EXAMPLE-2 presents a number of legal issues, one of which is whether Mary could rescind her contract with John because she consented to a contract tainted with error. Her error rested on the false belief that she would have the right to build the store on the lot if she owned it. Section V, *infra*, presents an analysis of this problem and describes a set of ANF models that can be used to assist CCLIPS in making the appropriate decisions.

C. Understanding Text

This Section describes techniques being used to enable CCLIPS to understand the information it reads. Subsection 1 describes some techniques under development elsewhere that could be used in CCLIPS. Subsections 2 through 4 describe the original versions of ANF and

CCLIPS. Subsection 5 describes how those versions are being enhanced to produce more intelligent results.

1. *Techniques that Could Help CCLIPS Understand Information*

A goal that is becoming more attractive as the expressive power of ANF increases is that of providing existing statutory material with formally structured descriptions that could be processed in lieu of the statutory text. The technique of processing formal descriptions of text instead of, or in addition to, the text itself has already been employed usefully in the legal domain and elsewhere.[34] The Legal Information Retrieval System ("LIRS"),[35] for example, uses representations of cases, statutes, and official comments to perform intelligent retrieval tasks. The TAXMAN project,[36] and the LEGOL project,[37] as well as the work of Meldman,[38] each considered the general problem of designing a language in which legal rules and legal concepts might be easily expressed. Sergot[39] has explored the possibility of using logic programming languages to represent areas of the law, and Gordon[40] has described some advantages of using an object-oriented approach to programming languages in a knowledge representation system. It seems that interest in both the formalization and normalization of the law is still very much alive.[41]

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34. *See* C. HAFNER, AN INFORMATION RETRIEVAL SYSTEM BASED ON A COMPUTER MODEL OF LEGAL KNOWLEDGE 61-65 (1981) (describes a conceptual retrieval system built upon representations of textual information); Popp & Schlink, *JUDITH, A Computer Program to Advise Lawyers in Reasoning a Case*, 15 JURIMETRICS J. 303, 306 (1975); Zarri, *Inference Techniques for Intelligent Information Retrieval*, in COMPUTING POWER AND LEGAL REASONING 215 (C. Walter ed. 1985).

35. C. HAFNER, *supra* note 34, at 3, 61, 85.

36. *See* McCarty, *Reflections on TAXMAN: An Experiment in Artificial Intelligence and Legal Reasoning*, 90 HARV. L. REV. 837 (1977); McCarty, *The TAXMAN Project: Towards a Cognitive Theory of Legal Argument*, in COMPUTER SCIENCE AND LAW 23 (B. Niblett ed. 1980); McCarty & Sridharan, *The Representation of an Evolving System of Legal Concepts: II. Prototypes and Deformations*, 1981 PROC. SEVENTH INT'L JOINT CONF. ON ARTIFICIAL INTELLIGENCE 246.

37. *See* Jones, Mason, & Stamper, *LEGOL 2.0: A Relational Specification Language for Complex Rules*, 4 INFO. SYSTEMS 293-305 (1979).

38. Meldman, *A Structural Model for Computer-Aided Legal Analysis*, 6 RUTGERS COMPUTER & TECH. L. J., 27-71 (1977).

39. Sergot, Sadri, Kowalski, Kriwaczek, Hammond & Cory, *British Nationality Act as a Logic Program*, 29 COMM. OF THE ACM 370-386 (1986).

40. Gordon, *Object-Oriented Predicate Logic and Its Role in Representing Legal Knowledge*, in COMPUTING POWER AND LEGAL REASONING 163 (C. Walter ed. 1985).

41. *See* Allen & Engholm, *Normalized Legal Drafting and the Query Method*, 29 J. LEGAL EDUC. 380 (1978); Allen, *Two Modes of Representing Sets of Legal Norms: Normalization and an Arithmetic Model*, 16 PROC. THIRD INT'L CONG. ON THEME: L'INFORMATICA GIURIDICA E LE COMUNITA NAZIONALI ED INTERNAZIONALI (SESSION III) 1-61 (1983); Allen & Saxon, *Computer Aided Normalizing and Unpacking: Some Interesting Machine-Processable Transformations of Legal Rules*, in COMPUTING POWER AND LEGAL REASONING 495 (C. Walter ed. 1985); deBessonet, *supra* note 27, at 46-54; Gray, *Statutes Enacted in*

Large commercial retrieval systems operating in the legal domain, however, have not adopted a formal approach to representation.[42] The major constraint on the use of a formal approach to represent legal information is the difficulty of encoding such a huge mass of material.[43] Some researchers have attempted to avoid that difficulty by concentrating their efforts on the creation of expert systems to deal with particular legal areas or tasks (including document preparation and construction of computer-based thesauri) or on the modeling of narrow areas of law. These areas include zoning laws,[44] automated legal drafting,[45] taxation of stock redemptions,[46] analysis of judicial decisions,[47] product liability law,[48] transfer tax planning,[49] automation of law offices,[50] general legal decision-making,[51] general taxation questions,[52] sentencing decisions,[53] contract law questions on examinations,[54] bankruptcy,[55] thesaurus

Normalized Form: The Legislative Experience in Tennessee, in COMPUTING POWER AND LEGAL REASONING 467 (C. Walter ed. 1985).

42. *See* Berring, *supra* note 31, at 39-56; Maggs, *Automated Processing of Legal Information*, 26 AM. J. COMPARATIVE L. 517 (Supp. 1978); Neth, *Computerized Legal Research in the Law Schools: The Case Western Reserve Experience*, 28 J. LEGAL EDUC. 553 (1977); Sprowl, *Computer-Assisted Legal Research—An Analysis of Full Text Document Retrieval Systems, Particularly the LEXIS System*, 1976 AM. B. FOUND. RES. J. 175.

43. Maggs & deBessonet, *Automated Logical Analysis of Systems of Legal Rules*, 12 JURIMETRICS J. 158 (1972).

44. Haar, Sawyer & Cummings, *Computer Power and Legal Reasoning: A Case Study of Judicial Decision Prediction in Zoning Amendment Cases*, 1977 AM. B. FOUND. RES. J. 651.

45. Boyd & Saxon, *The A-9: A Program for Drafting Security Agreements Under Article 9 of the Uniform Commercial Code*, 1981 AM. B. FOUND. RES. J. 637; Sprowl, *Automating the Legal Reasoning Process: A Computer that Uses Regulations and Statutes to Draft Legal Documents*, 1979 AM. B. FOUND. RES. J. 1.

46. Hellawell, *A Computer Program for Legal Planning and Analysis: Taxation of Stock Redemptions*, 80 COLUM. L. REV. 1363 (1980).

47. Hellawell, *CHOOSE: A Computer Program for Legal Planning and Analysis*, 19 COLUM. J. TRANSNAT'L L. 339 (1981); Lawlor, *Computer Analysis of Judicial Decisions*, in COMPUTER SCIENCE AND LAW 219 (B. Niblett ed. 1980).

48. Peterson & Waterman, *An Expert Systems Approach to Evaluating Product Liability Cases*, in COMPUTING POWER AND LEGAL REASONING 627 (C. Walter ed. 1985); Waterman & Peterson, *Rule-Based Models of Legal Expertise*, 1980 PROC. FIRST NAT'L CONF. ON ARTIFICIAL INTELLIGENCE 272.

49. R. Michaelson, A Knowledge-Based System for Individual Income and Transfer Tax Planning, (1981) (Ph.D. Dissert., U. Ill.).

50. Sprowl & Staudt, *Computerizing Client Services in the Law School Teaching Clinic: An Experiment in Law Office Automation*, 1981 AM. B. FOUND. RES. J. 699.

51. Finan, *LAWGICAL: Jurisprudential and Logical Considerations*, 15 AKRON L. REV. 675 (1982); Hellawell, *SEARCH: A Computer Program for Legal Problem Solving*, 15 AKRON L. REV. 635 (1982); Welch, *LAWGICAL: An Approach to Computer-Aided Legal Analysis*, 15 AKRON L. REV. 655 (1982).

52. Kovach, *Application of Computer-Assisted Analysis Techniques to Taxation*, 15 AKRON L. REV. 713 (1982).

53. DeMulder & Gubby, *Legal Decision Making by Computer: An Experiment with Sentencing*, 4 COMPUTER L. J. 243 (1983).

54. Gardner, *The Design of a Legal Analysis Program*, 1983 PROC. NAT'L CONF. ON ARTIFICIAL INTELLIGENCE 114.

construction,[56] toxic substance law,[57] and federal taxation questions.[58] Others have sought to improve strategies for retrieving information from cases and statutes written in natural language.[59]

AI research suggests that it might be feasible to write descriptive headings for Civil Code titles, chapters, sections, and articles to serve as indices for conceptual retrieval.[60] The development of ANF is almost at the point at which it could be used effectively for this purpose. Techniques similar to ones used in LIRS, LEGOL, TAXMAN, CYRUS, and BORIS could be used in CCLIPS to perform conceptual retrieval tasks. If the formalized descriptions were sufficiently representative of the statutory content, they could function as cross-contextual abstractions. In other words, they could function like Thematic Abstraction Units ("TAUs") in BORIS.

In BORIS, plan and expectation failures trigger TAUs, that is, abstractions that function like adages in describing the import of narratives.[61] TAUs are used in BORIS as cross-contextual indexing mechanisms because the same TAU may describe the content of more than one narrative. TAUs are triggered when BORIS encounters words that flag plan and expectation failures. A description of an expectation failure,

55. Boyd, *Choosing Between a Chapter 7 and a Chapter 13 Bankruptcy: An "Expert System" to Assist an Attorney in Making the Choice*, in COMPUTING POWER AND LEGAL REASONING 699 (C. Walter ed. 1985).

56. Ciampi, Pirro, Fameli & Trivisonno, *THES/BID: An Expert System for Constructing a Computer-Based Thesaurus for Legal Informatics and Computer Law*, in COMPUTING POWER AND LEGAL REASONING 375 (C. Walter ed. 1985).

57. Feinstein, *A Knowledge-Based Expert System Used to Prevent the Disclosure of Sensitive Information at the United States Environmental Protection Agency*, in COMPUTING POWER AND LEGAL REASONING 661 (C. Walter ed. 1985).

58. MacRae, *Tax Problem Solving with an IF-THEN System*, in COMPUTING POWER AND LEGAL REASONING 595 (C. Walter ed. 1985); Schlobohm, *TA—A PROLOG Program Which Analyzes Income Tax Issues Under Section 318(a) of the Internal Revenue Code*, in COMPUTING POWER AND LEGAL REASONING 765 (C. Walter ed. 1985).

59. Bauer-Bernet, *Beyond Keyword Interaction: Computerized European Community Law*, in COMPUTING POWER AND LEGAL REASONING 337 (C. Walter ed. 1985); Bing, *Legal Sources: Availability and Access by Information System*, in A DECADE OF COMPUTERS AND LAW 239 (1980); Harvold, *Search Techniques for Retrieving Legal Documents Stored in Full Text*, in A DECADE OF COMPUTERS AND LAW 133 (1980); Heather, *A Demand-Driven Model for the Design of a "Half-intelligent" Common Law Information Retrieval System*, in COMPUTING POWER AND LEGAL REASONING 69 (C. Walter ed. 1985).

For descriptions and overviews of some of the important research being done in artificial intelligence and law, computers and law, and in related field see generally J. Bing & S. Selmer, A DECADE OF COMPUTERS AND LAW (1980); COMPUTER SCIENCE AND LAW (B. Niblett ed. 1980); ARTIFICIAL INTELLIGENCE AND LEGAL INFORMATION SYSTEMS (C. Ciampi ed. 1982); DEONTIC LOGIC, COMPUTATIONAL LINGUISTICS AND LEGAL INFORMATION SYSTEMS (A.A. Martino ed. 1983).

60. *See* deBessonet, Hintze & Waller, *Automated Retrieval of Information: Toward the Development of a Formal Language for Expressing Statutes*, 6 S.U.L. REV. 1, 7 (1980).

61. M. DYER, *supra* note 19, at 29.

for example, may be accompanied by a description of an emotional state or state of arousal. States of arousal are represented by the knowledge structure AFFECT. A word like "angry" might trigger an AFFECT which, in turn, might trigger a TAU that entails that AFFECT.

In the statutory realm, techniques similar to the TAUs in BORIS can be used to trigger abstract descriptions of statutory antecedents.[62] For example, if the description of an accident mentioned that a person "failed to replace a light bulb," the word "failed" could be construed as an operator that would activate knowledge structures associated with the concepts of duty and legal causality. Those structures could be processed and used to analyze the text to see if the accident was caused by lack of adequate lighting and, if so, whether there existed a duty to provide adequate lighting that was breached by the failure to replace the light bulb. If a breach of duty were found, the system could then activate a set of statutory provisions indexed by the breach-of-duty formalism.

In CYRUS (Computerized Yale Retrieval and Updating System) Episodic Memory Organization Packets ("EMOPs") are used to organize events.[63] Descriptions of statutory events could be organized in EMOP structures according to their differences and could be accessed on that basis. TAU-like abstractions and EMOPs could help CCLIPS determine what legal effects follow from facts presented to it. Abstractions could be drawn from the facts and then matched against the TAU-like abstractions that would be attached to the statutory components. A perfect match would flag the applicable statutory component. Statutory relevance could then be indicated by locating events through EMOPs.

Another potentially useful technique for CCLIPS is deforming descriptions that can be used to produce a modified state description network. This process deforms high level descriptions into lower level descriptions and then maps them into one another based on shared properties.[64] The deforming descriptions are then mapped into one another based on shared properties. A recently developed program called HYPO modifies descriptions of hypothetical cases to reach goals described in legal argumentation.[65] This program modifies hypotheticals in order to

62. C. HAFNER, *supra* note 34, at 65; McCarty, *supra* note 11, at 267-76.

63. *See* J.L. KOLODNER, RETRIEVAL AND ORGANIZATIONAL STRATEGIES IN CONCEPTUAL MEMORY: A COMPUTER MODEL 194-98 (1984); Kolodner, *supra* note 24, at 228.

64. *Compare* McCarty, *supra* note 36, at 868-70; McCarty & Sridharan, *supra* note 36, at 246.

65. *See* Ashley, *Reasoning by Analogy: A Survey of Selected A.I. Research with Implications for Legal Expert Systems*, in COMPUTING POWER AND LEGAL REASONING 105 (C. Walter ed. 1985); Rissland, *Argument Moves and Hypotheticals*, in COMPUTING POWER AND LEGAL REASONING 129-43 (C. Walter ed. 1985); Rissland, Valcarce & Ashley, *Explaining and Arguing with Examples*, 1984 PROC. NAT'L CONF. ON ARTIFICIAL INTELLIGENCE 288-94.

strengthen the analogy between them and target cases in the data base. Similar techniques could be employed in CCLIPS because the system will be called upon to deform facts to match antecedents in the data base. In such cases, the facts presented could be viewed as exemplars or hypotheticals that are deformed to achieve retrieval goals.

The CCLIPS project also hopes to benefit from research conducted in the deontic realm of permissions and obligations.[66] The role of deontic operators in ordinary legal discourse has been the topic of much recent discussion.[67] Because CCLIPS expands high-level representations into basic representations, its developers are particularly interested in the work being done in this area. Once a basic set of permissions and obligations is established, CCLIPS can provide a foundation that will accommodate expansions of high-level representations of legal relations.[68]

The most useful techniques for automating the legal domain in the long run will result from research in the area of cognitive modeling. Cognitive modeling is an experimental computational approach intended to provide insight into human cognitive skills.[69] Long-term research goals for cognitive modeling are directed toward the production of process models for the representation of everyday thoughts and the understanding of everyday situations.[70] This includes the creation of models for the ordinary processes of comprehension, story understanding, question answering, reasoning, planning, argumentation, and debate.[71] Since legal concepts and processes are primarily rooted in ordinary concepts and processes,[72] progress made toward reaching the aforementioned goals would complement the work being done in the legal realm.

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66. *See* Allen, *supra* note 41, at 1-61; Borchgrevink & Hansen, *SARA: A System for the Analysis of Legal Decisions*, in A DECADE OF COMPUTERS AND LAW 342 (1980); McCarty, *From Permissions & Obligations*, in COMPUTING POWER AND LEGAL REASONING 573 (C. Walters ed. 1985).

67. *See* Bing, *Deontic Systems—A Sketchy Introduction*, in A DECADE OF COMPUTERS AND LAW 299 (1980); McCarty, *supra* note 66, at 573; Sanchez-Mazas, *Sistemas Normativos, Sistemas de Bertalanffy Y Redes Numericas Binarias*, 16 PROC. THIRD INT'L CONG. ON THEME: L'INFORMATICA GIURIDICA E LE COMUNITA NAZIONALI ED INTERNAZIONALI (SESSION III) 1-49 (1983).

68. McCarty, *supra* note 11, at 271-72; McCarty & Sridharan, *supra* note 36, at 250.

69. Dyer & Flowers, *Toward Automating Legal Expertise*, in COMPUTING POWER AND LEGAL REASONING 65 (C. Walter ed. 1985) (description of current research concerned with the design and implementation of computer programs capable of modeling various aspects of the cognitive processes of legal experts).

70. *Id.* at 65.

71. Rissland, Valcarce & Ashley, *supra* note 65, at 288-94 (legal reasoning and argument); J.L. KOLODNER, RETRIEVAL AND ORGANIZATIONAL STRATEGIES IN CONCEPTUAL MEMORY 22-23 (1984) (theory of remembering); Ashley, *supra* note 52, at 105 (analogy); Studnicki, *The Computational Aspects of Legal Interpretation*, in COMPUTING POWER AND LEGAL REASONING 157 (C. Walter ed. 1985) (comprehension and interpretation).

72. deBessonet, *supra* note 27, at 47-63.

The following Subsections describe the original versions of ANF and CCLIPS and the ways in which those versions are being improved. The techniques discussed above may prove quite useful in furthering efforts to improve ANF and CCLIPS.

2. *Original ANF*

The original version of ANF was used in the prototype of CCLIPS. The expression of information in ANF involved converting the information into a set of basic (atomic) statements configured strictly in accordance with a set of syntactical rules. Thus, the resulting atomic statement consisted of a statement expressed in a basic syntactical form. Some of the forms used are:

(1) <SUBJECT> IS <SO & SO>;[73]
(2) <SUBJECT> HAS <SO & SO>;
(3) <SUBJECT> CAUSES: <SUBJECT> IS <SO & SO>
AND/OR
<SUBJECT> HAS <SO & SO>
AND/OR
<SUBJECT> <VERB> <SO & SO>;
(4) <SUBJECT> <VERB> <SO & SO>;
(5) THERE IS <SO & SO>;
(6) <SUBJECT> INTERFERES-WITH <SO & SO>;
(7) <SUBJECT> MAY <VERB> <SO & SO>; and
(8) <SUBJECT> MUST <VERB> <SO & SO>.

The most basic statement-form used in ANF was the following four-slot unit:

(<subject><verb><object><indirect object>).[74]

This type of statement was produced by instantiating the subject and verb slots of the four-slot unit. Each of the four-slots could be instantiated with an atom (single word) or with a complex piece of information. Complex instantiations were referred to as clusters and were associated with particular slots. Each cluster had a root term, consisting of

73. The context of the expression SO & SO, once instantiated, would consist of whomever or whatever is to be taken as the subject. *Id.* at 55.

74. These slots were instantiated with the contents of atomic statements created by a manual normalization process. *Id.* at 47-63; deBessonet, Hintze, & Waller, *supra* note 60, at 9-12.

the corresponding primary subject, verb, object, or indirect object of the statement that was being parsed into the slots.

The statement:

A lessee improved the property under lease

could be parsed into the basic four-slot unit to produce:

((LESSEE IMPROVED LEASED-PROPERTY) AT T_1)

The expression "AT T_1" in this representation is a temporal description. All verbs were initially represented in the present tense along with temporal indicators that could be used to determine tense. In this example, "T_1" would have been associated with the described act of improvement so that, with reference to any "T_x" after T_1, the verb "IMPROVE" would have represented past action.

A cluster resulted when a root term was modified by one or more terms or expressions. If the original expression had read, "A lessee completely improved the property under lease," the expression would have contained a verb cluster. The resulting ANF expression would have read:

((LESSEE (IMPROVE (COMPLETELY)) LEASED-PROPERTY) AT T_1).

The subexpression "(IMPROVE (COMPLETELY))" is a verb cluster.

It was also possible to place verb modifiers at the end of a sentence. For example, the statement above could have been expressed as follows:

(((LESSEE IMPROVE LEASED-PROPERTY) (COMPLETELY)) AT T_1).

Negation in ANF was represented by the word "NOTCASE."[75] The negation of the original statement given above would have read:

(NOTCASE ((LESSEE IMPROVE LEASED-PROPERTY) AT T_1)).

Complex sentences could also be represented in ANF. In general, a complex sentence refers to one or more embedded states or events. An event description, for example, could occupy the subject position in an ANF expression. The statement "A lessee improved the property under

75. NOTCASE means "it is not the case that."

lease, which pleased the lessor," could have been represented in ANF as:

((LESSEE IMPROVE LEASED-PROPERTY) PLEASE LESSOR).

The subject position in this statement is occupied by an event-description, that is, the improvement of the leased property by the lessee. Thus, with the addition of appropriate temporal information, the ANF representation would read:

((((LESSEE IMPROVE LEASED-PROPERTY) AT T_1))
PLEASE LESSOR) AT T_2)
(T_1 <= T_2))

This indicates that the lessor became pleased either at the same time the event occurred or at some time after the event occurred. The following simple temporal scheme was employed:

(T_x = T_y) = (T_x equal to T_y);
(T_x < T_y) = (T_x before T_y);
(T_x > T_y) = (T_x after T_y);
(T_x <= T_y) = (T_x before or equal to T_y); and
(T_x >= T_y) = (T_x after or equal to T_y).

In addition to representing equality, the symbol "=" is used to represent identity. Thus, the expression:

BATON ROUGE = CAPITAL OF LOUISIANA

would have identified Baton Rouge as the capital of Louisiana.

The original version of ANF was designed for the Civil Code rules, which were represented in ANF formalisms. For example, the text of Article 536 of the Civil Code of Louisiana Code reads:

> **Article 536. Consumable things.** Consumable things are those that cannot be used without being expended or consumed, or without their substance being changed, such as money, harvested agricultural products, stocks of merchandise, foodstuffs, and beverages.[76]

76. LA. CIV. CODE ANN. art. 536 (West 1980).

Its "if . . . then" ANF counterpart reads:

```
(ART 536
((if ((there is thing-x) (thing-x (is or AKO)
        (thing (consumable))))
then ((if (((something-x-n use thing-x)(normally)))
      then ((something-x-n (burden (consume or expend))
              thing-x)))
                  or
      (if ((thing-x has substance-x)((something-x-n use
              thing-x) (normally)))
      then ((((something-x-n use thing-x) (normally)) change
              substance-x)))))

(if ((there is thing-x)(((something-x-n use thing-x) (normally))
        (burden (consume or expend)) thing-x))
then ((thing-x (is or AKO) (thing (consumable)))))

(if ((there is thing-x) (thing-x has substance-x)
        (((something-x-n use thing-x)(normally)) change
        substance-x))
then ((thing-x (is or AKO)(thing (consumable)))))
        (((thing (consumable)) (example-of))
                = (money or ((products (agriculture)) (harvested))
                  or foodstuff
                  or beverage
                  or (stock (of merchandise))
                  or (perhaps (merchandise)).
```

3. *Inadequacies of Original ANF*

The lack of a sophisticated temporal representation scheme was the principal inadequacy of Original ANF. Quite often sequences of events will activate legal rules. The antecedent of the rule may be viewed as a narrative description of the factual situation that will activate the rule. Narrative components of legal rules are usually stated concisely. Since each antecedent of this kind implicitly or explicitly describes a sequence of events, it follows that episodic units can be distinguished within each antecedent.

This characteristic of some antecedents increases the importance of temporal representation in ANF. The original version of ANF was somewhat weak in its ability to represent temporal relations.[77] It did not

77. The power of ANF to represent temporality has been increased significantly over the last two years. For a brief overview of the temporal representation scheme used in

differentiate between points and intervals, allowing only general temporal flags to be attached to events. Notions of sequentiality could be represented, but notions such as simultaneity were difficult to represent.

4. Original CCLIPS

The foregoing discussions point out that CCLIPS must be able to detect the nature of knowledge types to decide how they should be processed. Once CCLIPS determines the type of knowledge it is dealing with, it knows where to find appropriate formalisms to build new knowledge representations. CCLIPS does this by instantiating the formalisms with the information given and by manipulating the results to perform intelligent operations. This Section describes this process as implemented in the original version of CCLIPS using causality as a model.

The original goal of the CCLIPS project was to build a system that could perform conceptual retrieval[78] from a data base of Civil Code information.[79] The data base of the CCLIPS prototype consisted of processed ANF representations of Civil Code articles. ANF expressions were first parsed into formalisms that bore the general structure given below:

(<Subject Slot>
<Object Slot>
<Indirect Object Slot>
<Verb Slot>
<Semantic Slot>
<Index Slot>).

The "Subject," "Object," "Indirect Object," and "Verb" slots of this structure received the corresponding root components of atomic ANF statements. The "Semantic Slot" was filled with semantic information about the verb in the "Verb Slot." This semantic information was derived from a verb lexicon. The information in the verb lexicon was processed to produce a set of semantic inferences. These semantic inferences were encoded into semantic slots for access by memory search. The "Index Slot" was filled with information used to map the content of the other slots into appropriate articles of the Civil Code.

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the current version of ANF see *infra* pp. 379-82.

78. Conceptual retrieval is discussed in McCarty, *supra* note 11, at 265.

79. The CCLIPS prototype processed statutory information encoded in the original version of ANF.

Complex ANF statements that contained embedded descriptions of one or more states or events were parsed into a different formalism in which the relations among components were defined less precisely than was done for atomic statements. The formalism bore a structure similar to the one diagramed below:

(<Entity Slot-1>
<Entity Slot-2>
<Entity Slot-3>
<Verb Slot>
<Semantic Slot>
<Index Slot>).

Note that the "Entity" slots in this formalism do not describe the nature of the relations between the entities or expressions that fill the slots. The relations between the contents of the slots were defined in the programs that processed the formalism. The content of "Entity Slot-1" was related to the elements of "Entity Slot-2" and "Entity Slot-3" through the elements contained in the "Verb Slot."

For example, the ANF expression:

((LESSEE IMPROVE LEASED-PROPERTY) PLEASE LESSOR)

would have been represented in the database (except for indexing and semantic information) as:

((LESSEE ;Entity Slot-1	LESSEE	LEASED-PROPERTY)
(LEASED-PROPERTY ;Entity Slot-2	LESSOR	LESSOR)
(NIL ;Entity Slot-3	NIL	NIL)
(IMPROVE ;Verb-Slot	UPSET	PLEASE)

Several things should be noticed about this data structure. As just indicated, it relates the contents of "Entity Slot-1" to the contents of "Entity Slot-2" and "Entity Slot-3" through the contents of the "Verb-Slot." The original statement, which is complex, has been transformed into a set of noncomplex relations, each of which can be represented by

an atomic statement. The three atomic structures embedded in the instantiated formalism are:

(1) (LESSEE IMPROVE LEASED-PROPERTY);
(2) (LESSEE PLEASE LESSOR); and
(3) (LEASED-PROPERTY UPSET LESSOR).

As can be seen by comparing these atomic statements with the original input,

((LESSEE IMPROVED LEASED-PROPERTY) PLEASE LESSOR),

some of the relations produced by the process described above are not necessarily implied by the original input. For example, the process would have related "LEASED-PROPERTY" to the "LESSOR" through the verb "PLEASE," yet the inference "LEASED-PROPERTY PLEASE LESSOR" does not seem to be directly and necessarily implied by the original input. Most people, however, would recognize that there is some kind of relation between the leased property and the lessor that has something to do with the emotional state created in the lessor. The prototype of CCLIPS would not have attempted to classify the nature of that connection.

5. New Strategies for CCLIPS

It is important to note that because the original version of CCLIPS did not attempt to classify the nature of relations between components of ANF statements, it acquired a somewhat shallow understanding of the information it read. The new strategies used in CCLIPS attempt to classify connections of this sort by generating a penumbral set of causal inferences to surround each causal statement. For instance, PLEASE in the example above would carry an indication of the nature of the relation between the LESSOR and the LEASED-PROPERTY.

The new strategies designed for deeper understanding of text enable CCLIPS to understand the nature of relations between knowledge components. For example, the meaning of a statement that describes an event is defined in part by the relations evidenced by the causal structure of the statement. Therefore, to understand the meaning of the statement, CCLIPS must understand the causal relations described or otherwise implied by the statement.

CCLIPS understands causal relations by knowing and recognizing a statement's causal structure. The process of understanding consists of

instantiating and expanding formalisms that match the causal structure of the statement.[80]

III. NOTATIONAL CONVENTIONS

This Section discusses the notation used for the complex syntactical examples discussed in Section II. Since the notation used in the original version of ANF differs from the current version, the differences between the two forms are noted.

A. Notation Used in Original ANF to Represent Variables

In the original version of ANF, any expression that functioned as a variable was flagged as such by an uppercase letter appended by a hyphen to the end of the expression. In the expression LESSEE-X, LESSEE would have functioned as a variable and could have been instantiated by any constant or variable that met the criteria for a lessee. The same uppercase letter could be used to flag different variables. To indicate that a variable could be instantiated by one or more constants or variables, the letter N was appended by a hyphen to the uppercase letter that flagged the expression as a variable. The expression "LESSEE" in "LESSEE-X-N," for example, could have been instantiated by one or more constants or variables that satisfied the criteria for a lessee.

B. Notation Used in Current Version of ANF to Distinguish Types

In the current version of ANF, the following notational scheme has been adopted to distinguish types from individuals. The scheme bears some similarity to conceptual graph notation[81] which maps function type concepts onto a set T, whose elements are called type labels.[82] Type labels represent generic terms; they specify some attribute of the things or acts referred to. A generic term applies equally well to whatever has the specified attribute.[83]

In ANF, the generic term "lessee" would be represented by the type label LESSEE. Type labels in ANF are written in uppercase character strings. Subscripted, smallcase letters attached to type labels function as generic markers in ANF. The expression $LESSEE_x$ thus refers to an

80. See Appendix D for a more detailed description of causal inference generation and other types of causal connections such as the connection between the LESSOR and the LEASED-PROPERTY in this example.

81. *See* J. SOWA, CONCEPTUAL STRUCTURES: INFORMATION PROCESSING IN MIND AND MACHINE 69-122 (1984).

82. *Id.* at 49-83.

83. *Id.* at 84-87.

unspecified individual of type LESSEE and may be read "some lessee x" or "a lessee x." The subscripted, smallcase letters also serve a cross-referencing function. If different smallcase letters are attached to identical type labels, the expressions refer to different, unspecified individuals unless the contrary is indicated by an explicit representation of equivalence. Representations of equivalence override conflicting representations.[84]

Multiple occurrences of the same expression, including type label and subscript, refer to the same individual. When the same subscript is attached to two or more different type labels, they refer to the same individual, which in such a case would conform to both type labels. The expressions $LESSEE_x$ and MAN_x refer to the same individual, who is both a lessee and a man. By default, a type label that has no subscript implicitly carries a generic marker. The expression LESSEE thus refers to some unspecified individual of type LESSEE.[85]

If in a given context the same type label appears without subscript on multiple occasions, the label implicitly carries the same generic marker and thus refers to the same unspecified individual. When two or more different type labels have no subscripts, they are presumed to carry different generic markers unless the contrary is indicated by an explicit representation of equivalence.[86]

Finally, a relation of conformity is assumed to exist between a marker and its label. Thus, the expression $LESSEE_x$ implies that the unspecified individual x conforms to the type LESSEE.

C. Notation Used in Current Version of ANF to Distinguish Individuals

Subscripted numbers attached to type labels function as surrogates[87] or individual markers.[88] They refer to particular individuals. Thus, the expression $LESSEE_{151}$ refers to a particular individual of type LESSEE.

For notational convenience, proper names are expressed in the same form as type labels but refer to particular individuals. Any place a proper name appears in the notation CCLIPS assumes that the proper name uniquely identifies the individual to which it refers. Just as the

84. For example, the expressions $LESSEE_x$ and $LESSEE_x$ refer to different, unspecified individuals unless it is given explicitly that $LESSEE_x = LESSEE_x$.

85. J. SOWA, *supra* note 81, at 84-87.

86. The expressions LESSEE and LESSOR thus refer to different unspecified individuals because they are presumed to carry different generic markers.

87. *See* Codd, *Extending the Database Relational Model to Capture More Meaning*, 4 ACM TRANSACTIONS ON DATABASE SYSTEMS 397, 397-434 (1979).

88. *See* J. SOWA, *supra* note 81, at 84.

expression $LESSEE_{110}$ may be used to refer to a particular individual named John who is a lessee, the expression JOHN may be used to refer to that same individual. In such a case the expression JOHN is not a type label although it is expressed in uppercase letters. This Article uses popular names so that the reader will not confuse names with type labels.

D. Notation Used in Current Version of ANF to Represent Variables

When a type label is preceded by the "?" symbol, the expression functions as a variable and may be instantiated by any constant or variable that conforms to the type label. Variables are represented this way in the ANF formalisms, whereas generic marker notation is used in the ANF descriptions of "facts." The expression ?LESSEE is a variable that may be instantiated by any constant or variable that conforms to the type LESSEE. When different uppercase letters are attached to identical type labels of variables, the same constant or variable cannot be used to instantiate the variables unless there is an explicit indication of equivalence. The expressions ?LESSEE-X and ?LESSEE-Y may not be instantiated with the same constant or variable. When the same uppercase letter is attached to identical type labels, the instantiation of one such variable by a given constant or variable requires the uniform instantiation of the others by the same constant or variable.

Because generic terms are like variables in that they represent unspecified individuals of a given type, CCLIPS treats generic-marker notation as variable notation when performing certain matching operations. By doing so, it is able to match one ANF representation with another through instantiation. When an expression bears a generic marker and is used in a representation of a rule, CCLIPS treats the expression as a variable. CCLIPS is thus able to match descriptions of facts with antecedents of rules. For example, through instantiation, the fact-description

$$LESSEE_y \text{ IMPROVES } LEASED\text{-}PROPERTY_z$$

can be made to match the antecedent of the following rule:

$$\text{IF } LESSEE_w \text{ IMPROVES } LEASED\text{-}PROPERTY_x$$
$$\text{THEN } LESSEE_w \text{ HAS } RIGHT_y.$$

The match is achieved by treating the expressions $LESSEE_w$ and $LEASED\text{-}PROPERTY_x$ of the antecedent of the rule as variables, each of

which may be instantiated by any constant or variable that conforms to the variable's type label. Thus, the expression $LESSEE_y$ of the fact description matches the expression $LESSEE_w$ of the rule because the unspecified individual "y" referred to by the expression $LESSEE_y$ is of type LESSEE, which is precisely the condition that must be fulfilled for a valid instantiation of $LESSEE_w$ to occur. The expression $LESSEE_w$ is treated as if it were the variable ?LESSEE, which may be instantiated by any variable or constant that conforms to the type label LESSEE. The "y" of the expression $LESSEE_y$ of the fact description is treated as a variable that conforms to the type label LESSEE and thus may be used to instantiate the generated variable ?LESSEE.

E. Special Notation Adopted for Readability

For the convenience of the reader, the numerous examples presented in the following Sections are encoded in a version of ANF that is more readable than the one actually processed by CCLIPS. In the examples, generic or individual markers are sometimes attached to expressions as subscripts. In the version processed by CCLIPS, the markers are not imploded to the ends of expressions, which would necessitate numerous exploding operations during processing, but are set apart from them and are processed separately.[89] The connectors "and" and "or" used in the notation should be understood in their normal senses, not as LISP operators.

IV. REPRESENTATION OF FACTS AND LAW IN ANF

CCLIPS must be able to analyze fact descriptions of the sort encountered by lawyers in practice in order to operate effectively in the legal domain. Since lawyers analyze world situations in search of legal effects, CCLIPS must be able to do the same. CCLIPS thus requires a rich assortment of available techniques to understand reports about ordinary facts and the relations between them, both of which are primary components of real-world knowledge. This Section discusses the representations of facts and law in ANF, using causality as a model.

89. The morphology of a word can be obtained by an exploding operation. Since the morphology of a word depends upon the spelling of the word, it is necessary to break up a word into letters. This exploding operation takes a word and returns a list of letters. For example, the command "explode boys" produces "b o y s." Next, suppose you want the dictionary definition of "b o y s," or "b o y." This can be done by imploding the letters "b o y" to "boy" in order to ask a dictionary for the definition. *See* E. CHARNIAK & D. MCDERMOTT, INTRODUCTION TO ARTIFICIAL INTELLIGENCE 187-88 (1985).

A. Causality

Causality is one of the most important real-world phenomena that CCLIPS will have to understand to operate principles of causality that are defined or otherwise recognized by law—to be able to give sound legal advice. The notions of "proximate cause" and "remote cause" are widely known in the legal community.

Because of the importance of causal notions in law, ANF has been designed as an action-oriented language so that these notions can be represented in a form that CCLIPS can handle with convenience. ANF uses a primitive model of causality to represent the cause-effect relationships of the real world, and it uses this same model to represent other notions of causality, such as legal causality.

1. *Representing Causality*

The representation of causality bears heavily upon the intelligence of CCLIPS because CCLIPS uses knowledge of causal structures not only to recognize causal relations in parsing, but also to build an in-depth understanding of the information it reads. Representations of events written in ANF describe the essential causal features of those events in a way that enables CCLIPS to recognize their presence; however, the mere recognition of those features does not constitute a deep understanding of them. CCLIPS therefore must build an in-depth understanding by using the knowledge of causality available to it. It accesses causal formalisms as part of an instantiation and expansion process and generates inferences from those expansions using a built-in causal logic. Without its knowledge of causal structure, CCLIPS would not be able to perform these operations.

When thinking of ordinary cause-effect relations, one normally conceives of something causing a result or state of affairs. The "something" that brings about the result is sometimes called the "agent,"[90] and the result itself can be referred to as the "end-state." If a lessee causes property under lease to be improved, the lessee may be thought of as the agent that brought about the end-state, that is, the improved state of the property.

90. Although one may normally think of the agent in a causal relation as something that acts consciously to bring about the result, this Article uses "agent" in a broader sense to include anything that is responsible, in some way, for bringing about an end-state. This conception allows ANF to accommodate a wide range of phenomena by using a simple causal formalism, even though those events do not entail agents that have acted consciously. An example of such an agent would be a painting that would cause someone to be delighted at the mere sight of it.

The syntax for representing causal events contains sundry symbols for representing participants and causal relations. A primitive causal statement in ANF consists of a unary subject linked to a unary object by a causal link. More complex causal statements consist of multiple or complex subjects or objects joined by one or more causal links. The most basic causal formalism is represented in ANF as:

(?A CAUSE ?B).

In this representation "?A" occupies the "agent" or "subject" position in the relation, and "?B" occupies the "end-state," "product," or "object" position. The expressions "?A" and "?B" function as variables and may be instantiated with representations of entities, states, or events.[91]

a. Entities: Persons and Things

Persons and things are represented in a causal formalism as a single unit—an entity—or as a set of units—a cluster. A reference to two persons, say John and Mary, constitutes reference to a cluster consisting of John and Mary.

b. States

States are represented in state-description formalisms. The basic formalism used to represent states is:

(<Subject> <Verb> <So & So> {TOWARD <So & So>})

where the "<Verb>" is either HAS or IS and the directional expression TOWARD <So & So> is optional. Each of the following expressions represents this formalism:

(LESSOR IS PLEASED);
(LESSOR HAS PATIENCE);
(LESSOR IS TALL); and
(LESSOR IS ANGRY TOWARD LESSEE).

91. See Appendix B for types of items that can be instantiated into causal formalisms.

c. Events

Event descriptions in ANF denote action and imply the existence of at least one causal link. Events define the causal relationship between an agent and an end-state and are taken to be any relation between entities, states, or subevents that contains or implies a causal link. Each of the following expressions represents an event:

(LESSEE CAUSED (LESSOR IS PLEASED));
(JOHN CAUSED (MARY IS HAPPY)); and
((JOHN CAUSED (MARY IS HAPPY)) CAUSED (JACK IS GRATEFUL)).

Event descriptions include any statement that contains an action verb. These action verbs can be converted into a statement that contains a causal link. For example, the statement:

(LESSEE PLEASED LESSOR)

can be expanded into the following statement that contains the causal link CAUSED:

(LESSEE CAUSED (LESSOR IS PLEASED)).

Voluntary personal acts can also be described as an event. These personal acts are represented by referring to the same entity, state, or event both in the subject position and in the END-STATE position of a causal statement.[92] The representation of

(JOHN MOVED)

would be

(JOHN CAUSED (JOHN HAS MOVED)).

d. Beliefs

Both physical and mental causation can be represented conveniently in ANF. Mental activities are represented by statements that have the following general structure:

92. Conceptual dependency uses a similar technique. R. SCHANK & C. RIESBECK, INSIDE COMPUTER UNDERSTANDING 10-26 (1981).

(<Subject> <Mental Act> (<Product of Mental Act>)).

The ANF statements:

(LESSEE BELIEVES (<So & So>))[93]
(LESSEE INTENDS (<So & So>))

are partial instantiations of this structure. Also note that mental activities can be interpreted as the causes of some physical acts.[94]

2. *Causal Links*

The nature of the relationship between an agent and an end-state varies with the circumstances. In the law, for example, there are some relationships in which the agents are considered to be mere remote causes of the end-states. Any lawyer knows that the relations in those cases differ significantly from ones in which the agents are found to be proximate causes of the end-states.[95] The differences, of course, are partly defined by the legal consequences that result from each type of relationship.

Because causal relationships differ, the causal representation language used in CCLIPS must be able to capture differences in a way that will enable the system to detect them and to go about its business of trying to understand them. The representational devices used in ANF to represent these differences are called "causal links." They consist of special symbols designed for use in particular causal situations. CCLIPS is being designed to recognize thousands of types of causal connections. This Section discusses six factors used to distinguish causal connections and defines and otherwise describes some of the more important ones.

a. Proximate and Remote Cause

ANF distinguishes proximate cause (PROX-CAUSE) and remote cause (REM-CAUSE) by noting the position of the agent in relation to the end-state. In a causal representation, the position that is closest to

93. The "So & So" segments of these expressions represent mental possessions, such as beliefs and intentions.

94. R. SCHANK & C. RIESBECK, *supra* note 92, at 28-29.

95. Proximate cause is the limit courts place on an actor's responsibility for the consequences of his actions. Theoretically, the consequences of an act can be traced backwards in time to the "dawn of human events" and forwards in time to eternity. Legal cause is limited to causes so closely connected to the result that the law is justified in imposing liability. W. PROSSER & P. KEETON, HANDBOOK OF THE LAW OF TORTS 264 (5th ed. 1985).

the end-state is the proximate cause. For example, in the ANF expression:

((MATCH CAUSES FIRE)(FIRE CAUSES SMOKE))

the proximate cause of the smoke is the fire. The match is the proximate cause of the fire but only the remote cause of the smoke.

b. Contributing Cause

The contributing cause (CONTRIB-CAUSE) link in ANF represents the nature of the participation of the agent in the causal act as either a solitary or joint agent. Whenever a particular frame of reference is not the sole cause of the end-state, the agent is taken to be a mere contributing cause of the end-state. If two persons each put one quart of water into a bucket, each person contributed to cause (in ANF, CONTRIB-CAUSED) the bucket to contain two quarts.

c. Enabling Cause

ANF defines the relation of one causal act to another is defined in terms of how the acts bring about the end-state. This is represented by the ENABLING CAUSE (ENAB-CAUSE or ENC) link. When something is used by another to bring about an end-state, the causal relation may be described as one of enablement.[96] In EXAMPLE-1, if the lessee used tools to improve the property, the tools would be the enabling cause (ENAB-CAUSE) of the end-state: "lessor is pleased." The tools enabled the lessee to improve the property under the lease.[97]

d. Create Cause

The nature of the end-state as either a "created product" or "other results" is represented by the CREATE-CAUSE link. This identifies the relation between a "creator" and a "product." For example, to represent the idea that a lawyer produced a memorandum, the following ANF statement might be used:

(LAWYER CREATE-CAUSE MEMO).

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96. R. SCHANK & C. RIESBECK, *supra* note 92, at 28-29.

97. The relation of enablement is broken down into two categories when a system or machine performs a function that brings about an end-state. First, activation (ENAB-ACTIVATE-CAUSE) occurs when a person turns on a switch that starts a machine and the machine performs a task. The person enabled the machine to perform the task by activating it. Second, activation and operation (ENAB-OPERATE-CAUSE) occur when a person activates a machine and operates it to bring about an end-state. In this case, there is a stronger participation by the acting party in the causal events.

CREATE-CAUSE is a special link that activates task-oriented processes in CCLIPS. These processes attempt to define the scope of activity that created the product. The processes activate "angels"[98] that examine the statement to find the point at which some part of the end product has been created.[99]

e. Possible Cause

The strength or weakness of the causal connection between the agent and the end-state is defined in terms of the degree of certainty that such a causal relation exists. This is represented by using the POSSIBLE-CAUSE (POSS-CAUSE) or MAYBE-CAUSE links. POSS-CAUSE and MAYBE-CAUSE are employed to show that a given causal link may represent one or more special causal relations that bring about an end-state. These links flag the possibility that there exists a causal connection between the agent and the end-state. When such a causal link description is generated as an inference, the inference is referred to as a "penumbral inference." These inferences are generated in accordance with special rules designed to produce inferences that do not follow by deduction but which are nevertheless useful.[100]

POSS-CAUSE and MAYBE-CAUSE links are the weakest causal links used in ANF; the weakness is rooted in the lack of certainty that a

98. "Angels" in CCLIPS serve the same purposes that "demons" serve in some other systems. Demons are delayed action knowledge processors. They wait until their test conditions are satisfied to execute their actions. Activated demons remain alive until: (1) the test condition is completed; (2) the test condition has been completed by another demon; or (3) the test condition no longer has any chance of being satisfied. M. DYER, *supra* note 19, at 165-66.

99. The scope of the creation process can be accessed as an independent knowledge structure. Such a knowledge structure may be used to understand relations among the entities referred to in the text. For example, if the creation of a part of a thing is a prerequisite to the creation of the whole thing and it is known that the crucial part never came into existence, it may be inferred that the thing never came into existence.

100. For example, the sentence "a lessee put a mailbox on the leased property" could be represented by:

(LESSEE CAUSED (LEASED-PROPERTY HAS MAILBOX)).

The above statement, in addition to implying that the lessee caused a state relation to exist between the leased property and the mailbox, could imply that the lessee also created the mailbox. Because the creation of a state relation may or may not entail the creation of one or more constituents of the relation, CCLIPS faces special problems when it attempts to process state descriptions. To solve this problem, CCLIPS generates inferences that are possibly valid to serve as representations of the special relations by accessing a special causal logic. Thus, to cover the possibility that a given causal link might represent only part of the creation process, a statement representing that part would be generated. Inferences of this kind ultimately may be represented by employing the POSS-CAUSE and MAYBE-CAUSE links and are referred to as "penumbral inferences." *See* Appendix D.

causal connection exists between the agent and the end-state. Whenever a segment of a representation that occupies the subject or agent position in a causal description is related to the end-state of that description, either a POSS-CAUSE or a MAYBE-CAUSE link is employed to represent the relation.

f. Principle Cause or Subsidiary Cause

The extent to which an agent contributed to bring about the end-state is represented by the PRINCIPLE-CAUSE (PRIN-CAUSE) or SUBSIDIARY-CAUSE (SUBS-CAUSE) link. The PRIN-CAUSE link implies that the agent was a substantial factor that brought about the end-state. The SUBS-CAUSE link implies that the agent was an influential, but not a substantial, factor that brought about the end-state. Thus, given that something is the principal cause of a particular end-state, all other causes would be subsidiary.[101]

3. *Causal Link Descriptors*

Causal links can be associated with other information that can be used to further clarify causal relationships. Causal links, along with descriptors, can serve as nodes to which information can be attached.

ANF uses verbs and causal links as one method of explaining the meaning of an act that produces an end-state. This method breaks the act into parts or subacts. ANF employs the symbol CONSISTS OF ("CO") to represent whole-part and act-subact relationships. For example,

(C CO (A AND B)

indicates that "C" consists of a set of acts that constitute "A" and "B."

Another method of explaining or describing causal links is to attach one or more clauses to them that describe how an end-state occurs. The expression BY MEANS OF ("BMO") is one expression used in ANF to introduce clauses of this kind.[102] BMO clauses may be attached to ordinary verbs and causal links. For example, the expression "lessee pleased lessor," can be represented in ANF by:

(LESSEE CAUSED (LESSOR IS PLEASED)).

101. The classifications of the causal links recognized in ANF overlap to some extent. For example, an agent that is in a proximate cause position to an end-state may share that position with another agent so that the causal link qualifies both as a PROX-CAUSE link and as a CONTRIB-CAUSE link.

102. *See* Appendix C.

This representation indicates that the lessee was the cause of the emotional state of the lessor. It does not, however, indicate what the lessee did to please the lessor (if anything). If it were known that the lessor was pleased because the lessee had improved the leased property, this could be added to the ANF representation by using a BMO description:

((LESSEE CAUSED BMO) (LESSEE (CAUSED BMO (LESSEE IMPROVE LEASED-PROPERTY)) (LESSOR IS PLEASED))).

If what pleased the lessor is a combination of events, for example, the cleaning and painting of the leased property, these events could be placed in a statement as follows:

((E1 = (LESSEE CLEANED LEASED-PROPERTY))
(E2 = (LESSEE PAINT LEASED PROPERTY))).

Then the whole idea could be represented as:

((LESSEE (CAUSED BMO CAE) (LESSOR IS PLEASED))
(CAE = (E1 AND E2))),

where CAE represents a cluster of acts, E1 and E2, that pleased the lessor.

ANF also provides for abbreviated descriptors for the means by which end-states are brought about. As noted above, BMO clauses may be instantiated with statements. In addition, the BMO clauses may be instantiated with verbs or other expressions that describe, in abbreviated form, the acts that were performed to bring about the end-state. In such a case, the expression VBMO is used to introduce the clause. For example,

(LESSEE (IMPROVED VBMO PAINTING) LEASED- PROPERTY)
= (LESSEE (IMPROVES BMO (LESSEE PAINT LEASED-
PROPERTY)) LEASED-PROPERTY).

Another abbreviated descriptor is the expression IN ACCORDANCE WITH ("IAW"). This descriptor is used to introduce clauses that refer to rules, standards, or criteria that somehow define, govern, or qualify the term modified by the clause. The ANF statement

(COURT-PROCEEDING (PROCEEDED IAW RULES-OF-
COURT))

represents the idea that a court proceeded in accordance with some rules (here represented by the expression RULES-OF-COURT).

IAW may also modify qualifiers. The statement

(CAR IS (GOOD IAW STANDARDS))

represents the idea that the car is good based on the standards referred to by the expression STANDARDS.

4. Applying Causal Representations

Causal representations are used by CCLIPS to make crucial decisions about the nature of knowledge types it encounters in parsing. CCLIPS builds deep models of knowledge types by generating successive causal representations in order to understand causal phenomena.[103] The best way to understand the importance of the roles that causal structures play in the CCLIPS environment is to consider how causal structure bears upon meaning.

The causal structure of a statement is an integral part of its meaning. The English expression "a lessee improved the property under lease" may be represented in ANF as follows:

((LESSEE CAUSED (LEASED-PROPERTY IS IMPROVED))
CAUSED (LESSOR IS PLEASED)).

The structure of the origninal English expression allows for the following interpretations:

(1) The improvement of the property may have been the crucial factor that caused the lessor to be pleased; or
(2) The fact that the lessee was involved in the event may have been the crucial factor that caused the lessor's emotional state; or
(3) Both the improvement of the property and the lessee's involvement may have been crucial factors that brought about the end-state.

Possibility (3) seems to best capture the meaning of the original expression. The ANF version of the original expression represents possibility (3). This is evidenced by the fact that

(LESSEE CAUSED (PROPERTY IS IMPROVED))

103. Section V, *infra*, describes how these techniques can be usefully employed in the legal domain.

is placed in the "agent" position in relation to the end-state. The causal structure of possibility (3) can be represented as follows:

((?A CAUSE2 ?B) CAUSE1 (?C IS ?D)).[104]

Possibility (1) above could be represented in ANF as follows:

((LESSEE CAUSED (LEASED-PROPERTY IS IMPROVED)) AND
((LEASED-PROPERTY IS IMPROVED) CAUSED (LESSOR IS
PLEASED))).

This representation could be instantiated into the following causal structure:

((?A CAUSE ?B) AND (?B CAUSE (?C IS ?D))).

This causal structure differs from the one given for possibility (3).

The structural differences distinguish the two possibilities. The causal structure of possibility (3):

((?A CAUSE2 ?B) CAUSE1 (?C IS ?D)),

when considered out of context, does not syntactically or semantically rule out the possibility that the CAUSE1 link represents one or more special causal relations. This is true because the link CAUSE may qualify as one or more of the special causal relations described above. To cover the possibility that the link CAUSE1 represents an act of creation, CCLIPS can replace the link CAUSE1 with the link CREATE-CAUSE1. This generation process may be carried out recursively. Thus, once CCLIPS generates:

((?A CAUSE2 ?B) CREATE-CAUSE (?C IS ?D))

as a causal structure, it could then generate other possible inferences, such as,

((?A CAUSE2 ?B) CREATE-CAUSE ?D).[105]

104. For convenient reference, numbers have been attached to the causal links in this diagram.

105. See Appendix D for a detailed description of the theory behind the generation process.

5. Abstractions Show Causal Relation

Often, detailed causal information cannot be translated into ANF because it is too complicated or too incomplete for CCLIPS to perform conceptual retrieval. For example, the idea of a car transporting a person can be represented by:

(CAR (TRANSPORTS BMO ?SOME-ACTS) PERSON).

In instantiating the variable ?SOME-ACTS, one must consider that an explanation of how a car is able to transport a person is very complex and entails an explanation of how a car engine operates. If an appropriate knowledge structure were not available, a representation of the operation of an engine would have to be created, which would mean that the causal chains involved would have to be represented explicitly. This is too burdensome a task to be feasible. One alternative would be to terminate the expansion process at this point. However, this would make the representational scheme too shallow. Another possibility would be to create an alternative representation to substitute for the detailed one.

When one wishes to avoid having to describe causal acts in detail, the causal acts may be described abstractly.[106] In the expression:

((LAWYER1 WROTE PART-MEMO-A)
(LAWYER2 WROTE PART-MEMO-B))

the cluster of acts that resulted in the end-states, MEMO parts "A" and "B," could be represented by CAE.[107] The actors that participated to produce the MEMOS, LAWYER1 and LAWYER2, could be represented by CE.[108] Then, the expression PARTICIPATES-IN can be used in ANF to represent participation by one or more actors in one or more events. The entire scheme above can be abstractly represented as:

(CE PARTICIPATES-IN CAE).

Instead of terminating the expansion process at the point at which one faces the task of creating a detailed representation of the chain, an abstract description of the chain can be created by using representational

106. M. DYER, *supra* note 19, at 29.
107. *See* Appendix B.
108. M. DYER, *supra* note 19, at 29.

devices. These types of descriptions may be instantiated into BMO slots in lieu of causal chain descriptions.

B. Goals, States of Arousal, and Mental Acts

CCLIPS uses a complex array of knowledge structures to build deep representations of emotional states and interpersonal relationships. The following Subsections describe how states and relationships can be represented in ANF.

1. *Descriptions of SOUL*

For purposes of describing psychological aspects of human beings in ANF, the inner being of a person is represented by SPIRIT and SOUL. Only the aspects of SOUL are described here since SOUL descriptions are sufficient for ordinary cognitive and arousal level representation. The SOUL of a person consists of mental possessions ("MPs"), emotions ("EMOTs"), attitudes ("ATTs"), desires ("DESs"), and feelings ("FEELGs"). The following primitive statements refer to these aspects of SOUL:

(?PERSON HAS ?MP);
(?PERSON HAS ?EMOT);
(?PERSON HAS ?ATT);
(?PERSON HAS ?DES); and
(?PERSON HAS ?FEELG).

SOUL also comprises mental acts such as thinking, believing, deciding, and setting goals. Subsection 2, *infra*, describes how a text processing system can use descriptions of psychological phenomena to understand the text it reads. Subsections 3 through 7, *infra*, describe how these aspects of SOUL are represented for CCLIPS. Examples of their use in the legal domain can be found in Section V, *infra*.

2. *Descriptions of Psychological Phenomena in Text Processing*

Like CCLIPS, some text processing systems perform functions using psychological factors. This Subsection briefly explains how BORIS builds an in-depth representational scheme of psychological phenomena in order to show how CCLIPS employs similar techniques when parsing psychological statements expressed in ANF.

In BORIS,[109] emotional reactions are represented in a knowledge structure called an AFFECT, which has six basic components:

(1) STATE (describes the emotional state as being either positive (POS) or negative (NEG));
(2) CHAR (identifies who experiences the emotion);
(3) G-SITU (refers to the goal situation that gave rise to the emotional state);
(4) TOWARD (optional) (identifies and object where the emotion is directed toward that object);
(5) SCALE (optional) (describes the intensity of the emotion);
(6) E-MODE (optional) (describes expectations that characters have about future or on-going outcomes).

In the AFFECT lexicon of BORIS, information about AFFECTs is cross-indexed with descriptions of goal situations. Complex AFFECTs can be decomposed to more basic AFFECTs. Examples of the kind of information that appears in the lexicon of BORIS are presented below.[110]

Lexical items:	happy, joyous
Affect Info:	(AFFECT STATE (POS) CHAR x G-SITU (a))
Goal Situation (a):	goal of x achieved
Lexical items:	grateful, thankful
Affect Info:	(AFFECT STATE (POS) CHAR x G-SITU (b) TOWARD y)
Goal Situation (b):	y caused goal situation (a) to occur.

If BORIS were to encounter the word "grateful" in parsing, the AFFECT information associated with that word would be activated. Thus, goal situation (b), "y caused goal situation (a) to occur," would be activated. In turn, this would activate the goal situation (a) because goal situation (b) explicitly refers to goal situation (a).

BORIS interrelates emotional states, goal situations, interpersonal themes ("IPTs"), and thematic abstraction units ("TAUs") to produce

109. *Id.* at 105-06.
110. *Id.* at 107.

knowledge structures that can be accessed to answer questions about the emotional reactions of characters in the narratives it reads.[111] The interaction of these AFFECTs, GOALs, TAUs, and IPTs enables BORIS to build an in-depth representational scheme. CCLIPS employs similar techniques when parsing statements expressed in ANF. Beliefs, intentions, goals, and emotional states are represented in a way that allows CCLIPS to recognize the connections between constituent expressions. The following Subsections describe how mental possessions, emotions, desires, and feelings are represented in a way that enables CCLIPS to carry on its operations.

3. *Representation of Mental Possessions*

Mental possessions are defined in CCLIPS as objects of mental acts. For example, something that a person believes may be classified as a mental possession ("MP"). The following simple formalism is used to represent MPs:

(<subject> HAS <MP>).

Statements that represent mental acts imply MP statements; thus, the act of believing referred to above would imply the following instantiation of the MP formalism:

(PERSON HAS BELIEF).

Subsection 6, *infra*, describes how the mental acts themselves are represented.

4. *Representation of Emotions, Attitudes, and Desires*

The general forms used to represent attitudes are:

(1) (<subject> HAS <attitude> TOWARD <object>),
(2) (<subject> IS <attitude> TOWARD <object>).

ANF allows for the nature of the attitude or emotion to be described. The following are five different multi-form representations of "John loves Mary":

111. *Id.* at 127-28.

(1) (JOHN LOVES MARY);
(2) (JOHN HAS ((ATT$_1$ POS) = LOVE) TOWARD MARY);
(3) ((JOHN HAS (ATT$_1$ POS) TOWARD MARY)
(ATT$_1$ = LOVE));
(4) (JOHN HAS ((EMOT$_1$ POS) = LOVE) TOWARD MARY);
(5) (JOHN HAS ((FEELG$_1$ POS) = LOVE) TOWARD MARY).[112]

Descriptions (2) and (3) treat "love" as an attitude, description (4) treats it as an emotion, and description (5) treats it as a feeling. The intensity of emotions, feelings, and attitudes may be indicated by attaching an intensifier to the description of the emotion, feeling, or attitude. To represent the idea that John loves Mary deeply, the intensifier DEEP could be used to represent the depth of the love. The following representation, which treats love as an emotion, makes use of the intensifier DEEP:

((JOHN HAS (EMOT$_1$ POS) TOWARD MARY)
(EMOT$_1$ = LOVE)
(EMOT$_1$ IS DEEP)).

CCLIPS has a lexicon of ordered intensifiers. "True love" and "deep love," for example, are more intense than mere "love." At the most basic level, intensifiers are encoded in symbols that represent the degree to which the referenced intensity is above or below the norm. A similar technique is employed in BORIS.[113]

The general formalism used to represent desire is:

(<subject> HAS <desire> {TOWARD <object>}).

The portion of the formalism within brackets is optional. Acts of desire are represented in the same way as are other mental acts.

5. Representation of Feelings

Feelings, attitudes, and emotions can be described as being positive ("POS"), negative ("NEG"), or neutral ("NEUT"), or as involving pleasure ("PLEAS") or pain ("PAIN"). The following ANF statements represent feelings:

112. Emotion can be described as positive ("POS") or negative ("NEG"). *See* Subsection 5, *infra*.
113. M. DYER, *supra* note 19, at 117.

(?PERSON HAS (?FEELG POS));
(?PERSON HAS (?FEELG NEG));
(?PERSON HAS (?FEELG NEUT));
(?PERSON HAS (?FEELG PLEAS)); and
(?PERSON HAS (?FEELG PAIN)).

Manifestations of SOUL are somewhat loosely related in ANF. Feelings, emotions, and attitudes overlap to some extent. A feeling of pain, for example, may be intimately connected with an emotional state or attitude. It is possible for a person to feel pain yet have a positive attitude about feeling that pain. On the other hand, a person who feels pain may, as a result, experience negative attitudes and emotions. ANF allows multi-form representation in this area.

In ANF, a statement about feelings does not necessarily contain the directional expression TOWARD because sometimes feelings are not directed toward anything but are merely experienced. Thus, the statement:

(JOHN HAS (FEELG POS))

is a legitimate ANF expression even though it does not contain the directional expression TOWARD.

6. Representation of Mental Acts

Mental possessions ("MPs") are the objects of mental activities such as a thinking and believing. Mental activities are described in ANF by statements in the form of:

(<subject> <mental-act> <object>).

The following ANF statements are instantiations of this structure:

(1) (JOHN BELIEVES (?MP));
(2) (JOHN INTENDS (?MP));
(3) (JOHN KNOWS (?MP));
(4) (JOHN CONSIDERS (?MP));
(5) (JOHN HOPES (?MP)); and
(6) (JOHN THINKS (?MP)).

The expression (?MP) in each of these statements represents a mental possession. For example, the (?MP) of statement (1) above represents a belief.

7. Intentions, Goals, and Decision Making

The actor's intent is often necessary to determine the legal effect of a given act.[114] In the law of torts, for example, intentional acts may produce effects that differ from those produced by acts of negligence.[115] An actor who intentionally inflicts injury on another may face criminal charges in addition to the liability for damages that may be assessed against him in a civil action brought by the victim.

One of the most important legal distinctions drawn in the area of intention is the one between objective and subjective intent. Many legal effects are activated not by what an actor actually intends but by what the actor's manifestations imply when viewed objectively.[116] In the contractual realm, for example, to determine whether an offer to enter into a bargain has been made, it must be determined whether the actor manifested a willingness to enter into a bargain and whether that manifestation was made so as to justify another person in understanding that his assent to the bargain was invited.[117]

ANF is flexible in its ability to represent mental possessions and acts. The natural language description,

John intends to go to the store

could be represented in ANF in a number of ways, among them:

(1) (JOHN INTENDS (JOHN GOES-TO $STORE_1$));

(2) ((JOHN HAS $INTENTION_2$)
($INTENTION_2$ = (JOHN GOES-TO $STORE_1$)));

(3) (JOHN HAS ($INTENTION_2$ = JOHN GOES-TO $STORE_1$)).

As in BORIS, intentions imply goals. Thus, to say that

(JOHN HAS $INTENTION_2$)

is to say:

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114. *See, e.g.*, W. PROSSER & P. KEETON, *supra*, note 95, at 33-39.

115. *Id.* at 33-36.

116. *See* A. CORBIN, CORBIN ON CONTRACTS §§105, 106, 538, 539 (1952).

117. RESTATEMENT (SECOND) OF CONTRACTS § 24 (1979). For an overview of the problems one is likely to encounter when attempting to model the law of offer and acceptance, see Gardner, *supra* note 54, at 114-18.

(JOHN HAS $GOAL_3$).

A goal-achievement representation in ANF has three basic parts: (1) a description of a goal; (2) a description of an attempt to achieve the goal; and (3) an indication of success. The idea that John achieved the goal of being inside a house could be represented as follows:

((JOHN HAS $GOAL_1$)
($GOAL_1$ = (JOHN IS (IN $HOUSE_2$)))
((JOHN ATTEMPTS $GOAL_1$) = $ATTEMPT_3$)
($ATTEMPT_3$ SUCCEEDS)).

A more detailed way of representing the same idea is:

(((JOHN INTENDS (JOHN CAUSES
(JOHN IS (IN $HOUSE_2$)))) CAUSE ($ATTEMPT_3$))
($ATTEMPT_3$ = (JOHN ATTEMPTS
(JOHN CAUSES (JOHN IS (IN $HOUSE_2$)))))
($ATTEMPT_3$ CAUSES (JOHN IS (IN $HOUSE_2$)))).

This represents the idea that John had an intention that caused him to attempt to carry out the intention and that his attempt was successful. The causal relation between the intention and the attempt can be explained by mental causality.[118] Actually, there is a missing link in the causal sequence described in this example. Between having a goal and actually attempting to achieve the goal is the act of deciding to engage in the attempt. The following is a representation of an act by which John wills an attempt to achieve $GOAL_1$:

((JOHN HAS $GOAL_1$)
(JOHN WILLS-ATTEMPT-AT $GOAL_1$)
((JOHN ATTEMPTS $GOAL_1$) = $ATTEMPT_3$)
($ATTEMPT_3$ SUCCEEDS)).

To produce a more explicit representation of the idea, representations of the causal connections between the acts should be added. For example, there is a causal connection between John's willing the attempt and the actual attempt. The connection may be represented as follows:

---

118. *See* R. SCHANK & C. RIESBECK, *supra* note 94, at 28-29.

((JOHN WILLS-ATTEMPT-AT $GOAL_1$)
CAUSES (JOHN ATTEMPTS $GOAL_1$)).

A model of decision-making can be added to the goal achievement model. ANF decision-making is a process by which a person considers alternatives and decides on a goal or intention. The general formalism used for decision-making is:

((?SUBJECT CONSIDERS <alternative-list>)
(?SUBJECT DECIDES-UPON <alternative(s)>)).

John's decision to go to a movie instead of to a store could be represented as follows:

((JOHN CONSIDERS
((JOHN ATTENDS $MOVIE_x$) (JOHN GO-TO $STORE_y$)))
(JOHN DECIDES (JOHN ATTENDS $MOVIE_x$))).

C. Temporal Representation

The importance of the ability of a legally oriented language to represent time was recognized in the LEGOL project.[119] Over the last decade, useful techniques for handling temporality have been developed by AI researchers.[120] Temporal calculi can be used to determine what events can take place within, before, or after any given time reference.[121] In the natural language processing realm, the technique of using reference events[122] and reference intervals[123] has proved to be a useful one. Networks of events[124] are established to formulate the basis for

119. Cook, Hafner, McCarty, Meldman, Peterson, Sprowl, Sridharan, & Waterman, *The Applications of Artificial Intelligence to Law: A Survey of Six Current Projects*, 1981 PROC. AFIPS NAT'L COMPUTER CONF. 693, 689-96; Jones, Mason & Stamper, *supra* note 37, at 293-305.

120. *See* Allen, *An Interval-Based Representation of Temporal Knowledge*, 1981 PROC. SEVENTH INT'L JOINT CONF. ON ARTIFICIAL INTELLIGENCE 221, 221-26; Findler & Chen, *On the Problems of Time, Retrieval of Temporal Relations, Causality, and Coexistence*, 2 INT'L J. COMPUTER & INFO. SCI. 161, 161-85 (1973); Hirschman, *Retrieving Time Information from Natural Language Texts*, in INFORMATION RETRIEVAL RESEARCH 154-71 (1981); Kahn & Gorry, *Mechanizing Temporal Knowledge*, 9 ARTIFICIAL INTELLIGENCE 87, 87-108 (1977); Long, *Reasoning about State from Causation and Time in a Medical Domain*, 1983 PROC. NAT'L CONF. ON ARTIFICIAL INTELLIGENCE 251, 251-54; Malik & Binford, *Reasoning in Time and Space*, 1983 PROC. EIGHTH INT'L JOINT CONF. ON ARTIFICIAL INTELLIGENCE 343, 343-45.

121. Findler & Chen, *supra* note 120, at 165.

122. Hirschman, *supra* note 120, at 158.

123. Allen, *supra* note 120, at 224.

124. Hirschman, *supra* note 120, at 156-66.

incorporating new events into the overall temporal scheme. A reference interval[125] may be defined for any given event to include all possible events to which the given event need be related. This technique seems particularly suitable for use in CCLIPS because CCLIPS uses reference intervals to define the scope of certain processes, such as the process of creation. Reference intervals may be changed incrementally[126] to maintain an ongoing sense of "now" and to lessen the task of updating since only those events that occur within a given reference interval at any given point need be updated.[127]

A system engaged in inferencing and matching can successfully employ temporal descriptions. For example, mutually exclusive temporal descriptions can disassociate incoming lexical items from other information in memory. Conversely, mutually exclusive conditions cannot be allowed to overlap in time.[128] This kind of information can be used to maintain consistency in the knowledge base[129] and to notify a user when an inconsistent fact is introduced.[130]

For CCLIPS to be able to employ the aforementioned techniques and to acquire an in depth understanding of the texts it reads, it will have to be able to recognize and understand the following:

(1) adverbial time expressions (e.g., "last week," or "yesterday");
(2) verb tenses;
(3) temporal connectives (e.g., "precedes," or "the result of");[131]
(4) changes in state (e.g., "Mary became well");
(5) narrative time progressions (e.g., whether events in a narrative are concurrent or progressive);[132] and
(6) imprecise references (e.g., "a while ago," or "recently").

Accordingly, ANF has been designed to allow explicit representation of temporal information at the surface level. The following subsection describes a set of primitive temporal concepts that can be combined to form more complex notions of time. The concept of "yesterday," for example, is a complex notion because one must understand the concepts of "day," "now," "sequence," "before" (and therefore "after" also), and

125. Allen, *supra* note 120, at 223.
126. *Id.* at 224-25.
127. *Id.* at 222.
128. Long, *supra* note 120, at 254.
129. Allen, *supra* note 120, at 223; Kahn & Gorry, *supra* note 120, at 98-100; Malik & Binford, *supra* note 120, at 344.
130. Kahn & Gorry, *supra* note 120, at 98-100.
131. Bruce, *A Model for Temporal References and Its Application in a Question-Answering Program*, 3 ARTIFICIAL INTELLIGENCE 1, 2-4 (1972).
132. Hirschman, *supra* note 120, at 164-66.

"consecutiveness" to be able to conceptualize the day that is sequentially before and consecutive to the current ("now") day.

1. Temporal Features of ANF

CCLIPS automatically assigns temporal descriptions[133] to entities and events when those descriptions are not given explicitly. In ANF, the expression TR is used to represent time references, including references to one or more points, intervals or chains. The expression:

OVER TR

when attached to an event description, signifies that the event occurred over the time reference TR. If the event consisted of subevents, the expression OVER TR implies that all the subevents occurred within the TR, but it does not imply that one or more of those subevents were in progress at each and every point within the TR. The expression:

FOR TR

indicates that the event to which the expression is attached was occurring at every point within the time reference TR.

Because events occur over time, CCLIPS generates an OVER TR description for every event unless another temporal description is given explicitly. Thus, the expression:

(PERSON ATE DINNER)

would be expanded to:

((PERSON ATE DINNER) OVER ?TR).

The expression ?TR stands for the time interval over which the eating took place, assuming of course that it took the person more than an instant to eat dinner.

133. ANF allows one to represent the following temporal concepts and relations at the surface level: points; intervals; chains; starting points of intervals; intersection of intervals; consecutive points, intervals, or chains; equal of points, intervals, or chains; disjointed points, intervals, or chains; and relations of inclusion and exclusion.

The letter T is used in ANF to refer to a point in time, whereas the letter I is used to refer to an interval of time. The expressions ST-PT and END-PT are used to represent the starting points and ending points of TRs. Relations between TRs are represented by temporal connectors. Some of the temporal connectors used in ANF are given below.

Connector	*Meaning*
B	before
A	after
C	consecutive
NC	not consecutive
IT	intersects/overlaps
BC	before and consecutive
AC	after and consecutive
BNC	before and not consecutive
ANC	after and not consecutive

In this notation, to say that two TRs are "consecutive" is to say that there are no intervening points between them and that they have no point(s) in common. As mentioned previously, the temporal description "OVER TR" is used to indicate that the event to which it pertains may not have been in progress at each and every point within the referenced TR. The representation:

((JOHN INGESTED DINNER$_1$) OVER TR$_{10}$)

indicates that at one or more points or intervals during "TR$_{10}$," it is valid to say that "JOHN" was ingesting dinner. It follows that "TR$_{10}$" contains at least one point or interval about which it can validly be said that "JOHN" was ingesting an increment of "DINNER$_1$" at that point or for that interval. Thus, the representation above is equivalent to the following:

(((JOHN INGESTED DINNER-INCREMENT$_2$) FOR TR$_8$)
. . .
. . .
. . .
((JOHN INGESTED DINNER-INCREMENT$_n$) FOR TR$_n$)
(TR$_8$ B TR$_n$))
(TR$_{10}$ INCLUDES (TR$_8$ THROUGH TR$_n$))

(DINNER$_1$ CO
(DINNER-INCREMENT$_2$ THROUGH DINNER-INCREMENT$_n$)))

The original representation has been transformed into a representation of subacts of ingestion. Each subact is represented to have taken place for an entire subinterval of time. The subscript "n" is used in ANF to represent the last of a possible series of acts or TRs.

Temporal descriptors were not included in most of the examples in the preceding sections of this article. For illustrative purposes, temporal descriptors are included in the following example. The natural language description for a person who walks to a store can be represented in ANF as:

((NOTCASE ((PERSON WAS (AT STORE)) AT T_a))
(PERSON (CAUSED BMO ((PERSON WALKED) OVER TR_b))
((PERSON WAS (AT STORE))(AT T_c FOR TR_d)))
(T_a BNC T_c)
(T_a = ST-PT-TR_b)
(END-PT-TR_b BC TR_d)
(ST-PT-TR_d = T_c)).

In this context, the expression AT flags the location of something unless it is immediately followed by a TR, in which case it introduces the TR that describes the time when something occurred. The representation above indicates that the PERSON was not at the store at a particular point in time (T_a), but that over an interval of time (TR_b), the PERSON performed one or more acts of walking that caused the person to be at the store at point T_c. Given that the person was at the store at point T_c, it follows that the person was there for some amount of time [here represented by FOR TR_d], whether that amount be equal to an interval or to an instant (in which case T_c would be equal to TR_d). The point T_a, which represents a "reference point" at which the person was not at the store, is the starting point of the interval TR_b (assuming of course that it took more than one instant to walk to the store). The end point of that interval of walking is described as being before and consecutive to the point at which John was actually at the store. This idea is represented by the expression:

(END-PT-TR_b BC TR_d)

where BC stands for "before and consecutive." The expression represents the idea that the end point of TR_b is before and consecutive to TR_d.

CCLIPS' temporal descriptions in the example above relate state and event descriptions using an interval calculus. By substituting new temporal descriptions, CCLIPS can incorporate alternative state and event descriptions to build an in-depth temporal scheme.

V. APPLICATION OF AI TECHNIQUES IN THE LEGAL DOMAIN

This Section describes how the foregoing techniques can be employed usefully in the legal domain. Subsection A discusses how the representational techniques described in this article can be used to build models of legal concepts. It also emphasizes that CCLIPS must interact with the user to solve difficult problems of text understanding. Subsection B discusses how conceptual models built from ANF expressions can be used to detect legal issues.

A. A. Building and Using ANF Models of Legal Concepts

ANF has many special features designed to make knowledge representation in the legal realm convenient. By Means Of ("BMO") clauses are used for causal explanation and expansion; the expression Consists Of ("CO") is used to identify the constituents of a thing or event. In Accordance With ("IAW") clauses define, govern, or qualify the terms they modify.

A model of a valid offer in contract law can be constructed using an IAW clause along with other representational devices. A test known as the "reasonable person test" is often used to determine whether a given manifestation is an offer.[134] This test consists of determining whether a reasonable person would interpret the manifestation as an offer.[135] To indicate in ANF that an act has been performed as a reasonable person would have performed it, the expression:

IAW STAND-REAS-OBJ

is attached to the verb that represents the act. This expression indicates that the act was performed in accordance with the standards that determine reasonableness based on objective criteria. The expression:

(MARY (BELIEVED IAW STAND-REAS-OBJ) (?BELIEF))

134. *See* A. CORBIN, *supra* note 116, § 11.
135. *Id.*

indicates that a reasonable person acting in place of Mary would have believed ?BELIEF. The following ANF expressions represent a situation in which an offer is made:

((PERSON$_x$ COMMUNICATES INFORMATION TO PERSON$_y$)
CAUSES (PERSON$_y$ (BELIEVES IAW STAND-REAS-OBJ)
(INFORMATION IS OFFER))).

These expressions indicate that PERSON$_y$ believed that the communication from PERSON$_x$ was an offer.[136]

The legal effects of a given act may depend upon the intent of the actor. Sometimes that intent must be determined objectively. The objective intent of a person is the intent implied by his actions.[137] The ANF knowledge structure for OBJECTIVE-INTENTION is:

IF ((?A MANIFESTS ?MANIFESTATION TO ?B)
CAUSES (?B (UNDERSTANDS IAW STAND-REAS-OBJ)
(?MANIFESTATION EVIDENCES ?INTENTION)))
THEN (?MANIFESTATION (EVIDENCES (OBJECTIVELY))
?INTENTION)

This simply means that if the manifestation by "?A" causes "?B," acting reasonably, to infer that "?A" has a particular intention, then from an objective point of view that intention is manifested.

An ANF legal concept model of the process of making an offer could be constructed from the following three representations:

(1) (?INTENTION = (?A INTENDS (?A MAKES
(BMO ?A COMMUNICATES ?INFORMATION TO ?B)
?OFFER TO ?B)));

136. It is beyond the scope of this Article to discuss all the conceptual problems that could arise in the course of determining whether a given manifestation is an offer. Suppose that PERSON$_y$ did not believe that the communication was an offer but that a reasonable person would have believed it to be such. How should the communication be classified in such a case? This raises the legal question whether a manifestation is an offer if the person who perceives the manifestation does not understand it to be an offer. Another question that could arise in some situations is whether a communication that otherwise qualifies as an offer should be held to be such if the person to whom the communication is directed never receives the communication. To avoid addressing problems of this sort, the discussions and examples in this Section cover only cases in which the communication is received and is interpreted by the recipient as an offer.

137. *See* A. CORBIN, *supra* note 116, §§ 105, 106, 538, 539.

(2) (((?A HAS ?INTENTION)
CAUSES (?A WILLS (?A CARRY-OUT ?INTENTION)))
CAUSES (?A (ATTEMPTS (BMO ?A COMMUNICATES
?INFORMATION TO ?B)) (?A CARRIES-OUT
?INTENTION)));
(3) ((?A COMMUNICATES ?INFORMATION TO ?B)
CAUSES (?B (UNDERSTANDS IAW STAND-REAS-OBJ)
(?INFORMATION IS OFFER))).

Representation (1) above defines ?INTENTION as an intent to make an offer. Representation (2) indicates that ?A acted on his intention by communicating ?INFORMATION to ?B. Representation (3) indicates that the communication caused ?B, acting objectively and reasonably, to construe it as an offer. These representations cover the cases in which ?A intends to make an offer. Because of the way the objective theory of contracts operates, however, it is possible for someone to make an offer without actually intending to do so by creating manifestations construed by a reasonable person to be an offer.[138] In such a case, the person is said to have intended to make an offer from the objective point of view. Thus, representation (3) includes an objective element—(UNDERSTANDS IAW STAND-REAS-OBJ).

Representations may be accessed as knowledge structures to determine whether a given manifestation is an offer. Representation 3 may be converted to rule-form to read as follows:

(IF (((?A COMMUNICATES ?INFORMATION TO ?B)
CAUSES (?B (UNDERSTANDS IAW STAND-REAS-OBJ)
(?INFORMATION-1 IS OFFER))))
THEN ((?INFORMATION IS OFFER))).

The OFFER knowledge structure could be activated to help CCLIPS decide whether ANF input refers to an offer. If CCLIPS were to parse ANF input that contained the verb communicate, or a verb conceptually dependent upon communicate, it would activate the following knowledge structure:

(?A COMMUNICATES ?INFORMATION TO ?B).

This knowledge structure would then be used to activate the OFFER knowledge structure based on the fact that it matches the first line of the

138. *Id.*

antecedent of OFFER. CCLIPS would then instantiate OFFER with the content of the ANF input. It is able to do this because the ANF input conforms to the structure of the activated knowledge structures since those knowledge structures are represented in ANF.

For CCLIPS to decide whether input is an offer, it would have to instantiate the input into the entire antecedent of the OFFER-knowledge structure. If the input completely fills the OFFER antecedent, CCLIPS could determine whether the input implied that someone reasonably and objectively believed that a manifestation was an offer.

Determining whether input constitutes an offer is an extremely difficult operation for CCLIPS. Ultimately, CCLIPS would have to turn the difficult decision-making tasks over to the user. The reason for this perhaps can be best understood by example. The example chosen deals with the problems associated with determining whether a given newspaper advertisement for the sale of an item is an offer rather than of some other type of communication, such as a price quotation.

The test to determine whether a given newspaper advertisement for the sale of one or more items constitutes an offer is whether the advertisement is "clear, definite, explicit," leaving "nothing open for negotiation."[139] If so, the advertisement is an offer. A court deciding whether a newspaper advertisement is an offer may consider:

ITEM-IDENTITY	Identification of the items offered for sale,
QUANTITY	A specification of the quantity of the items offered for sale,
QUALITY	A specification of the quality of the items offered for sale,
PRICE	A specification of the price of the items offered for sale,
TIME	A specification of when the items are to be offered for sale,
WHERE	A specification of where the items are to be offered for sale,
OFFEROR	A specification of who is offering the items for sale, and
OFFEREE	An identification of the offeree.

139. *See id.* § 25; Lefkowitz v. Great Minneapolis Surplus Store, 251 Minn. 188, 86 N.W.2d 689 (1957).

The following language, reportedly contained in a newspaper advertisement by a particular department store, was construed by the court to meet the test of an offer:

Saturday 9 A.M.

1 Black Lapin Stole
Beautiful
worth
$139.50
$1.00
First Come
First Served.[140]

If CCLIPS were to have knowledge structures that incorporated the factors listed above, it could perhaps decide whether particular language manifested an offer. It would do this by associating the content of the knowledge structure with the content of the advertisement. First, CCLIPS would have to recognize that the communication was a commercial advertisement. Next, it would have to associate the information of the knowledge structure (listed below in the column on the left) with the information in the advertisement (listed below in the column on the right).

ITEM-IDENTITY:	Stole
QUANTITY:	1
QUALITY:	Black Lapin
PRICE:	$1.00
OFFEREE:	First Come, First Served

This top-down method of analysis would work fine as long as expressions like "first come, first served" could be recognized by the system. The problem with this approach is that even if the system were to find all the factors listed above in an advertisement, that in and of itself would not justify the conclusion that the advertisement is an offer. Those factors merely guide courts in making decisions about whether advertisements are offers. There are so many context-dependent factors used by courts that it would be infeasible even to attempt to list them all. Each case has its own particulars and presents its own difficulties.

For example, the problem of interpretation presented by the advertisement under consideration would have been more difficult had the

140. *Lefkowitz*, 251 Minn. at 189, 86 N.W.2d at 690.

advertisement read differently. The advertisement could have contained the following additional language that might have changed its entire import:

THIS IS NOT AN OFFER.

How this would affect the import of the advertisement would to some extent depend on whether the language was conspicuous.

A slightly more difficult problem would have been presented had the advertisement begun with the heading:

PRICE QUOTATION.

This is a typical problem that arises in the area of document interpretation. The problem presents itself when the title of an instrument does not accurately describe the contents of the body of the instrument. What should control the import of the instrument in such a case—the title or the body of the instrument? Generally, the title is considered to be a mere factor to be weighed along with others to determine the nature of the instrument.[141]

Different legal transactions may have factors in common. A lease, for example, is similar to a sale in that one party promises some performance in consideration for certain rights to real property.[142] An instrument labeled LEASE AGREEMENT could prove to be a sale instead of a lease if the contents of the instrument indicate that the ownership of the object passed from one party to the other for consideration. Similarly, if the newspaper advertisement example had the heading PRICE QUOTATION, the court would have to determine whether that was sufficient to identify the advertisement as a mere quotation of prices rather than an offer. In such a case, the content of the advertisement could be construed to satisfy the criteria for an offer, yet the presence of the heading PRICE QUOTATION adds weight to the possibility that the advertisement is a mere price quotation.

As reflected in the OFFER knowledge structure, the basic test to determine whether a communication is an offer depends on whether the recipient, acting as a reasonable person, would construe the communication as such. A determination would have to be made about what effect the heading PRICE QUOTATION would have on a reasonable person reading the advertisement. Would the presence of that heading lead

141. *See generally* R. NORDSTROM, HANDBOOK OF THE LAW OF SALES § 126 (1970).
142. *Id.* §§ 32-37.

that person to conclude that the advertisement is not an offer? As an alternative to answering such a question, CCLIPS would pose the question to the user.

B. Using ANF Legal Concept Models to Detect Legal Issues[143]

Under the Articles of the Civil Code of Louisiana a simple error voids a contract if the error bears upon the "principal cause" of the contract.[144] Essentially, the "cause" of a contract is the motive(s) for entering into the contract.[145] Since "cause" is defined in terms of motive,[146] the error must bear upon the principal motive for contracting. The essence of error under the Civil Code is mistaken belief;[147] thus, an error as to the principal motive results from the motive being rooted in a mistaken belief. The PRIN-CAUSE link can be employed to build the following simple model of the principal cause or motive for contracting:

```
((?PERSON-X HAS ?MOTIVE)
        PRIN-CAUSE (?PERSON-X ENTER-INTO ?CONTRACT
        WITH
                ?PERSON-Z)).
```

The "principal cause" is that consideration without which the contract would not have been made.[148] The PRIN-CAUSE link aptly accommodates this notion because it activates the following information:

```
(IF (NOTCASE (?PERSON-X HAS ?MOTIVE))
THEN (NOTCASE (?PERSON-X ENTER-INTO ?CONTRACT
        WITH ?PERSON-Z))).
```

This means that if ?PERSON-X does not have ?MOTIVE, then ?PERSON-X does not contract with ?PERSON-Z. This follows because the PRIN-CAUSE link signifies that the ?MOTIVE is a substantial factor that brings about the act of contracting. The aspects of motivation that are relevant for the Louisiana law of error are represented below in ANF formalisms:

---

143. In the following discussions, motives are assumed to result from processes prompted by beliefs and desires. References to the processes that produce the motives have been omitted for simplicity.

144. LA. CIV. CODE ANN. art. 1825 (West 1980).

145. *Id.* art. 1896.

146. *Id.* art. 1825, 1896.

147. *Id.* art. 1821.

148. *Id.* art. 1825.

(((?PERSON DESIRES (?OBJECT-OF-DESIRE))
AND (?PERSON BELIEVES (?BELIEF)))
(CAUSE ENAB-CAUSE) (?PERSON HAS ?MOTIVE)).

These formalisms represent the idea that motivation is rooted in belief and desire.

This principal motive model is not adequate to model the law of error. The Civil Code implies that no error in the motive can invalidate a contract unless the other party knew or should have known that the motive was the principal motive for contracting.[149] The expression (OBJECTIVELY) can be associated with the PRIN-CAUSE link so that together they imply that the PRIN-CAUSE connection would be detected by a reasonable person who would perceive the act involved. The expression (?A (PRIN-CAUSE (OBJECTIVELY)) ?B) thus implies that ?A is the principal cause of ?B from the objective point of view.

The legal concept model for error can now be constructed. The components of the model are presented below in segmented form.

(1) (((?PERSON-X DESIRES (?OBJECT-OF-DESIRE))
(?PERSON-X BELIEVES (?BELIEF)))
(CAUSES ENAB-CAUSES) (?PERSON-X HAS ?MOTIVE))
(2) (NOTCASE (?BELIEF IS TRUE))
(3.1) ((((?PERSON-X HAS ?MOTIVE)
PRIN-CAUSE
(?PERSON-X ENTER-INTO ?CONTRACT WITH
?PERSON-Z))
and
(3.2.1) (?PERSON-Z KNOWS ((?PERSON-X HAS
?MOTIVE)
PRIN-CAUSE
(?PERSON-X ENTER-INTO ?CONTRACT WITH
?PERSON-Z))))
or
(3.2.2) ((?PERSON-X HAS ?MOTIVE)
(PRIN-CAUSE (OBJECTIVELY)) (?PERSON-X ENTER-
INTO
?CONTRACT WITH ?PERSON-Z))).

The conjunction of segments (1), (2), and (3) constitutes the model for error. Segment (2) flags the point at which error in belief occurs

149. *Id.* art. 1826 (objective test).

because it points out that the belief described in segment (1) is false. Segment (3.1) represents the idea that the ?MOTIVE is a principal motive from a subjective point of view. Segment (3.2.1) enables that motive to qualify legally as the principal cause because it indicates that ?PERSON-Z is aware of its status as such. Segment (3.2.2) takes care of the case in which ?PERSON-Z should have known that ?MOTIVE was the principal motive to contract. The causal link description in segment (3.2.2) contains the expression (OBJECTIVELY) and thus functions in CCLIPS to charge ?PERSON-Z with the knowledge that a reasonable person would have acquired in that contractual situation.

This legal concept model may be accessed as a knowledge structure to help detect legal issues posed by fact descriptions such as the following:

> Mary wants to build a store on a lot owned by John and believes she would have the right to do so if she owned the lot. This serves as the primary motivation for her purchase of the lot from John.

This could be represented in ANF as:

((JOHN OWNS LOT_2)
(((MARY DESIRES (MARY CONSTRUCTS $STORE_1$ ON LOT_2))
(MARY BELIEVES
(IF MARY OWNS LOT_2
THEN MARY MAY CONSTRUCT $STORE_1$ ON LOT_2)))
(CAUSE ENAB-CAUSE) (MARY HAS $MOTIVE_3$))

((MARY HAS $MOTIVE_3$)
PRIN-CAUSE (MARY ENTER-INTO $CONTRACT_4$ WITH JOHN))
($CONTRACT_4$ = (MARY PURCHASE LOT_2 FROM JOHN))).

If the facts include a zoning law prohibition against commercial construction, Mary's belief would be false. If it was also a fact that John was aware of Mary's belief and desire at the time of contracting ($MOTIVE_3$) the model on error could be used to detect the legal issues determining whether Mary could rescind the contract on account of error. The entire ANF fact description could be matched against the legal concept model (through instantiation).

The facts would match segments (1) and (2) of the model but would fail to fit segment (3). The facts indicate that John knew that Mary had $MOTIVE_3$, but segment (3) requires that John be apprised (directly or indirectly based on objective standards) of the PRIN-CAUSE

link of Mary's motive to contract. The facts do not indicate explicitly whether John knew or should have known of that PRIN-CAUSE connection; therefore, the facts do not match segment (3). Thus, the crucial issue is whether John, as a reasonable person, should have known that Mary would not have entered into the contract had she known the true facts. To resolve that issue, it would have to be determined whether John reasonably could have believed that Mary would have purchased the lot anyway for some alternative reason(s).

CONCLUSION: THE FUTURE OF CCLIPS

The version of CCLIPS described in this Article is being designed to perform conceptual retrieval operations on the provisions of the Civil Code of Louisiana. Ultimately, the provisions of the Code will have to be represented in ANF, at least to some extent, if this goal is to be achieved. The Code contains 3556 articles, which is enough information to justify the use of conceptual retrieval techniques since it is difficult to keep particulars, details, and cross references in mind.

Detailed representation of the Code and the official comments in ANF would be difficult to achieve. Comments to articles are not considered primary sources of law; however, they are very important because they contain information that defines and otherwise relates the conceptual contents of the articles. Admittedly, portions of those comments would have to be represented in ANF for CCLIPS to perform conceptual retrieval of the sort envisioned by the authors, all of which points to a trade off between breadth and depth.

The solution seems to be to use ANF to describe the essentials of the Code rather than its details. Brief descriptions of the conceptual contents of articles and comments could be written in ANF and processed instead of, or in addition to, the Code itself. This approach would produce wider coverage but would sacrifice depth. Although the approach has its limitations, the authors believe it would produce useful results when used in conjunction with ordinary key-word retrieval techniques applied to the entire text. At the very least, the conceptual retrieval could reduce inefficient key-word results. This approach seems well suited to the version of CCLIPS that is described in this Article.

The long-term goals of the CCLIPS project are to enhance the system to accommodate an English-like version of ANF. The authors believe that once a more flexible version of ANF is available, it will become more feasible to consider writing both the statutory text and the comments in ANF. Success appears to be contingent not only on the availability of the more expressive version of ANF, but also upon the availability of a multiplicity of conceptual models of legal phenomena and real-world phenomena. The authors are currently working on models to

serve the system, some of which have been described in the foregoing pages.

The efforts of the authors to provide CCLIPS with an adequate collection of conceptual models hopefully will be complemented by research being conducted elsewhere. Interesting work is being done at the Center for the Study of Language and Information to create a common sense knowledge base that could serve to ground a number of different types of AI systems.[150] Intelligent legal systems would benefit from having such a knowledge base because the knowledge would enhance a system's understanding of factual situations. Important work is also being done to model the deontic realm to enable systems like CCLIPS to handle problems posed by deontic operators such as "shall," "may," and "must," which frequently cause problems in the area of statutory interpretation. The progress made in the development of analogical and other reasoning methods is relevant to CCLIPS because its developers have set ambitious goals in this area. Advances in techniques by which conceptual memory is organized for retrieval will be particularly appreciated because of the sizable amount of conceptual information that CCLIPS must store in memory.

If CCLIPS reaches the level of development envisioned by the authors, an attempt will be made to empower it to process natural language input through interaction with the user. The goal would be to develop ANF so that natural language input could be digested without difficulty to accord with the basic conventions of ANF. Hopefully, a sufficient amount of conformity with those conventions could be produced to enable the system to clear up deviations through slight or moderate interaction with the user. The usefulness of the system, of course, would in large measure depend on how often the system would have to ask the user to clear up what it does not understand.

For some applications, quite a bit of interaction could be tolerated. Statutory drafting is an example of such an application. If the system were capable of acquiring an in-depth understanding of the information entered into it, it would be in a position to advise the drafter of inconsistencies and other deficiencies that might result from, or be included in, the information entered. Drafters are accustomed to taking considerable time to write even small pieces of legislation in attempts to come up with language that captures the legislators' intent. The process of drafting can become quite tedious; it is not unusual for numerous changes to be made in a proposed draft before a final draft is adopted. CCLIPS

150. J. Hobbs, T. Blenko, B. Croft, G. Hager, H. Kautz, P. Kube & Y. Shoham, Commonsense Summer: Final Report (Report No. CSLI-85-35, Center for the Study of Language and Information, 1985).

could be useful in this situation despite its likely need to call for interaction.

In the future, CCLIPS will have many uses in the legal realm besides those associated with statutory drafting. Expert systems could be built on top of it, and its methods seem applicable to many other areas of the law. Some of the same techniques that work on statutes could be made to work on cases. There is, however, a need for systems to perform conceptual retrieval both inside and outside the legal profession. Any advances CCLIPS makes in this area would have immediate impact on many disciplines.

Artificial Intelligence applications such as CCLIPS have the potential to alter the nature of the legal profession. The more analytically integrated the domain, the better a system like CCLIPS will perform. Once AI systems begin to operate effectively in the legal domain, legal professionals may become motivated to be more analytical in their approaches to law.

Overall, the prospects for the future success of CCLIPS appear to be good at this stage of its development. Reports on improvements in the system will be published when appropriate. The authors invite comments from readers.[151]

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APPENDIX A: CAUSAL FORMALISMS

Every action verb defined in CCLIPS has an associated causal formalism that is activated when the verb is used.[a1] For example, if the expression:

A LESSEE HELPED A LESSOR

was read, the causal formalism associated with "help" would be activated. An important segment of this formalism is presented below:

```
(?A HELP ?B) <==>
((?A CAUSE (?B HAS (?SOUL-ASPECT -> POS))))
  OR
(((?B HAS ?BURDEN) AT ?TIME-1)
(?A CAUSE ((NOTCASE (?B HAS ?BURDEN)) AT ?TIME-2)))
  OR
(((NOTCASE  (?B HAS ?ENHANCEMENT)) AT ?TIME-1)
(A CAUSE ((?B HAS ?ENHANCEMENT) AT ?TIME-2))) ... ).
```

This is only part of the formalism for "help." Only three senses of the verb "help" are described. The formalism, for example, does not provide for a case in which a negative aspect of the SOUL of "?B" is transformed into a non-negative aspect. In such a case "?B" would be "helped" by whatever caused the transformation.

In this formalism, the symbol "<==>" represents reverse implication and the expression "POS" represents positiveness. The symbols "?A" and "?B" are variables. The information to the right of the symbol "<==>" represents an expansion of the information to the left of the symbol. The expansion itself is also subject to expansion. The terms "BURDEN" and "ENHANCEMENT," for example, may be expanded to produce a new expansion. The entire scheme constitutes an abstraction/expansion hierarchy.[a2] Higher-level representations are related to lower-level representations through "abstraction-expansion" relationships. In the formalism above, (?A HELP ?B) is related to the stated expansion in this way. The information to the right of the symbol "<==>" represents the following three senses of the verb "help":

---

a1. *See generally* M. DYER, *supra* note 19.

a2. The concept of an abstraction-expansion hierarchy is described in some detail in McCarty, *supra* note 11, at 272.

(1) (?A CAUSE (?B HAS (?SOUL-ASPECT -> POS)))

This represents a causal act in which "?A" causes "?B" to have some positive soul-aspect, such as a positive attribute or emotional state.

(2) (((?B HAS ?BURDEN) AT ?TIME-1)
(?A CAUSE ((NOTCASE (?B HAS ?BURDEN)) AT ?TIME-2)))

This represents the removal of a burden. "?B" has the burden at one point in time, and "?A" causes that state of affairs to change at another, subsequent point in time. Here, the temporal sequence is indicated by the sequentiality of the numbers attached to the temporal descriptors.

(3) (((NOTCASE (?B HAS ?ENHANCEMENT)) AT ?TIME-1)
(?A CAUSE ((?B HAS ?ENHANCEMENT) AT ?TIME-2)))

This represents the acquisition of an enhancement. Thus, the entire formalism represents senses of the word "help" in which "?A" helps "?B" by causing either:

(1) ?B to have a positive soul-aspect; or
(2) ?B to be relieved of a burden; or
(3) ?B to be enhanced.

The abstraction "(?A HELP ?B)" follows from any of these three senses by implication. The reverse implication, of course, does not hold because an abstraction defined disjunctively does not necessarily imply any particular disjunct.

In CCLIPS, the activation of a formalism, such as the one given above for "help," triggers other processes similar to the operation of demons in BORIS.[a3] Demons in BORIS perform specific tasks and fire when certain trigger conditions are met. BORIS uses two general types of demons: those that deal with knowledge-structure activation and those that help build episodic memory. The words in the lexicon of BORIS have demons attached to them so that when a word is recognized in parsing, it is placed in a working memory along with its associated demons. Disambiguation demons attempt to select an appropriate conceptualization for the parsed word, by activating CD structures.

a3. For a more detailed discussion of the operation of demons and related processes in BORIS, see M. DYER, *supra* note 19.

CCLIPS operates in a similar manner. If, for example, the formalism for "help" were to be activated during parsing, other task-oriented processes would also be activated to determine what sense of "help" was being referred to by the parsed word. These subprocesses would search working memory to see if some data structure could be found to match all or part of the formalism for "help." If the activated subprocesses were to find that whatever was in the position of "?B" had been described as having a burden immediately prior to being helped, this would activate the sense of "help" that is defined in terms of a burden being removed. In this regard, it can be seen that removing or releasing a burden presupposes a previous state in which the burden existed. A representation of the previous state is included in the formalism itself as:

((?B HAS ?BURDEN) AT ?TIME-1).

CD-based systems use similar techniques. AFFECTs in BORIS, for example, have standard relationships with one another. For example, if a character feels "relieved," then this points to some earlier state in which the character may have felt "fearful." Similarly, in CCLIPS, the acquisition of a thing presupposes a state of not having the thing.

Once a causal formalism has been activated, CCLIPS generates a possible inference (see Appendix D) to accompany the formalism. The kind of inferences generated depends in some measure upon the type of causal agent involved. The inferences generated when the causal agent is an entity differ from those generated when the causal agent is an event.

The following formalism represents the idea that something ("?A") caused something else ("?B") to exist:

(?A CAUSE (?B EXISTS)).

This formalism would activate the following inferences:

(1) (?A CAUSE (?B EXISTS))
(2) (?B EXISTS)
(3) (?A CREATE-CAUSE (?B EXISTS))
(4) (?A PROX-CAUSE (?B EXISTS).

The meanings of the causal links that appear in these inferences are described in Section IV.A.2 of this Article. Inference 1 is the original statement. A representation always implies itself. Inferences 2, 3, and 4

follow almost immediately from inference 1. These inferences could be activated if CCLIPS were to encounter the original causal structure.

APPENDIX B: SYMBOLS AND EXPRESSIONS USED TO REPRESENT AGENTS AND END-STATES

1. Unary Entity ("UE")

A UE is an individual entity defined by set criteria. The definition may or may not be explicit. Whenever reference is made to a single individual, the reference is to a UE. If reference is made to more than one individual, the reference is not to a UE but to a cluster-entity. Reference to a person named "John" is reference to a UE, but reference to John and Mary is reference to a CE (cluster-entity).

2. Cluster-entity ("CE")

Cluster representation is used in ANF for many reasons. Besides providing a convenient and concise means of referring to groups, CEs constitute useful lexicographical components. The noun "team," for example, could be defined as a CE with specified criteria for membership. If the word "team" were to be encountered in parsing, CCLIPS would activate all the attendant CE information.

A CE consists of a group of entities. The individuality of each member of the group is determined by particular criteria, and the group, in turn, is defined by more inclusive criteria. CEs may contain subclusters ("SUBCEs"). If one wished to refer to a group consisting of two male and two female persons, say Tom, Bob, Jill, and Mary, a CE representation could be used for that purpose. The expression "CE_1," for example, could be used to represent the group. SUBCEs could be then distinguished within CE_1. Tom and Bob could be identified as members of $SUBCE_2$, and Jill and Mary could be identified as members of $SUBCE_3$. Each of these SUBCEs would carry its own criteria for membership.

CEs are categorized under CE-ABSTRACTIONS that are activated any time an appropriately indexed CE is parsed. CE-ABSTRACTIONS can be very useful in processing statements. For example, a CE-ABSTRACTION would be useful to define how many members of a CE must participate in a given act before the act will be taken as an act of the CE. In some situations, a CE-ABSTRACTION that requires a quorum for CE action will be accessed to assist in determining whether action by members constitutes action of the CE itself. Sometimes one may wish to ignore individual members and to refer to the cluster as a block.

3. CE Taken as a Block ("CEB")

The primary reason for drawing a distinction between CEs and CEBs is that the inferences they activate differ. Individual members are ignored when a CEB representation is encountered. Thus, given the statement:

(CEB_1 HELPED JOHN),

detailed inferences about the relation of each member of CEB_1 to JOHN would not be activated as would have been the case if

(CE_1 HELPED JOHN)

had been given instead. Actually, a CEB is a special kind of CE. For example, the parsing of the statement:

(CE_1 HELPED JOHN)

would activate a number of knowledge structures associated with CE_1, including its criteria for membership and the criteria to be used to determine when action by the CE implies action by its members. If some or all of this information had not been explicitly defined for CE_1, the CE would expand into alternatives, one of which would be the block-unity sense of this CE. Assuming that CE_1 had been defined to include members Tom, Bob, Jill, and Mary, a number of inferences would be generated for the statement:

(CE_1 HELPED JOHN),

including:

(1) CE_1 helped John
(2) CEB_1 helped John
(3) Tom helped John
(4) Bob helped John
(5) Jill helped John
(6) Mary helped John
(7) {Tom,Bob} helped John
. . .
(17) {Tom,Bob,Jill,Mary} helped John.

Inference (2) represents "CE_1" taken as a block.

It should be noted that this set of inferences may activate other processes within the system. One such process is the "multiple subjects classifier." The subjects of inferences 1 through 6 given above are singular, but the subjects of inferences 7 through 17 are multiple. Statements with multiple subjects or objects activate processes that attempt to determine the nature of the relations between the subjects or objects. In the legal domain, the nature of the relations must be determined because legal results may be dictated by the nature of the relations between subjects or objects.

4. Clusters of Acts ("CAVs," "CAVBs." "CAEs," and "CAEBs")

In addition to allowing explicit representation of groups of entities, ANF allows representation of groups of acts. The symbol "CAV" is used for this purpose. A particular act consisting of a set of subacts may be represented by a CAV. The inclusive act of studying, for example, may consist of subacts of reading and outlining material. The expression "CAV," for example, could be used to refer to subacts associated with the verb "study." The idea that a lessee improved the property under lease could be represented as follows:

((LESSEE CAV_y LEASED-PROPERTY)
(CAV_y CO ((LESSEE CLEANED LEASED-PROPERTY)
(LESSEE PAINTED LEASED-PROPERTY))).

The symbol "CO" used in this representation means "consistency of."

If for some reason one wished to ignore the individual subacts, the expression "$CAVB_y$" could be used instead of "CAV_y" to establish block reference.

In ANF, one can define CAVs in several ways. In the example above, "CAV_y" is equated with descriptions of events. Another way to define CAVs is to focus solely upon descriptions of the acts involved. The following two definitions of "CAV_y" are examples of this kind of definition:

(1) (CAV_y CO ((CLEANED) (PAINTED))); and
(2) (CAV_y CO ((CLEANING) (PAINTING))).

On occasion, one may wish to refer to a set of acts that are not already grouped or otherwise defined. If one wished to refer to all the acts that caused the West to be won, for example, the expression "CAV_1" could be used for that purpose. Membership in CAV_1 could be defined as follows:

CAV_1 == {ACT_n|(ACT_n CONTRIB-CAUSE (WEST IS WON))}

Thus, CAV_1 is defined to be the set of all ACT_n such that ACT_n contributed to the West being won.

When no criteria for membership in a CAV are set, the CAV refers to some set of unidentified acts, which in ANF would be represented by the expression "SOME-ACTS." For example, if no criteria for membership had been set for CAV_1, the expressions "CAV_1" and "$SOME\text{-}ACTS_1$" would be equivalent.

The act of studying (taken as a noun) can be represented in ANF by the expression CAE, which represents a cluster of acts that function in expression as an entity. The expression CAEB is used to represent block reference to such a cluster. Thus, the statement

IMPROVING THE PROPERTY UNDER LEASE MADE THE LESSEE TIRED,

could be represented in ANF as:

((CAE_x CAUSED (LESSEE IS TIRED))
(CAE_x INCLUDES ((LESSEE CLEANED LEASED-PROPERTY)
(LESSEE PAINTED LEASED-PROPERTY)))).

In this representation, the expression "INCLUDES" indicates that the listing is not necessarily exhaustive. If "CAE_x" were not defined, "CAE_x" would be equivalent to "$SOME\text{-}ACTS_x$." Thus, in such a case,

(CAE_x CAUSED (LESSOR IS PLEASED));

is equivalent to:

($SOME\text{-}ACTS_x$ CAUSED (LESSOR IS PLEASED)).

APPENDIX C: ACTION FORMALISMS, BMOs AND PLANS

BMO-clause representation can be employed when representing human interaction. Suppose one wished to represent the idea that John told Mary something that made her happy. The verb "tell" is defined in ANF as a type of oral communication. Some formalisms for oral communication are given below.

(1) (?SUBJECT (COMMUNICATES (BMO ?SUBJECT SPEAKS))
?INFORMATION TO ?RECEIVER)

(2) (?SUBJECT (CAUSES (BMO ?SUBJECT
(COMMUNICATES
(BMO ?SUBJECT SPEAKS))))
(?RECEIVER HAS ?INFORMATION))

(3) ((?SUBJECT (CAUSES (BMO ?SUBJECT SPEAKS))
(?RECEIVER HAS ?COMMUNICATION))
(?COMMUNICATION = ?INFORMATION))

These formalisms have the following relationships to one another: Formalism 1 <—> Formalism 2 <—> Formalism 3. The reverse-directional arrows represent that the formalisms can be converted into one another in a straightforward manner. The formalisms are expansions of the following knowledge structure associated with the verb "tell":

(?SUBJECT TELLS ?INFORMATION TO ?RECEIVER).

Formalisms 1 and 2 define the verb "tell" in terms of the more primitive verb "communicate." Formalism 3 uses the word "communication" instead of "communicate" and is designed to accommodate the noun that stands for an act of communicating. The idea expressed in EXAMPLE-2 that John made Mary happy by telling her he would consider selling her the lot could be represented by instantiating the past-tense version of the knowledge structure given above for "tell" and by combining the result with an instantiation of another general formalism used to represent states of arousal. The following formalism is one used to represent states of arousal:

(<subject> CAUSES (OBJECT IS <description of emotion>)).

The result of combining the two instantiations would read:

((JOHN TOLD INFORMATION$_1$ TO MARY)
(INFORMATION$_1$ CAUSED (MARY IS HAPPY))).[c1]

c1. For the sake of simplicity, the content of John's communication to Mary is represented by the symbol "INFORMATION$_1$."

CCLIPS would expand this representation by parsing its contents into other associated knowledge structures, such as Formalisms 1, 2, and 3. CCLIPS would activate the formalisms through a conceptual dependency relationship that exists between the verbs "tell" and "communicate." To "tell" someone something is to "communicate" something to them. Since Mary is described as having a particular emotional state, a knowledge structure for emotional states would also be activated and instantiated. The result of the instantiation process would read:

((JOHN (CAUSES (BMO JOHN
(COMMUNICATES (BMO JOHN SPEAKS))))
(MARY HAS INFORMATION$_1$))
((MARY HAS INFORMATION$_1$)
CAUSES
(MARY HAS ((EMOT$_2$ POS) = HAPPY))))

This expanded version of the original ANF representation results from instantiating Formalism 2 and an appropriate knowledge structure for happiness.

BMO clauses are also used to define plans. The information in the BMO slot may be abstracted as the plan by which a particular goal is to be carried out. For example, in the representation:

((MARY HAS GOAL$_1$)
(GOAL$_1$ = (MARY (CAUSES (BMO MARY DRIVES CAR))(MARY IS
(AT LOT$_2$)))),

the entailed BMO clause contains content that can be identified as the plan by which Mary intends to achieve her goal. In this example, she plans to achieve the goal by driving a car.

APPENDIX D: INFERENCE GENERATION

CCLIPS generates inferences based upon the nature of the connections between events and upon the nature of the involvement of individuals in those events. When an individual does something that causes a state to exist or an event to occur, that individual has a particular relationship to each individual involved in the resulting state or event. The inferences that CCLIPS generates are based on those relationships.

Segments of the following examples are written in a special notation adopted solely to describe the theoretical foundation of the generation processes in CCLIPS. Unique numbers have been assigned to

causal links and verbs. The same has been done for state-description links (i.e. "HAS" and "IS"). Special connectors relate the subjects of the statements to the objects of those statements (thus flagging the nature of the relationships between those subjects and objects). These special connectors each bear the form:

(<E or S> <number> <s or o>)

In this notation, 'E' stands for an event; 'S' stands for a state; the number in the number slot identifies the particular causal or state-description relationship; and an's' or 'o' signifies a subject or an object of the state or event. Whenever a connector that bears this special form appears between a subject component and an object component (or an object and a subject) the E or S describes the nature of the relationship between the two components; the number identifies the particular relationship; and the s or o identifies the first component as either a subject or an object. The first component is always taken to be the primary component of the entire representation. For example, with reference to the state description "(?C HAS1 ?D)," the special representation "(?D S1o ?C)" carries the following meaning:

(a) "?D" is the primary component of this special representation. By stipulation, the presence of the special connector "S1o" makes the first component of the representation (i.e. "?D") function as the primary component.[d1]

(b) "?D" is related to "?C" in a state description in which "?D" is the object. The letter "S" of the connector "S1o" identifies the nature of the description as being a state description. The letter "o" indicates that "?D" is the object in the referred to state description.

(c) The state description in which "?D" is related to "?C" is identified by a state-description link (in this case "HAS1") that bears the number 1. This is indicated by the presence of the number 1 in the connector "S1o."

The special notation described above is used in some of the examples that follow.

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d1. For an example of why it is useful to treat the first component as the primary component of the entire representation, see the discussion that accompanies inference (7) of Example A, *infra*.

Example A

Inferences could be generated for the formalism

((?A CAUSE2 ?B) CAUSE1 (?C HAS1 ?D))

based upon the following information, which consists of deductions and abstractions drawn from the formalism.

(1) (?C HAS1 ?D)

This follows from the formalism by deduction.

(2) (?C S1s ?D)

This is an abstract deduction drawn from the formalism. It is referred to as an "abstract" deduction because it consists of an abstract description of an inference that follows from the original formalism by deduction. In other words, inference (2) is an abstract description of "(?C HAS1 ?D)," which follows from the formalism by deduction. The "S" of "S1s" indicates that "?C" is the primary component of this inference and that "?C" is related to "?D" in a state description. The number 1 of "S1s" ties the state description to the link "HAS1," and the letter "s" indicates that "?C" occupies the subject position in the referred to state description.

Another example is:

(3) (?D S1o ?C)

which is an abstract deduction drawn from the formalism. The expression "S1" of "S1o" has the same meaning as defined in (2) above. The letter "o" of "S1o" indicates that "?D" is the primary component of this inference and that "?D" occupies the object position in the referred to state description.

(4) (?A CAUSE2 ?B)

This follows from the original formalism by deduction.

(5) (?A E2s ?B)

This is an abstract deduction drawn from the formalism. It indicates that "?A" and "?B" are related to one another in an event description whose causal link bears the number 2. As is usual for this notation, "?A," being in the subject position in this inference, is taken to be the primary component of the representation.

(6) (?B E2o ?A)

This is an abstract deduction drawn from the formalism. It has meaning similar to representation (5) above except that "?B" is taken to be the primary component. The letter "o" indicates that "?B" occupies the object position in the referred to event description.

(7) ((?A CAUSE2 ?B) CAUSE1 (?C S1s ?D))

This odd looking representation, which follows from the original formalism only in a penumbral sense, relates the causal event "(?A CAUSE2 ?B)" to "?C." This is accomplished by treating "?C" as the primary component of the representation "(?C S1s ?D)," an effect dictated by the presence of the special connector "S1s." To say that

((?A CAUSE2 ?B) CAUSE1 (?C S1s ?D))

is to say that "?C" was caused, since "?C" is taken to be the primary component of the end-state caused by "(?A CAUSE2 ?B)." This inference is, at best, penumbral because the original statement does not imply that "?C" itself was caused, but rather that a state of "?C" was caused. An inference of this sort is hereinafter referred to as a penumbral inference. The meaning of representation (7) above is that the event "(?A CAUSE2 ?B)" is related to "?C" in some way through "CAUSE1." If the system had this information in memory, it would be in a position to recognize that it had a near match for the input "((?A CAUSE ?B) CAUSE ?C)."

The following examples (8 through 14) are all penumbral inferences.

(8) ((?A CAUSE2 ?B) CAUSE1 (?D S1o ?C))

The meaning of this expression is similar to that of representation (7) above except that here "?D" is the primary component of the end-state "(?D S1o ?C)" and is identified as being the object of the state description indexed by the expression "S1" of "S1o."

(9) ((?A E2s ?B) MAYBE-CAUSE1 (?C HAS1 ?D))

The expression "E2" of "E2s" indicates that "?A" is related to "?B" in an event and that the event is identified by a link that bears the number 2. The "s" of "E2s" indicates that "?A" is in the subject position in the referenced event. The presence of the special connector "E2s" makes "?A" the primary component of the representation "(A E2s ?B)"; thus, inference (9) relates "?A" to the end-state "(?C HAS1 ?D)" through the link "MAYBE-CAUSE1," which carries the number of the link from which it is derived. In this example, the MAYBE-CAUSE link is derived from the link "CAUSE1" because the link "CAUSE1" relates the event in which "?A" participates (i.e. "(?A CAUSE2 ?B)"); to the end-state "(?C HAS1 ?D)." Although weaker than a direct causal link, the MAYBE-CAUSE link is stronger than some other causal links, such as the POSS-CAUSE link. The strength of the MAYBE-CAUSE link in this example is derived from the fact that "?A" occupies the position of agent in a segment of the causal structure and thus, in some sense, "causes" the results that are represented further down the causal structure.

(10) ((?A E2s ?B) POSS-CAUSE1 (?C S1s ?D))

This inference weakly relates "?A" to "?C" since "?A" is the primary component of the subject of the link "POSS-CAUSE1," and "?C" is the primary component of the object of that link. This entire inference represents the idea that it may be valid to infer that "?A," by participating in the event indexed by "?E2," caused (in a weak penumbral sense) "?C." As is the case for the MAYBE-CAUSE link (see discussion of inference (9) above), the POSS-CAUSE link bears the number of the link from which it was derived, which in this example is the link "CAUSE1."

(11) ((?A E2s ?B) POSS-CAUSE1 (?D S1o ?C))

This means the same as inference (10) above except that "?D" is the primary component of the object of the link "POSS-CAUSE1."

(12) ((?B E2o ?A) MAYBE-CAUSE1 (?C HAS1 ?D))

This means the same as inference (9) above except that "?B" is the primary component of the subject of the link "MAYBE-CAUSE1."

(13) ((?B E2o ?A) POSS-CAUSE1 (?C S1s ?D))

This means the same as that of inference 10 above except that "?B" is the primary component of the subject of the link "POSS-CAUSE1."

(14) ((?B E2o ?A) POSS-CAUSE1 (?D S1o ?C))

This means the same as that for inference 11 above except that "?B" is the primary component of the subject of the link "POSS-CAUSE1."

Example B

CCLIPS is capable of generating deductive and penumbral inferences for each causal structure it encounters. A description of how penumbral inferences are used appears below.

Given the structure:

((?A CAUSE (?B HAS ?C)) CAUSE (?E IS ?H))

CCLIPS could generate the following knowledge structures (penumbral inferences) for that structure:

(1) (?A POSS-CAUSE ?B);
(2) (?A POSS-CAUSE ?C);
(3) (?A POSS-CAUSE ?E);
(4) (?A POSS-CAUSE ?H);
(5) (?A MAYBE-CAUSE (?E IS ?H));
(6) (?B POSS-CAUSE ?E);
(7) (?B POSS-CAUSE ?H);
(8) (?B MAYBE-CAUSE (?E IS ?H));
(9) (?C POSS-CAUSE ?E);
(10) (?C POSS-CAUSE ?H);
(11) (?C MAYBE-CAUSE (?E IS ?H));
(12) ((?B HAS ?C) POSS-CAUSE ?E);
(13) ((?B HAS ?C) POSS-CAUSE ?H);
(14) ((?B HAS ?C) MAYBE-CAUSE (?E IS ?H));
(15) ((?A CAUSE (?B HAS ?C)) POSS-CAUSE ?E);
(16) ((?A CAUSE (?B HAS ?C)) POSS-CAUSE ?H).

CCLIPS uses inference-knowledge structures such as these when it attempts to answer queries posed by the user. The following example illustrates the use of penumbral inferences. The natural language description:

a lessee improved the leased property, which pleased the lessor

may be represented in ANF as:

((LESSEE CAUSED (LEASED-PROPERTY HAS IMPROVEMENTS))
CAUSED
(LESSOR IS PLEASED)).

This ANF version differs slightly from that previously given for EXAMPLE-1; however, the reader should not be troubled by this because the two representations are equivalent in CCLIPS.

It should be noted that this ANF representation is an instantiation of the following causal structure:

((?A CAUSE (?B HAS ?C) CAUSE (?E IS ?H))[d2]

This is the same structure that was used previously to show which penumbral inferences would be generated for such a structure. Penumbral inferences could be generated for the ANF representation above by parsing its components into the inference-knowledge structures associated with this causal structure.

Suppose the user wanted to know whether or not it was the improvements that made the lessor happy. How should the system respond to such a query? The query could be represented in ANF as:

(IMPROVEMENTS CAUSE (LESSOR IS PLEASED)?

Technically read, neither the natural language description nor its ANF counterpart implies that the improvements were the sole cause of the lessor's pleased state. Each of those descriptions implies that an entire event pleased the lessor. The improvements were merely involved in that event. It is possible, for example, that the lessor would not have been pleased had the improvements been made by someone other than the lessee. For one to be able to deduce that the improvements were the cause of the lessor's emotional state, a different causal structure would have to be present, such as:

((?A CAUSE (?B HAS ?C))
((?B HAS ?C) CAUSE (?D IS ?E)))

d2. Note that differences in verb tense are ignored in this example.

In other words, if the ANF version had read:

((LESSEE CAUSED (LEASED-PROPERTY HAS IMPROVEMENTS))
((LEASED-PROPERTY HAS IMPROVEMENTS)
(CAUSED
(LESSOR IS PLEASED)))

the appropriate causal structure would have been present, and CCLIPS could have deduced that the improvements caused the emotional state of the lessor. The original ANF representation, however, does not bear this structure; therefore; the conclusion could not be reached by deduction. However, CCLIPS could draw a valid penumbral inference that the improvements caused the lessor's state. It would do this by instantiating inference-knowledge structure (11) in *Example A, supra.* The result would read:

(IMPROVEMENTS MAYBE-CAUSE (LESSOR IS PLEASED)).

By making minor adjustments in verb tense and by recognizing that the link "MAYBE-CAUSE" is a penumbral derivative of the link "CAUSE," which is the present-tense version of the causal link of the query, CCLIPS could match the inference with the query and thus would be in a position to respond intelligently. Although it could not give a valid affirmative response, it could inform the user that an event involving improvements pleased the lessor, which is precisely the idea that serves as the foundation for the penumbral inference.

COMMENTS

PROTECTING THE "LOOK AND FEEL" OF COMPUTER SOFTWARE

BY JOHN PINHEIRO † AND GERARD LACROIX ††

The computer industry is poised on the threshold of a second generation of copyright issues. The first generation centered on the copyrightability of the "languages" and codes in which software is written and read. The second generation involves determining the existence and scope of protection for the "look and feel" of computer programs under copyright law.[1]

In 1980 an amendment to the 1976 Copyright Act (the "Act") expressly included computer codes or instructions within the scope of protected literary works and effectively terminated the litigation debate over copyrightability of computer code.[2] The 1983 landmark decision of *Apple Computer v. Franklin Computer Corp.*[3] established that computer code was copyrightable irrespective of whether its purpose was to operate the hardware or perform a specific application,[4] whether it was written in

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1. "Look and feel" describes the manner in which the software interacts with the user. *See infra* notes 26-31 and accompanying text; *see generally* Siegel & Derwin, *Copyright Infringement of the "Look and Feel" of an Operating System by its Own Applications Programs*, 4 COMPUTER LAW., Jan. 1987, at 1. This article addresses the question of whether a program's "look and feel" can receive copyright protection, not patent protection. *See* Sumner, *The Versatility of Software Patent Protection: From Subroutines to Look and Feel*, 3 COMPUTER LAW., June 1986, at 4-5. Sumner argues that, "[A] patent can protect the 'look and feel' of software where the features sought to be protected are functional." *Id.* at 4. *See also* Note, *Defining the Scope of Copyright Protection for Computer Software*, 38 STAN. L. REV. 497, 503-04 (1986).

2. 17 U.S.C. § 101 (Supp. 1986). *See* 1 M. NIMMER, NIMMER ON COPYRIGHT § 2.04[C], at 2-44 (1986).

3. 714 F.2d 1240, 1249 (3d Cir. 1983), *cert. dismissed*, 464 U.S. 1033 (1984). *Accord* Stern Elecs. v. Kaufman, 669 F.2d 852 (2d Cir. 1982).

4. Application programs direct the computer to perform specific data processing activities required for the solution of business, scientific, and other problems faced by computer users. Examples include word processing, spreadsheets, and data base creation.

source or object code,[5] or whether the code was stored on software or embedded in semiconductor chips.[6]

While the courts have implemented Congress' desire to protect programming code under copyright law, a second generation of issues has emerged focusing on the scope of that protection. The courts must now decide which program characteristics, other than codes or instructions, copyright law protects.[7] The scope of protection will be of great economic significance to the computer industry, possibly even more important than the protection of the programming code itself.[8] For example, attractive appearance and easy access often constitute the prime selling points of computer software because they are more important to the user than the programming code. Experts predict that in the future, software manufacturers will become more concerned with protecting the "look and feel" than the codes of their programs.[9] Therefore, defining the exact scope of copyright protection available for the "look and feel" of computer programs is vitally important to the software industry.[10]

In contrast, operating programs control the execution of computer programs and provide scheduling, debugging, input/output control, accounting compilation, storage assignment, data management, and related services. Examples include MS DOS, UNIX, and FINDER.

5. Source code is a set of computer instructions written in a language (e.g. BASIC, COBOL or PASCAL) that is input to a translation process. In contrast, object code is a set of compiled or assembled machine instructions that can be directly executed by the computer.

6. Programming code is often stored in Read-Only Memory (ROM) which is a basic type of semiconductor memory used for permanent storage.

7. On the other end of the technological spectrum is the issue of the protectability of microcode. District Judge William Ingram has ruled in a currently pending case that microcode is a protectable software program. The infringement portion of the case has not yet been decided. NEC Corp. v. Intel Corp., No. 84-20799 WAI (N.D. Cal. Sept. 22, 1986) (plaintiff's motion to reopen issue of infringement granted). *See* Laurie & Everett, *The Copyrightability of Microcode: Is It Software or Hardware or Both?*, 2 COMPUTER LAW., Mar. 1985, at 1.

8. The "look and feel" of a computer program often involves much more creativity and greater commercial value than the program code which implements the product. Russo & Derwin, *Copyright in the "Look and Feel" of Computer Software*, 2 COMPUTER LAW., Feb. 1985, at 1.

> In producing a product that does not have any connection with the actual code of the popular program but has similar appearance, identical command sets, and perhaps improved features for a more reasonable price, the competition can often capture a large portion of the market that would otherwise belong to the first company by default.

Davis, *"Look and Feel" Isn't Everything in This Case*, BYTE, July 1986, at 24 (letter to the editor).

9. "Computer and copyright lawyers at the Protecting and Marketing Computer Software and Semiconductor Chips in the Pacific Rim Conference agreed that [look and feel] will be the primary component that manufacturers will wish to protect—overshadowing even computer code." Ranney, *"Look and Feel" Discussed as Major Copyright Issue*, INFOWORLD, Nov. 11, 1985, at 13. *See also* Mace, *Some Firms Drop Copyright Protection*, INFOWORLD, Sept. 30, 1985, at 16.

10. Note, *supra* note 1, at 502.

To date, only two cases have made progress towards creating such a definition. In the recently decided case, *Whelan Associates v. Jaslow Dental Lab*,[11] the Third Circuit took an initial step when it extended copyright protection "beyond the programs' literal code to their structure, sequence, and organization."[12] The Northern District Court of California took a second step in *Broderbund, Inc. and Pixellite Software v. Unison World, Inc.*[13] That case involved a claim that "the overall appearance, structure, and sequence of audiovisual displays in defendant's 'Printmaster' infringe plaintiffs' copyright on 'Print Shop.'"[14] Finding the "total concept and feel" of these programs to be essentially identical,[15] the trial court extended copyright protection to the "look and feel" of the plaintiffs' Print Shop program. *Broderbund* is not the final word, however, as the decision is being appealed[16] and similar cases are currently pending.[17] This Comment examines the problems engendered

11. 797 F.2d 1222 (3d Cir. 1986), *cert. denied*, 55 U.S.L.W. 3473, No. 86-675 (Jan. 12, 1987).

12. 797 F.2d at 1248. *See Copyright Protection Extends to "Structure, Sequence and Organization" of Computer Program*, 3 COMPUTER LAW., Sept. 1986, at 23-4.

13. No. C-85-3457 WHO (N.D. Cal. Oct. 8, 1986), *appeal docketed*, No. 221 (9th Cir. Dec. 30, 1986) [hereinafter *Broderbund*]. *See* Plains Cotton Cooperative Assoc. v. Goodpasture Computer Service, Inc., No. 86-1126 (5th Cir. Jan. 21, 1987) (LEXIS, Genfed library, Fedcir file). In *Plains Cotton*, the court of appeals affirmed the denial of a preliminary injunction concerning two similar software packages that provide information regarding cotton prices, availability, and accounting functions. The court did not "accept the contention that the District Court ignored the evidence of organizational copying and focused exclusively on evidence of direct copying." *Id.* Furthermore, the court "decline[d] to embrace *Whelan*" stating that "market factors play a significant role in determining the sequence and organization of cotton marketing software and we decline to hold that those patterns cannot constitute 'ideas' in a computer context." *Id.*

14. *Broderbund, supra* note 13, at 2.

15. *Id.* at 20.

16. *Appeal docketed*, No. 221 (9th Cir. Dec. 30, 1986). *See* Calbreath, *Key Decision on Software Law*, The Recorder, Oct. 14, 1986, at 4.

17. Cadam, Inc. v. Adage, Inc., No. C-86-2146-T (D. Ma. July 21, 1986) (software vendor claims that look and feel of its software is its distinguishing feature and ought to be protected) (transferred from Northern District of California to Judge Tauro in the U.S. District Court in Boston); Lotus Development Corp. v. Mosaic Software, No. 87-0074-k, and Lotus Development Corp. v. Paperback Software, No. 87-0076-k (D. Ma. Jan. 12, 1987) (suits charge defendants with deliberately recreating the interface and look and feel of Lotus' 1-2-3 program); Manufacturers Technologies, Inc. v. CAMS, Inc., No. N-85-253 TFGD (D. Conn. June 7, 1985) (dispute concerns whether defendant's Quickcost and Rapidcost programs infringe on the copyright of plaintiff's Costimator program) (preliminary injunction denied, but numerous motions pending before trial); Microstuf, Inc. v. Softklone Distrib. Corp., No. C-86-128A (N.D. Ga. Jan. 27, 1986) (alleges that Softklone's Mirror communication program too closely duplicates the appearance and operation of Microstuf's Crosstalk XVI program); Plains Cotton Cooperative Assoc. v. Goodpasture Computer Service, Inc., No. 86-1126, slip op. (5th Cir. Jan. 21, 1987) (denial of preliminary injunction affirmed on appeal). *See generally* Davis, *Special Problems In "Look and Feel" Copyright Cases*, in COMPUTER LAW INSTITUTE 1986, 741 (1986).

by the emergence of look and feel copyright issues in light of these cases as well as more traditional doctrine. This Comment first presents some background information, including a working definition of look and feel and a model look and feel dispute, and then addresses three unresolved issues regarding the copyrightability of look and feel: (1) distinguishing ideas from expressions; (2) determining whether look and feel falls with the statutory categories of protected works; and (3) determining copyright infringement.

The fundamental question under copyright analysis is whether the look and feel of a computer program is an expression or an idea. This issue underlies all of copyright doctrine because copyright law protects only the expressions of ideas, functions, and processes, not the ideas themselves.[18] Section II of this Comment outlines the importance of the idea/expression distinction and examines the difficulties that arise when distilling unprotected ideas from protected expressions.

That section argues that separating idea from expression may be impossible to accomplish within the context of look and feel for at least two reasons. First, the legal tests currently used to sift uncopyrightable ideas from copyrighted expressions were all devised before the advent of computer software and are not readily adaptable to software cases. Second, the specific nature of computer software compounds the difficulties associated with distinguishing ideas from expressions.

The next issue concerns whether look and feel satisfies the basic requirements of the Copyright Act. Since copyright is wholly statutory, look and feel will only receive protection if it falls within the categories of protected works enumerated in the Act. Inclusion in a statutorily protected subject matter category is the threshold question for determining whether copyright law applies and is discussed in detail in Section III.

Briefly, the 1980 amendment to the Act protects computer programs under the "literary works" category in the statute.[19] Programs are defined as literary works when limited to their programming code.[20] It is unclear, however, whether the category of literary works protects the look and feel of programs.[21]

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18. *See* R. NIMMER, THE LAW OF COMPUTER TECHNOLOGY ¶ 1.02[3], at 1-5 (1985); Apple Computer v. Franklin Computer Corp., 714 F.2d at 1252-53.

19. 17 U.S.C. § 101 (Supp. 1986); M. NIMMER, *supra* note 2, § 2.04[C], at 2-43 to -44.1.

20. 17 U.S.C. § 101 (Supp. 1986).

21. *See infra* notes 110-21 and accompanying text. A precise determination of the scope of the literary works category is crucial because an imitator can copy a program's design, presentation, and output without copying the underlying code. For the converse situation where a court held that, despite dissimilarity in output, similarity in object code constituted infringement, see Midway Mfg. Co. v. Strohon, 564 F. Supp. 741 (N.D. Ill. 1983).

If look and feel falls outside the scope of protected literary works, then the copyrightability of look and feel will depend on how closely a program's design, presentation, output, and user interface can be analogized to the other categories of protected works enumerated in the Copyright Act. Section III argues that particular elements of a program's look and feel are similar to protected works such as commands,[22] graphics,[23] and audiovisual works.[24] However, since the categories were not designed to accommodate computer software, a significant amount of procrustean stretching and sawing is necessary in order to analogize the elements of look and feel to copyrightable works of authorship.

Assuming that the protected works of authorship include copyrightable elements of look and feel does not end the inquiry. The final step presented in Section IV is a discussion of infringement issues. The two conditions for determining infringement are the imitator's access to the protected program and the substantial similarity between the look and feel of the two programs.[25] As Section IV describes, any comparison of the look and feel of two programs for infringement is difficult because tests for substantial similarity blur the distinction between idea and expression.

This Comment concludes that a program's total look and feel should not be granted protection under copyright law. Look and feel is a broad, descriptive term that integrates both ideas and expressions. Although certain characteristics of the look and feel of computer programs may fall within categories enumerated by the Copyright Act, any infringement determination that relies on a direct comparison of the overall look and feel of programs inevitably fails to recognize systematically the distinction between idea and expression. Thus, copyright protection of a program's total look and feel should not be permitted because a test has not yet been formulated which simultaneously protects look and feel and distinguishes idea from expression. Specific elements of a program's look and feel, however, should be protected if they constitute distinct expressions within a protected work of authorship.

22. 17 U.S.C. § 102(1) (1982); commands are protected under the "literary works" category.
23. 17 U.S.C. § 102(5) (1982).
24. 17 U.S.C. § 102(6) (1982).
25. R. NIMMER, *supra* note 18, ¶ 1.06, at 1-42.

I. BACKGROUND

A. What is the "Look and Feel" of Computer Software?

Before addressing any issues regarding protection, "look and feel" must be more fully described. "Look and feel" is not a legal term, but is commonly used in the literature to discuss the legal issue of copyright protection for programs.[26] This computer industry term of art escapes precise definition for several reasons. First, this area is so new that no judicial or other authoritative definition has yet been stated. The *Broderbund* opinion refers to the "total concept and feel" of a program, but never defines the scope of that term.[27] Adding to the confusion, the meaning of look and feel varies from source to source in the general literature. For instance, look and feel has been discussed as both a physical characteristic of a program[28] and as an approach to determining infringement.[29] Finally, the term look and feel is vague because it embodies the user's subjective perception of a program; truly it is a term of "art."

This Comment adopts the following as a workable definition of the look and feel of a computer program: its "design, presentation and output as experienced by the user,"[30] including the various observable attributes of a program such as commands, graphics, sounds, symbols, sequences, arrangement, and more general aesthetic qualities experienced by the user. Consequently, this Comment treats look and feel as a somewhat subjective characteristic of a program rather than as an approach for determining infringement.[31]

B. The Apple/DRI Dispute

In such a vague area of the law it is easy to lapse into abstraction. It is therefore prudent to anchor the copyright analysis solidly in the concrete. A recent dispute between Apple Computer ("Apple") and

26. *E.g.*, Davis, *supra* note 17, at 741.

27. *Broderbund*, *supra* note 13 at 20. Although the opinion is unclear, the court presumably equated the "total concept and feel" with "the overall appearance, structure, and sequence of the audiovisual displays." *Id.* at 2.

28. *E.g.*, Russo & Derwin, *supra* note 8, at 1.

29. *E.g.*, 5 COMPUTER L. REP. 55 (1986) (although one court found inadequate evidence of infringement, it apparently adopted the "look and feel" approach to determining substantial similarity).

30. Russo & Derwin, *supra* note 8, at 1.

31. This Comment argues that using look and feel as an approach to determining the substantial similarity between two programs merely reformulates the "audience test" and fails to address the concerns of the Copyright Act. *See infra* note 168 and accompanying text.

Digital Research Inc. ("DRI") provides a good illustration of a controversy over the protection of the look and feel of a computer program. This dispute will serve as a useful paradigm for the discussion which follows.

In early October 1985, Apple and DRI reached an agreement regarding Apple's claim that DRI's Graphics Environment Manager ("GEM") programs infringed Apple's copyright on the user interface software for Apple's Macintosh personal computer.[32]

The Apple Macintosh performs application programs, such as MacWrite and MacPaint, as well as operating programs, such as FINDER.[33] FINDER is a user interface program that directs how information is displayed on the screen and controls the flow of information to and from the peripherals.[34] The purpose of FINDER is to insulate the user from the intricacies of the disk operating system ("DOS").[35] FINDER permits easy use of the Macintosh because the user can dispense with the laborious memorization of numerous keyboard command sequences.

FINDER begins by presenting the user with a screen display depicting a desktop.[36] A bar on the top of the screen contains options for the user, known as a "menu," so that the user can "pull down" specific command submenus and perform the commands inscribed thereon. The user can access disks as well as lower-level documents (e.g. files or application programs) by clicking a control device, known as a "mouse," over a representative icon which appears on the screen. Documents are deleted by using the mouse to drag the relevant icon over to a "trash can" icon. In sum, FINDER is an operating program that is exceedingly simple to use.

The unique "user friendly" characteristics of FINDER collectively constitute the program's look and feel. The look and feel facilitates use of the Macintosh by those who are unfamiliar with computers[37] which is

32. Davidson, *The Blackbox Approach to Software Copyright Infringement*, 3 COMPUTER LAW., Mar. 1986, at 25, 28; Foster & Ranney, *Apple Forces GEM Change*, INFOWORLD, Oct. 7, 1985, at 1; Note, *supra* note 1, at 524 n.132.

33. *See supra* note 4 for an explanation of operating and application programs.

34. D. CLAPP, MACINTOSH COMPLETE! 12 (1984).

35. Thompson, *Bringing the Macintosh to the PC*, INFOWORLD, June 10, 1985, at 43; Warfield, *The New Interface Technology: An Introduction to Windows and Mice*, BYTE, Dec. 1983, at 218, 220; White, *The Desktop Metaphor*, BYTE, Dec. 1983, at 220 (a revolution is occurring in computing based on techniques for controlling computers by pointing to video symbols instead of typing commands on keyboards).

36. *See generally* D. CLAPP, *supra* note 34, at 19-68.

37. Tim Turnpaugh, Senior Vice President of Technology Services at Seattle First National Bank, commented that "the difference in learning to use the Mac[intosh] compared to learning an MS-DOS machine is about 8-to-1 in the Mac's favor." LaPlante, *Apple Offers Alternative to MS-DOS Machines*, INFOWORLD, Oct. 13, 1986, at 15.

a major factor in the success of the Macintosh.[38] Apple has also manufactured graphics, painting, and word processing software which function similarly to FINDER.[39]

In the spring of 1985, DRI commenced distribution of GEM, a series of operating, graphics, painting, and word processing software designed for the IBM Personal Computer.[40] DRI promoted GEM as "a system that makes an IBM PC as easy to use as that master of simplicity, the Macintosh."[41] Independent software reviews also found many similarities existing between the two programs, including almost identical icons, windows, and menu bars.[42] The GEM screen also "bears a striking resemblance to the Macintosh screen."[43] For example, both interfaces allow users to access by clicking the mouse, to copy by superimposition, and to delete by dragging a document icon over a "trash can" icon.

The strong similarities between the DRI and Apple programs prompted Apple to threaten DRI with legal action unless it agreed to modify GEM.[44] Without admitting liability, DRI agreed to stop selling its current versions of GEM after a certain date and pay Apple an undisclosed monetary settlement.[45] In addition, DRI agreed to provide programming services for Apple at a reduced rate and to allow Apple to examine and approve DRI's revised versions of GEM.[46]

Apple also required DRI to change several characteristics of GEM's look and feel. These modifications included, but were not limited to: (1) eliminating the trash can icon; (2) eliminating certain icon animation sequences; (3) using darker borders rather than inverse video to indicate activated icons; (4) rewording certain commands (e.g. replacing "Type" with "Typeface"); (5) relocating several command menu labels; (6) modi-

38. According to a recent report by the research firm of Frost and Sullivan, by the end of the decade the Macintosh will be firmly entrenched as a second standard to the IBM personal computer with $1.3 billion in software sales annually. MICRO MARKETWORLD, Apr. 28, 1986, at 33.

39. These programs are MacDraw, MacPaint, and MacWrite, respectively.

40. An indication of GEM's planned similarity to the Macintosh software is the fact that the names of the DRI programs are GEM Desktop, GEM Graph, GEM Paint, and GEM Write. GEM has great strategic importance to DRI, whose performance has been poor over the past two years. Foster, *A 'Roller Coaster' Year for Former Front-Runner DRI*, INFOWORLD, Sept. 9, 1985, at 35.

41. Digital Research Inc., GEM Desktop Sales Brochure (1985).

42. *E.g.*, Thompson, *supra* note 35, at 43.

43. *Id.* Thompson concluded his review by noting that "imitation is the sincerest form of flattery." *Id.* at 45.

44. *See generally* Foster & Ranney, *supra* note 32, at 1.

45. 4 COMPUTER L. REP. 338 (1985).

46. *Id.*

fying certain patterns in GEM Draw; and (7) using a pencil eraser icon instead of a chalkboard eraser in GEM Paint.[47]

Both parties refuse to divulge any further information at this time. For present purposes, however, the Apple/DRI dispute provides sufficient facts to illustrate the major issues raised by copyrighting the look and feel of computer software.

II. SEPARATING IDEA FROM EXPRESSION

The fundamental policy underlying the Copyright Act is to promote the dissemination of the arts and sciences by providing an incentive for the publication of new works.[48] This is accomplished by granting the original author certain exclusive rights in the work. Under copyright law, the limited monopoly granted must not be so broad that it prevents others from building upon the ideas expressed in the work.[49] Separating ideas from expressions is the primary means of balancing these two competing interests of—providing an incentive to create without allowing an overly restrictive monopoly.[50] In *Whelan v. Jaslow*,[51] the court declares that the purpose of the copyright law is to create the most efficient and productive balance between protection of authors and dissemination

47. Forbes, *DRI Says New GEM Meets Apple's Terms*, INFOWORLD, Nov. 11, 1985, at 1, 8.

48. Intellectual property law is based on the Constitutional mandate to: "Promote the Progress of Science and the Useful Arts by securing for limited times to Authors and Inventors the exclusive Right to their respective Writings and Discoveries." U.S. CONST. art. I, § 8, cl. 8. This mandate is difficult to fulfill since a delicate balance must be maintained between two antagonistic policy goals: encouraging creation by awarding some form of proprietary right; and maximizing the free flow of new ideas and inventions. The Patent and Copyright Acts form the two pillars upon which Congress has decided to rest this policy balance. Under this scheme an inventor must fulfill the relatively stricter requirements embodied in the Patent Act in order to receive a proprietary interest in an idea or process because the grant of even a limited monopoly over a process interferes with the free flow of ideas. Protection of the expression of the idea poses a lesser threat to the dissemination of ideas and will therefore receive protection if the relatively lenient conditions of the Copyright Act are fulfilled. Hence, it is crucial to distinguish between the expression of an idea which receives copyright protection, and the idea itself which cannot receive protection under the Copyright Act. *See* 1 M. NIMMER, *supra* note 2, § 1.03[A], at 1-31 to -32.2.

49. In the Broderbund-Unison dispute, Unison has also charged Broderbund in another suit with attempting to restrain trade. According to David Schachter, an attorney for Unison, "[w]e were arguing that their copyright cannot protect the appearance of the screen, because to do that gives them a virtual monopoly." Clark, *Software's 'Look' Ruled Copyrightable*, San Francisco Chron., Oct. 14, 1986, at 27, col. 5.

50. *See* Hemnes, *The Adaptation of Copyright Law to Video Games*, 131 U. PA. L. REV. 171, 210-12 (1982); Reback & Siegal, *Toward a Computer Test for Software Infringement*, 1 COMPUTER LAW., Dec. 1984, at 5.

51. 797 F.2d 1222, 1235 (3d Cir. 1986), *cert. denied*, 55 U.S.L.W. 3473, No. 86-675 (Jan. 12, 1987).

of information. The focus on efficiency and productivity is not purely economical but, rather, is informed by policy goals as well. The key is to find a balance that creates an incentive to produce works of authorship, yet promotes the spread of learning, culture, and development.

Section 102 of the Copyright Act permits the copyright of expressions but prohibits the copyright of "any idea, procedure, process, system, method of operation, concept, principle, or discovery."[52] This reflects an attempt to encourage creative expression through the attribution of limited proprietary rights, while preserving the right of others to "use, adapt and build on an idea."[53] The idea/expression dichotomy has been criticized as obsolete,[54] but no better formula has been devised to conceptualize "the fundamental elements in an artistic creation and [to balance] the competing interests inherent in copyright law."[55]

Ultimately, distinguishing an idea from its expression entails a policy judgment as to whether the promotion of arts and sciences is better served by granting protection, or by authorizing a more liberal exploitation of the original work by others.[56] The courts, however, usually address the issue from a mechanical perspective, and policy judgments are often only implicit.[57] While this approach may be acceptable for resolving copyright cases involving less technological works, it is not helpful when addressing qualitatively new questions, such as differentiating idea from expression in software's look and feel.

This Section considers four approaches to distinguishing idea and expression: Judge Learned Hand's "levels of abstraction" test; the "commercial value" approach; the "program structure" analysis of *Whelan v. Jaslow;* and the "plurality of expressions" test.

A. Levels of Abstraction Test

Judge Learned Hand's authoritative "levels of abstraction" test is often the starting point for distinguishing ideas from their expressions.[58] This test was originally developed for literary works.

52. 17 U.S.C. § 102 (1982). *See* Mazer v. Stein, 347 U.S. 201, 217 (1954). This restriction prevents an overlap with the Patent Act which was enacted to address these matters. 35 U.S.C. § 101 (1982); *see* R. NIMMER, *supra* note 18, ¶ 2.01, at 2-2.

53. R. NIMMER, *supra* note 18, ¶ 1.02[3], at 1-5; Note, *supra* note 1, at 498.

54. Sid & Marty Krofft Television Products v. McDonald's Corp., 562 F.2d 1157, 1163 n.6 (9th Cir. 1977).

55. *Id.*

56. R. NIMMER, *supra* note 18, ¶ 1.06, at 1-43.

57. *See Krofft*, 562 F.2d at 1163; Warner Bros. v. American Broadcasting Co., 720 F.2d 231, 240 (2d Cir. 1983). *See also* R. NIMMER, *supra* note 18, ¶ 1.06, at 1-43 (author argues for explicit policy balancing).

58. *See, e.g., Krofft*, 562 F.2d at 1163.

> Upon any work . . . a great number of patterns of increasing generality will fit equally well, as more and more of the incident is left out. The last may perhaps be no more than the most general statement of what the [work] is about, and at times consist only of its title; but there is a point in this series of abstractions where they are no longer protected, since otherwise the [author] could prevent the use of his "ideas," to which, apart from their expression, his property is never extended.[59]

Hand's approach to distilling idea from expression entails a comparison of the works involved, starting at a level consisting of concrete expressions and working towards the abstract idea. For instance, similarities of phraseology and details of characterization are copyrightable as expressions.[60] The "plot" or "pattern," (defined as the sequence of events and interplay of the characters), also constitutes an expression.[61] As the analysis becomes more general and abstract, a level is reached where the expression converges with the idea itself, and any similarity is only of ideas, thereby precluding infringement. Thus, while "no one could copy [Shakespeare's] drama concerning the star-crossed lovers of Verona merely by paraphrasing the dialogue . . . anyone could borrow [*Romeo and Juliet's* basic idea] of a romance between members of two hostile families."[62]

In the context of computer software, look and feel can be examined two different ways under the levels of abstraction test; either based on the look and feel of the software or based on the design structure of the software. However, neither approach supports the conclusion that look and feel is copyrightable.

First, a hierarchy of levels of abstraction can be constructed focusing on look and feel. The concrete computer code or instructions form the least abstract layer of such a hierarchy. The next layer of abstraction includes specific elements of the user interface, such as the windows, menu bars, commands, and icons in the FINDER program. Look and feel is even more abstract because it is subjective and essentially depends upon the user's perception of the software's operation. Thus, at a very abstract level, the program can be characterized as the entire user interface or its total look and feel. Ultimately, the most abstract level is the fundamental idea or function of the program. Viewed as part of this

59. Nichols v. Universal Pictures Corp., 45 F.2d 119, 121 (2d Cir. 1930).

60. *See* 3 M. NIMMER, *supra* note 2, § 13.03[A], at 13-29 to -30.

61. The majority rule is that a "plot" so defined is copyrightable. *Id.*, § 13.03[A], at 13-29. *See also* Chafee, *Reflections on the Law of Copyright: I*, 45 COLUM. L. REV. 503, 514 (1945).

62. 3 M. NIMMER, *supra* note 2, § 13.03[A], at 13-25 to -26.

hierarchy, the look and feel of a program should not receive copyright protection because it is positioned at the abstract end of the hierarchy.

Second, an alternative hierarchy focuses on the design structure of computer software. The bottom layer again consists of the programming code. At a somewhat more abstract level, a program is described by the specific structure of the subroutines. Even more abstract, a program is characterized by a flowchart. Finally, a program can be represented by an algorithm and, ultimately, by its basic idea or purpose. Under this analysis, the programming code of a word processing program, for example, is clearly protected,[63] while the idea of using a computer to input, store, and edit text is not protected.[64] Unfortunately, look and feel does not fit within this hierarchy because it consists of the program's output and user interface which does not directly correspond with the design structure. The concept of look and feel is not a flowchart, algorithm, or any other design stage; look and feel conceptually permeates several layers of this hierarchy. Thus, overall, neither hierarchy supports copyright protection of a program's look and feel.

Another difficulty is that, even assuming look and feel can be pinned to a particular level of a hierarchy, this test does not provide any guidance for determining which intermediary levels of abstraction are protected expressions and which levels are unprotected ideas. The levels of abstraction test is only a starting point in understanding the idea/expression distinction because it does not easily differentiate between an idea and its expression. On the other hand, "[n]o court or commentator . . . has been able to improve on Judge Learned Hand's famous abstractions test."[65] The test is useful in conceptualizing the problem, but is not a means of drawing the line between ideas and expressions in any given work.[66] Judge Hand himself admitted: "[n]obody has ever been able to fix that boundary [between idea and expression] and nobody ever can."[67] Therefore, "the test for infringement is of necessity vague . . . . Obviously, no principle can be stated as to when an imitator has gone beyond copying the 'idea,' and has borrowed its 'expression.' Decisions must therefore inevitably be *ad hoc*."[68]

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63. *See supra* notes 2-3 and accompanying text.

64. *See supra* note 52 and accompanying text.

65. *Krofft*, 562 F.2d at 1163.

66. 3 M. NIMMER, *supra* note 2, § 13.03[A], at 13-20.1.

67. Nichols v. Universal, 45 F.2d at 121.

68. Peter Pan Fabrics, Inc. v. Martin Weiner Corp., 274 F.2d 487, 489 (2d Cir. 1960). *See* Atari v. North American Philips Consumer Elecs. Corp., 672 F.2d 607, 615 (7th Cir.), *cert. denied*, 459 U.S. 880 (1982); Reback & Siegal, *supra* note 50, at 4-5 (test is subjective).

The problem is even more acute when facing a new copyright issue such as the proper scope of protection for the look and feel of computer software. Deciding which levels deserve protection is more difficult in the realm of computer programs because, unlike literary works, computer programs are functional, utilitarian creations. Professor Raymond Nimmer explains: "[t]he software environment uniquely blends idea, expression, and process in a manner that cannot be compared readily to books or articles that describe systems. Computer programs not only describe a process or idea, but in an appropriate form directly implement it."[69] The function of the program pervades every level of the hierarchy because the function can be viewed as either very concrete or very abstract. Therefore, the problem of distinguishing idea from expression is even more complicated in the area of functional computer software. Although the failure of the levels of abstraction test to provide a mechanism for determining which levels should be protected may not be so critical in the area of literary works, this failure limits use of the test in the area of computer software.

In short, the levels of abstraction test is difficult to apply to look and feel of software. Even if applied, this test yields the result that total look and feel should not be protected.

B. The "Commercial Value" Approach

The "commercial value" approach focuses on the "substantive value" of the plaintiff's work.[70] "[The] method is to identify the commercially or artistically central elements of the first work and then to inquire what the effect of protecting these would be on subsequent works."[71] Advocates for the protection of look and feel often try to justify copyright protection based on the commercial value of software development expenditures.[72]

Exclusive reliance on the commercial value approach, however, raises mercantile concerns which have not been part of traditional copyright analysis.[73] The courts have rejected the argument that an otherwise

69. R. NIMMER, *supra* note 18, ¶ 1.03, at 1-10.

70. Atari v. North American, 672 F.2d at 619; Universal Pictures Co. v. Harold Lloyd Corp., 162 F.2d 354, 361 (9th Cir. 1947).

71. R. NIMMER, *supra* note 18, ¶ 1.07, at 1-49.

72. For example, Leon Williams, president and chief executive officer of Micropro International Corporation stated in reference to the *Broderbund* decision, "[p]eople who are blazing new trails in software need this kind of protection. A lot of people are spending a lot of money and time to develop advanced software." *Court backs 'Look & Feel' Copyright*, INFOWORLD, Oct. 20, 1986, at 1, 8. *See supra* note 9 and accompanying text. Meanwhile, opponents of copyright protection for look and feel argue that protection "could curtail development of software built on the features of existing products." LaPlante, *Suits Trigger Debate Over Ramifications*, INFOWORLD, Jan. 19, 1987, at 1.

73. "The decision should and will turn even more explicitly on a balance that in-

uncopyrightable process should be given protection simply "because the plaintiff has expended a large amount of money, time, and effort in promoting, developing and . . . market[ing] its system."[74] Moreover, the test is premised on the erroneous assumption that dollar value and creativity are synonymous.

Finally, such an approach overly protects the original author at the expense of idea dissemination. The application of this approach to the Apple/DRI conflict, for example, would extend Apple's potential copyright protection to monopolistic proportions. The commercial value of Macintosh resides primarily in the unique user friendly environment of FINDER, the heart of the program's look and feel.[75] Thus, using the commercial value approach, menu bars, windows, desktop, and animation sequences would all be protected since these characteristics make Macintosh easy to use, and hence commercially valuable.[76]

However, allowing Apple to copyright these features would also stifle subsequent creativity.[77] Although the commercial value test provides some economic incentive to produce commercially valuable works, it does not optimally encourage productivity because it creates monopolistic property rights. The FINDER animation sequence,[78] for example, is so basic that allowing copyright protection would severely hamper competing operating systems. Although certain video screen arrangements are copyrightable,[79] extending protection to Macintosh's animation sequence would, in effect, confer a monopoly over a simplified process of inputting (or outputting) data on a computer. So characterized, the sequences constitute ideas and must remain available to other computer manufacturers.[80]

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volves issues of commercial utility and market access with which copyright has not commonly dealt." R. NIMMER, *supra* note 18, § 1.08[1], at 1-54.

74. Affiliated Enter., Inc. v. Gruber, 86 F.2d 958, 961 (1st Cir. 1936).

75. *See supra* text accompanying note 38.

76. *See supra* notes 34-35 and accompanying text.

77. "[These lawsuits] probably will have somewhat of a dampening effect on competition because it will mean that companies won't find it quite so easy to come out with a competing product . . . ." Warner & LaPlante, *Lotus Considers Action Against Clone Makers*, INFOWORLD, Nov. 11, 1986, at 1, 8 (quoting Richard Bernacchi, a computer law specialist in the Los Angeles law firm of Irell & Manella).

78. The FINDER's animation sequence is based on the concept of an office. The disk is like a file cabinet. Typically, when the disk is opened on the desktop, several file folders appear. When the file folders are opened, either more subfile folders or the documents contained within the folders appear.

79. Russo & Derwin, *supra* note 8, at 6, *quoting* Norton Painting Co. v. Augustana Hospital, 155 U.S.P.Q. (BNA) 133, 135 (N.D. Ill. 1967). The copyrightability of literary plots might provide a useful analogy for an argument in support of protection. 3 M. NIMMER, *supra* note 2, § 13.03[A], at 13-29.

80.

> [I]f order and sequence is the expression, the skilled effort is not separable, for the form, arrangement and combination is itself the intellectual conception involved. . . . This is because

From a policy standpoint, granting Apple a copyright in FINDER's look and feel would not only stifle subsequent creativity, but it would also delay beneficial standardization. For instance, users could more easily adapt to different programs if the menu bars were always located at the top of the screen, yet Apple requested that DRI move its menu to the left side of the screen to avoid copying the overall look and feel of the Macintosh desktop.[81] These modifications do not protect creative expression and are counterproductive. As Michael Scott, executive director of the Center for Computer Law in Manhattan Beach, California explains: "[d]o you really want 20 different user friendly concepts? You would have to learn each one, which defeats the whole purpose."[82] The commercial value approach probably would permit look and feel components to be classified as copyrightable "expressions," however that would be counterproductive to the public.

C. The "Program Structure" Analysis of Whelan v. Jaslow

The "program structure" analysis of *Whelan Associates, Inc. v. Jaslow Dental Laboratory, Inc.*,[83] is equally problematic. There the Third Circuit extended copyright protection to include the "structure" of the program as well as the source and object code.[84] Whelan alleged that Jaslow Labs had copied its dental laboratory accounting program. Although there was no substantial evidence of direct line by line copying, at trial Whelan argued that Jaslow's file structure and screen outputs were virtually identical.[85]

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in the usual case sequence, choice, and arrangement have only stylistic significance, rather than constituting as they would here, the essence of the expression.

Synercom Tech., Inc. v. U. Computing Co., 462 F. Supp. 1003, 1014 (N.D. Tex. 1978) (paper input formats not copyrightable).

81. "Many software designers try to make their menus look like those in other programs to make it simpler for users to move between different programs. If they can't apply consistency, software developers worry that they will have to design needlessly complex screens and instructions just to avoid other companies' copyrights." Bulkeley, *Courts Expand the Copyright Protection of Software, but Many Questions Remain*, Wall St. J., Nov. 18, 1986, at 37, col. 4.

82. Ranney, *supra* note 9, at 13. "These user-friendly interfaces are important mostly for people who want an automatic entry into new programs. If each user interface is different from each other, not much is accomplished. If, on the other hand, there are similarities where they would be helpful and innovations when they are needed, users would be much better off." Davis, *supra* note 8, at 388.

83. 797 F.2d 1222 (3d Cir. 1986); *cert. denied*, 55 U.S.L.W. 3473, No. 86-675 (Jan. 12, 1987).

84. *Whelan* does not limit copyright protection to the literal aspects of a computer program, but rather extends protection to "the overall structure of a program, including its audiovisual display." *Broderbund*, *supra* note 13, at 9.

85. 797 F.2d at 1228. On these facts the court created the following test for distinguishing idea from expression: "the purpose or function of a utilitarian work would be the work's idea, and everything that is not necessary to that purpose or function would

The *Whelan* court defined the protected "expression of an idea" in software as "the manner in which the program operates, controls and regulates the computer in receiving, assembling, calculating, retaining, correlating, and producing useful information either on a screen, printout or by audio communication."[86] In other words, the court held that copyright law protects the program "structure."[87]

If a court applied this definition of expression broadly, then a software's design, presentation, output, and user interface all would receive copyright protection. However, such extensive protection overemphasizes the goal of protecting authors and neglects the need for free dissemination of facts. Within the context of the Apple/DRI paradigm it is easy to see that the command menus, windows, and the icon animation sequences, as well as FINDER's desktop, all determine "the manner in which the program operates . . . the computer in . . . producing useful information." Thus, the look and feel of Apple's program would receive full protection under a broad reading of the analysis in *Whelan*.[88]

Courts should reject this notion of protected expression as overly inclusive. [89] Indeed, the "manner in which the program operates,

be part of the expression of that idea." *Id.* at 1236. This test requires the court to make two difficult findings. First, the court must determine the purpose or function of a program. This analysis is somewhat circular because how the court chooses to define a program's purpose will dictate the scope of protection. For instance, the *Whelan* court stated that "the purpose of the [protected] program was to aid in the business operations of a dental laboratory." *Id.* at 1238. Alternatively the court could have described the purpose as providing order entry, invoicing, accounts receivable, end of day procedure, and end of month procedure for a dental prosthetic laboratory. This definition limits the program's idea and hence narrows the extent of copyright protection. Second, this test requires the court to determine if certain elements are "necessary" for the program's purpose. This factually difficult determination involves substantial judicial discretion. It is doubtful that an approach based on such subjective findings would lead to consistent results.

86. *Id.* at 1239 (quoting Whelan Assocs. v. Jaslow Dental Labs., 609 F. Supp. 1307, 1320, 225 U.S.P.Q. (BNA) 156, 165 (E.D. Pa. 1985)).

87. "By analogy to other literary works, it would thus appear that the copyrights of computer programs can be infringed even absent copying of the literal elements of the program." 797 F.2d at 1234.

88. Apart from the idea/expression issue, *Whelan* can be distinguished from look and feel cases on another basis. In *Whelan*, the issue was whether the defendants violated the copyright by translating the source code. This issue is not pertinent in look and feel cases because look and feel can be reproduced without access or copying the source code. *See* Davis, *supra* note 8, at 24 (letter to the editor).

89. Davis, *Computer Software—the Final Frontier: Clones, Compatibility and Copyright (pt. 1)*, 2 COMPUTER LAW., June 1985, at 3; Liebman, Katsch & Leitch, *Back to Basics: A Critique of the Emerging Judicial Analysis of the Outer Limits of Computer Program Expression*, 2 COMPUTER LAW., Dec. 1985, at 4 [hereinafter Liebman]. *But see* Note, *supra* note 1, at 528 (author advocates a more restrictive reading of *Whelan.*) *See* Plains Cotton Cooperative Assoc. v. Goodpasture Computer Service, Inc., No. 86-1126 (5th Cir. Jan. 21, 1987) (LEXIS, Genfed library, Fedcir file).

controls and regulates the computer" is indistinguishable from the very function or process the creator designed the software to perform. *Whelan's* broad approach ultimately fails because it does not address the critical issue in copyright analysis: distinguishing between a program's expression and its underlying process or function.[90]

Moreover, there is an alternative, narrow interpretation of the *Whelan* holding which is less problematic. One might read *Whelan* as extending copyright protection to the structure of the programming code only.[91] Given the problems implicated by the broad reading, *Whelan* should be limited to this narrow, more practical holding.[92]

D. The "Plurality of Expressions" Test

The useful "plurality of expressions" test first appeared in the famous Third Circuit decision *Apple Computer v. Franklin Computer Corp.*[93] Apple filed suit alleging that Franklin was liable for copyright infringement of several operating programs. Franklin claimed that extending copyright protection to Apple's operating system would violate § 102(b) which precludes protection of ideas. The court ruled "[i]f other programs can be written or created which perform the same function as Apple's operating system program, then that program is an expression of the idea and hence copyrightable."[94] The central focus is whether the idea can be expressed in a plurality of ways; if so, then that particular expression is copyrightable.[95]

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90. Davis, *supra* note 89, at 2; Liebman, *supra* note 89, at 4.

91. In describing the development of a computer program, the court noted the first task is to identify the problem the program seeks to solve. *Whelan*, 797 F.2d at 1229. The programmer may construct a flowchart composed of "subroutines" or "modules" each of which deals with elements of the larger problem. *Id.* at 1230. The structure of the subroutines and modules within a program is important because one internal arrangement may be more efficient than another. This definition of a program's structure—the program's particular subroutines or modules—would still be protected in a narrow reading of the *Whelan* holding.

92. A better approach which fulfills the purpose of the Copyright Act is to deny copyright protection unless the second creator actually copies the computer code or transposes the original code in another programming language. *Accord* Liebman, *supra* note 89, at 5. This more restrictive view obtains the result reached in *Whelan* without adhering to the overly inclusive language therein.

93. 714 F.2d 1240, 1253 (3d Cir. 1983), *cert. dismissed*, 464 U.S. 1033 (1984). *See generally*, 1 M. NIMMER, *supra* note 2, §2.18[J], at 2-220 to -222.

94. Apple v. Franklin, 714 F.2d at 1253. *See also Whelan*, 797 F.2d at 1236 n.28, 1237; Davidson, *supra* note 32, at 26.

95. In *Broderbund* the defendant argued that idea and expression were indistinguishable in the plaintiff's program because there was "no other conceivable way to structure such a program." *Broderbund, supra* note 13, at 7. The court rejected this contention by pointing to the existence of another program with the same function or idea as the plaintiff's program, but with a different expression of that idea. "Yet the expressions of those ideas are very different. The menu screen and sequence of screens in the two pro-

An almost identical approach consists of denying copyright protection when the idea and expression merge, that is, when only a few ways of expressing an idea are possible.[96] A similar concept, called *scènes à faire*, is used in the field of literary works. *Scènes à faire* are incidents of plot which necessarily follow from a common theme or setting.[97] A *scène à faire* is not copyrightable since the similarity between two works results from the fact that a common idea is only capable of expression in a more or less stereotyped form.[98]

The plurality of expressions test combines several distinct advantages. First, the test is clear and relatively easy to apply. Instead of determining a cutoff between levels of abstraction, this test simply asks whether an idea (e.g. deleting a file) can be expressed in a plurality of manners (e.g. a trash can icon or other representation). Thus, the test is based on tangible and discrete factors instead of vague abstractions.

Second, this test is likely to yield more consistent and predictable results. By focusing attention on the various ways to express an idea, one generally reaches only a few possible conclusions. If only one way to express an idea exists then the law provides no copyright protection. When the list of possible expressions is infinite,[99] copyright law should permit protection, but when there are limited possibilities,[100] the law should not provide copyright protection.

Most importantly, the plurality test incorporates the idea/expression analysis and other underlying policies of copyright law.[101] A copyright is a limited monopoly over a particular expression.[102] Therefore, even if

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grams are different. The entire structure and organization of the user interfaces are different. In short, the existence of [another program] proves that there do exist other, quite different ways of expressing the ideas embodied in [the plaintiff's program]." *Id.* at 7-8. "Because there are a variety of program structures through which [the idea or function of the protected program] can be expressed, the structure is not a necessary incident to that idea." *Whelan*, 797 F.2d at 1240.

96. "If there is only one way to express the idea, 'idea' and 'expression' merge and there is no copyrightable material." M. Kramer Mfg. Co. v. Andrews, 783 F.2d 421, 436 (7th Cir. 1983); *see* Morrissey v. Proctor & Gamble Co., 379 F.2d 675, 678 (1st Cir. 1967); Herbert Rosenthal Jewelry, 446 F.2d 738, 742 (9th Cir. 1971). *See also* Russo, *supra* note 8, at 7.

97. Schwartz v. Universal, 85 F. Supp. 270, 275 (S.D. Cal. 1945).

98. 3 M. NIMMER, *supra* note 2, § 13.03[A], at 13-32 to -33.

99. *See infra* note 104 and accompanying text.

100. *See infra* note 105 and accompanying text.

101. *Whelan*, 797 F.2d at 1237 (test would advance basic purpose underlying idea/expression distinction—preserving balance between competition and protecting expression). The test also reconciles the apparent anomaly that video game images are protected expressions. For example, there are an unlimited number of creatures which could be depicted running through a maze chase game. Therefore, the particular type of creature (e.g. a yellow circular PAC-MAN with a chomping mouth) could be protected while the idea of a maze chase game could not.

102. A copyright is the exclusive right held by the author or developer of an original

the author monopolizes one expression, the plurality test allows healthy competition because viable, alternative ways to express the same idea still exist.[103]

Applying the plurality test to the programs involved in the Apple/DRI dispute indicates that only some of GEM's characteristics infringed Apple's software. For example, the trash can icon is only one of many ways to express the delete function.[104] In contrast, methods of expressing activated icons are few.[105] Likewise, there is only a limited number of ways to express certain commands such as "edit," "search," and "type." Therefore, simply because Apple chose "type," the plurality test would not require DRI to use only alternative commands such as "typeface." The same analysis applies to the location of the command bar labels on the video screen. The necessity of saving the center of the screen for applications use as well as the dimensions of the screen itself limit the command bar labels to a few functional positions.

Copyright law cannot protect look and feel as a global concept because the law requires ideas to remain freely transferable. Yet look and feel broadly defines a program and includes both expressions and ideas. Therefore, instead of looking at the program as a whole, a court should analyze and dissect the look and feel of a program into its component elements to determine which features the law should protect and which are unprotectable ideas.

As demonstrated, a court faces enormous conceptual and practical difficulties when distinguishing ideas from expressions. Judge Learned Hand's levels of abstraction test is extremely vague and inconclusive. The commercial value approach also fails because it is too broad and focuses on mercantile concerns foreign to traditional copyright analysis. Likewise, *Whelan's* broad structural analysis proves to be too overprotective and difficult to apply in a consistent manner. The plurality of expressions test, on the other hand, more properly accounts for the

work of authorship to make copies of such work and utilize them for commercial purposes. S. ELIAS, INTELLECTUAL PROPERTY LAW DICTIONARY 42 (1985).

103. Corporate counsel for Kyocera Unison stated that the ruling in *Broderbund* went too far in giving an unfair advantage to developers who bring their products to market first, locking out similar products which follow. Lach, *Court Backs "Look and Feel" Copyright*, INFOWORLD, Oct. 20, 1986, at 1, 8. This "locking out" is impossible, however, if expressions are only protected when they can be represented in a plurality of ways. *See supra* note 101 and accompanying text.

104. For example, a delete function could be expressed with a garbage bin, dump yard, eraser, sink, garbage truck, black hole, spittoon, bit bucket, or toilet. Still it is not clear that Apple should be the only company eligible to use a trash can icon. Perhaps as long as the competing trash can icon was not identical in appearance to the original, it would be deemed a different expression.

105. The limited means of indicating activated icons include: inverse video, darker borders, lighter borders, and blinking icons.

competing interests inherent in the look and feel of computer software. By not protecting look and feel as a global concept the plurality test balances the competing policies of the copyright law: encouraging innovation while stimulating the free flow of ideas.

III. LOOK AND FEEL AND SECTION 102(a) WORKS OF AUTHORSHIP

In addition to separating look and feel into its component ideas and expressions, a court must determine if the allegedly protected work falls within the precise provisions of the Copyright Act. Since copyright property rights are wholly statutory,[106] the elements of a computer program's look and feel must satisfy the subject matter requirements of section 102(a) in order to receive copyright protection.[107]

Section 102(a) limits copyright protection to seven enumerated works of authorship.[108] The question is whether a computer program's look and feel falls within any of these categories. Although Congress did not intend the seven categories to exhaust the limits of authorship,[109] practitioners who wish to extend copyright protection to new types of works usually search for analogies from among these categories.

A. Literary Works

The 1980 Amendment to the Copyright Act treats computer programs as works of authorship under the literary works category. It can be argued that look and feel should be protected as a literary work because it is a characteristic of a protectable program.

Such simplistic reasoning offers little guidance in analyzing whether look and feel falls within the statutory categories. The scope of rights derived from copyright protection vary depending on whether the work is classified as a literary work, audiovisual work, or another work of

106. Freeman v. Trade Register, 173 F. 419 (W.D. Wash. 1909).

107. In addition to limiting protection to specified works of authorship, the operative language of § 102(a) also limits copyright protection to "original works of authorship fixed in any tangible medium of expression." This imposes three conditions on copyright protection: authorship, originality, and fixation in a tangible medium. Assuming the existence of authorship, originality is a *de minimis* requirement. It is well established that only a modicum of creativity suffices for a work to be protected. Universal Athletic Sales Co. v. Salkeld, 511 F.2d 904, 908 (3d Cir.), *cert. denied*, 423 U.S. 863 (1975). The fixation condition is discussed *infra* note 148 and accompanying text.

108. 17 U.S.C. § 102(a) (1982). The categories are: "(1) literary works; (2) musical works, including any accompanying words; (3) dramatic works, including any accompanying music; (4) pantomimes and choreographic works; (5) pictorial, graphic, and sculptural works; (6) motion pictures and other audiovisual works; and (7) sound recordings."

109. 1 M. NIMMER, *supra* note 2, § 2.03[A], at 2-25 n.7.

authorship.[110] For instance, a motion picture film will generally consist of a series of related images and words. Thus, a motion picture can possess both an audiovisual portion and a literary portion,[111] and the scope of copyright protection will vary accordingly.

Similarly, a computer program embodies both a literary portion expressed by the programming code, and a non-literary portion. While courts treat the programming code as a literary work,[112] it does not follow that the courts must treat the look and feel also as a literary work or as a protectable characteristic of a literary work. Therefore, this Comment seeks to identify carefully which categories of works conform to the peculiar nature of look and feel.[113]

The 1980 Amendment to the Act defines a computer program as a "set of statements or instructions to be used directly or indirectly in a computer in order to bring about a certain result."[114] Since literary works are composed of "statements and instructions,"[115] the literary work category easily includes the computer program's "set of statements or instructions." However, as one moves away from the statements and instructions toward the design, presentation, output, and user interface, the literary work category no longer encompasses the total breadth of the computer program.

The 1980 amendment deliberately limits the definition of a computer program to its "statements or instructions" instead of defining a program broadly to include its attributes of look and feel. This amendment incorporates nearly verbatim the recommendations of the National Commission of New Technological Uses of Copyrighted Works ("CONTU"), a group that Congress established in 1974 for the purpose of revising the Copyright Act. Therefore, courts and commentators regard CONTU's final report as particularly authoritative.[116] The CONTU Report declined to address the issue of copyright protection for a software's design, presentation and output, preferring to leave that matter to the courts.[117] Although the question is an open one because

110. *See id.*, § 2.04[B], at 2-40.

111. *Id.*

112. *Id.*, § 2.04[C], at 2-44.1.

113. Another analogy is to a book which contains musical compositions, maps, reproductions of a work of art, photographs, prints, and pictorial illustrations. If the works collected in book form have been published in a different form or medium, the copyright for the book merely protects the collection as such but will not extend to the length and scope of the individual works contained therein. *See* M. NIMMER, NIMMER ON COPYRIGHT § 13.2, at 53-54 (1971).

114. 17 U.S.C. § 101 (1982).

115. *Id.*

116. National Commission on New Technological Uses of Copyrighted Works, Final Report 12 (1979) [hereinafter CONTU Report]. *See* Liebman, *supra* note 89, at 6.

117. CONTU Report, *supra* note 116, at 22-23. *See* Davis, *supra* note 89, at 6. CON-

no explicit answers exist within the report, a close reading of the report suggests that CONTU did not intend to extend copyright protection beyond the program's computer code.[118]

The peculiar nature of computer software suggests that a court should limit the category of literary works to a program's code. As one legal practitioner points out: "[v]irtually every other type of copyrighted work involves creation of a form of expression which is eventually reproduced for the user in substantially the form in which it was created. . . . Yet computer programs . . . never look the same on the computer screen [or print-out] as they were originally programmed."[119] The design, presentation, output, and user interface of software radically differ from the programming code. They bear little resemblance to literary works, thus the proper analysis treats the elements of look and feel as non-literary works of authorship.[120]

Finally, computer programmers can emulate a program's look and feel without copying the precise programming code in which it is written.[121] This fact demonstrates that as a practical matter the programming code and the look and feel of a program cannot be treated identically under the Act. Look and feel is neither intuitively nor rationally definable as a literary work merely because the Act affords protection to the programming code of a computer program as a literary work.

TU never reached the issue of copyrightability of a program's output. Liebman, *supra* note 89, at 6.

118. "[I]t can be argued that a strict construction of CONTU's recommended (and subsequently adopted) definition of a computer program— limiting protection to machine executable statements or instructions— best accords with CONTU's intent." Liebman, *supra* note 89, at 6-7, arrives at this conclusion after a detailed analysis of the report.

But see, Whelan, 797 F.2d at 1241: "[t]he CONTU Report never suggests that copyright protection should be limited to the literal code. . . . [T]he second part [of the Report]— particularly the reference to the compatibility of flowcharts—demonstrates that the Commission intended copyright protection to extend beyond the literal code." However, the fact that CONTU defined a flow chart as a "graphic representation . . . for the solution of a problem" weakens this *Whelan* analysis of the report. This language suggests that CONTU intended a court to treat a flow chart version as a graphic work under § 102(a)(1), but not as a computer program/literary work. According to Professor Arthur Miller of Harvard Law School, a member of CONTU, ". . . flow charts and logic diagrams do not fit the definition of 'computer program' in § 101 and hence cannot qualify for protection as a literary work under § 102(a)(1)." Liebman, *supra* note 89, at 7-8. Similarly, look and feel is a particular representation of a program that does not fit the § 101 definition.

119. Davis, *supra* note 89, at 7-8.

120. *But see* Note, *supra* note 1, at 499, 533.

121. For instance, in the Apple/DRI dispute, DRI wrote its programming code based on the look and feel of Apple's programs but without copying Apple's literal program. Thus, the source code and object code of DRI's programs do not infringe the programming code of Apple's programs.

B. Commands

Subsection A above argues that a court should not automatically consider the look and feel of software as a literary work, simply because the programming code is a literary work. Each of the software's menus, symbols, labels, and commands, however, might be included individually within the literary works category. According to the definition in § 101 of the Act, literary works are "works other than audiovisual works expressed in words, numbers, or other verbal or numerical symbols or indicia."[122]

Commands composed of "mere" words probably lack sufficient originality to merit protection. Generally, the Copyright Office prohibits the copyright of simple commands such as "[w]ords and short phrases such as names, titles, and slogans; familiar symbols or designs; mere variations of typographic ornamentation, lettering or coloring; mere listing of ingredients or contents."[123] Although some authority exists for protecting the original arrangement and selection of uncopyrightable words or symbols,[124] courts will probably refuse to extend copyright protection to short lists of common words such as file, edit, search, format, font, and style; or to symbols like arrows or boxes. For example, in the Apple/DRI dispute, Apple's use of "type" does not involve a unique, protectable command within the meaning of § 101 such that Apple should require DRI to use an alternative such as "typeface."

Although commands are probably not expressly protected as literary works, a court might treat the commands as an integral part of another type of copyrighted work. In *WGN Continental Broadcasting Co. v. United Video, Inc.*, the Court of Appeals for the Seventh Circuit held that "[teletext] intended to be viewed with and as an integral part of [an audiovisual] program" would be protected by the copyright on an audiovisual work.[125] It follows that commands and screen symbols that are related to the screen output are protected, but only if the output is protected as another type of copyrighted work.[126] Hence, it is necessary to examine whether look and feel falls within another protected category.

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122. 17 U.S.C. § 101 (1982); *see* Russo & Derwin, *supra* note 8, at 8.

123. 37 C.F.R. § 202(a) (1985).

124. See the cases cited in 1 M. NIMMER, *supra* note 2, § 2.04[B], at 2-41 n.15.1. *See also* Russo & Derwin, *supra* note 8, at 9.

125. WGN Continental Broadcasting Co. v. United Video, Inc., 693 F.2d 622, 628 (7th Cir. 1982).

126. *Accord*, Note, *supra* note 1, at 522.

C. Pictorial or Graphic Works

Pictorial and graphic works are defined as "two-dimensional and three-dimensional works of fine, graphic, and applied art, photographs, prints and art reproductions, maps, globes, charts, technical drawings, diagrams, and models."[127] An author may copyright his graphics[128] as "pictorial and graphic" works which constitute one of the protected subject matter categories enumerated in § 102 of the Act.[129]

In *John H. Harland Co. v. Clarke Checks, Inc.*, the Eleventh Circuit Court of Appeals held that an author may copyright the artistic background design on a check even though the author cannot copyright the form of the check.[130] The Seventh Circuit Court of Appeals observed that a creator could not copyright a game, but the creator could seek protection for "the pattern or design of the game boards and playing cards as pictorial or graphic works."[131]

The look and feel of software may also fall within the category of pictorial or graphic works. For example a court might extend protection to the individual windows, icons, and menu bars as graphics in the Apple/DRI conflict.[132] Section 101 of the Act, however, contains the following caveat:

> [Pictorial and graphic works] shall include works of artistic craftsmanship insofar as their form but not their mechanical or utilitarian aspects are concerned; the design of a useful article . . . shall be considered a pictorial or graphic, or sculptural work only if, and to the extent that such design incorporates pictorial, graphic, or sculptural features that can be identified separately from, and are capable of existing independently of, the utilitarian aspects of the article.[133]

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127. 17 U.S.C. § 101 (1982).

128. *See* Russo & Derwin, *supra* note 8, at 6.

129. 17 U.S.C. § 102 (1982).

130. John H. Harland Co. v. Clarke Checks, Inc., 711 F.2d 966 (11th Cir. 1983).

131. Atari v. North American Philips Consumer Elecs. Corp., 672 F.2d 607, 615 (7th Cir.), *cert. denied*, 459 U.S. 880 (1982) (*quoting* 1 M. NIMMER, *supra* note 2, § 2.18[H][3], at 2-12).

132. Protecting individual elements of a program as graphics could be particularly important should a court deny protection for the whole look and feel as an audiovisual work. *See infra* text accompanying notes 141-55.

133. 17 U.S.C. § 101 (1982). *See also* Durham Industries, Inc. v. Tomy Corp., 630 F.2d 905, 913 (2d Cir. 1980). This case involved copyrights to two mechanically-operated children's games featuring Walt Disney characters. The court held that the counterclaimant failed to specify "aesthetic elements" of the games that could be identified separately from and exist independently of the utilitarian aspects of the work. The shapes, dimensions, and configurations of the toys were dictated "primarily by utilitarian considerations." *Id.* at 915.

This same section defines a useful article as "an article having an intrinsic utilitarian function that is not merely to portray the appearance of the article or *convey information.*"[134]

If a court stringently applied this caveat, the graphics of a program may not be capable of copyright protection. In general, "if an article has *any* utilitarian function, it can be denied copyright protection except to the extent that its artistic features can be identified separately and are capable of existing independently as a work of art."[135] Within the context of computer software, the aesthetic qualities of the windows, icons, and menu bars are inseparable from their utilitarian functions. For instance, a change in the graphics of an icon indicates the active or inactive status of the icon.

In *Broderbund,* by contrast, the district court found that artistic and aesthetic considerations, not utilitarian or mechanical ones, dictated the structure, sequence, and layout of the audiovisual displays in the plaintiff's protected program.[136] Since the imitator in *Broderbund* had a wide range of expressions to choose from, the choice was "governed predominantly by artistic and not utilitarian considerations."[137] In other words, those elements of a program's look and feel which are utilitarian are more likely to be expressible in only a limited number of ways, and hence unprotectable. Thus, the *Broderbund* conclusion complements the plurality of expressions analysis.[138] A potential rebuttal to the utilitarian/aesthetic dichotomy rests upon the assertion that the utilitarian aspects reside within the computer program and the hardware, while the aesthetic appeal rests in the graphics displayed on the screen.[139] This distinction is too simplistic for modern, sophisticated software. In a user interface, for instance, the graphics are intrinsic to the program's usefulness because they replace the utilitarian typed commands that direct traditional disk operating systems, thus liberating the user from memorizing tedious commands.[140] Thus, the utilitarian purpose of certain elements of the program's graphics will foreclose copyright protection.

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134. 17 U.S.C. § 101 (1982) (emphasis added).

135. Fabrica Inc. v. El Dorado Corp., 217 U.S.P.Q. (BNA) 698, 700 (9th Cir. 1983) (emphasis in original).

136. *Broderbund, supra* note 13, at 12.

137. *Id.*

138. See *supra* text accompanying notes 93-105 for a discussion of the plurality of expressions test.

139. "In a video game, the audiovisual aspects of the game that appear on the screen are conceptually separable from its utilitarian aspects—a computer program and hardware." Williams Elecs., Inc. v. Bally Mfg. Corp., 568 F. Supp. 1274, 1281 n.15 (N.D. Ill. 1983).

140. *See supra* note 35 and accompanying text.

D. Audiovisual Works

The most promising subject matter category for the look and feel of software is "audiovisual works."[141] Section 101 defines audiovisual works as "works that consist of a series of related images which are intrinsically intended to be shown by the use of machines."[142] This section, and the cases involving video games, provide a framework for analyzing look and feel. However, even if look and feel properly fits within the audiovisual works category,[143] the distinction between idea and expression still determines which components are ultimately protected.

Although there are problems with the analogy to video games, these problems can be overcome. The audiovisual display analysis of the video game cases constitute a legal foundation on which to rest the partial protection of look and feel.[144]

Copyright law now protects the audiovisual display of video games.[145] Before arriving at this result, the leading video game case

141. *See* Russo & Derwin, *supra* note 8, at 5. In *Broderbund,* the Court held that the defendant "infringed the copyright of plaintiff Pixellite Software on the audiovisual displays of the computer program known as The Print Shop." *Broderbund, supra* note 13, at 1.

142. 17 U.S.C. § 101 (1982).

143. An initial objection to the protection of look and feel as an audiovisual display is that a court could characterize the desktops and windows of FINDER, for example, as a series of blank forms. Ever since the Supreme Court case of *Baker v. Selden,* courts have excluded forms from copyright. 101 U.S. 99 (1879) (denying copyright for a set of bookkeeping forms). *See* 1 M. NIMMER, *supra* note 2, § 2.18[B], at 2-199 n.21. *See also* R. NIMMER, *supra* note 18, § 1.03[4][a], at 1-19.

The Court in *Baker* based its holding on a distinction—copying for use verses copying for explanation—that was later explicitly rejected in Mazer v. Stein, 347 U.S. 201 (1954). For a vigorous critique of the Baker v. Seldon doctrine see 1 M. NIMMER, *supra* note 2, § 2.18[C], at 2-201 n.28.

Thus, the only limit to copyrighting forms should be a *de minimis* originality requirement. *See supra* note 107 and accompanying text. *See also Whelan,* 797 F.2d at 1243 (blank forms may be copyrighted if sufficiently innovative that their arrangement of information is itself informative); Continental Casualty Co. v. Beardsley, 253 F.2d 702, 704 (2d Cir.), *cert. denied,* 358 U.S. 816 (1958); 1 M. NIMMER, *supra* note 2, § 2-18[C], at 2-201 n.28. The generally cautious Copyright Office Regulations bar the copyright of blank forms that do not convey information. 37 C.F.R. § 202.1(c) (1985).

There is little doubt that a user interface such as FINDER or GEM conveys information if only by providing "dialog messages" when the computer malfunctions or when the user commits an error. Thus, the restrictions which apply to forms should not ban copyrightability of complex programs that interact with the user. *See* Russo & Derwin, *supra* note 8, at 7. *But see* R. NIMMER, *supra* note 18, ¶ 1.03[4][a], at 1-19 (output of a spreadsheet program not copyrightable because of insufficient originality).

144. *See e.g., Broderbund, supra* note 13, at 1; the court tried the case as an audiovisual copyright infringement claim.

145. Atari v. Amusement World, Inc., 547 F. Supp. 222, 226 (D. Md. 1981) (video game copyrightable as video work and motion picture); Atari v. North American, 672 F.2d at 615; M. Kramer Mfg. Co. v. Andrews, 783 F.2d 421 (4th Cir. 1986); Midway

examined three arguments against protection: (1) that the ephemeral images of the video games failed to satisfy the requirement of section 102(a) that the work is "fixed in any tangible medium of expression;" (2) that the creative participation of individual players gave each game the character of an original audiovisual work substantially different from the original display embedded on the game's circuit boards, and therefore, the images could not be copyrighted by plaintiff; and (3) that player interaction with the game prevented the formation of "a series of related images" as required by § 101's definition of audiovisual work.[146] The Second Circuit ultimately rejected these arguments, primarily because a "substantial portion" of the sights and sounds of the game were repetitive.[147] The repetitive nature of video games supports the conclusion that the computer program is fixed in a tangible medium,[148] that each game is not wholly dependent on the creative participation of the user, and that the game consists of a series of related images. Thus, video games are protectable as audiovisual works and, by analogy, one could argue that the visual aspects of computer software are also protectable.

However, one might criticize the analogy to video games because a software user typically expends a great amount of creative energy when using application and operating programs. In contrast, video games usually involve a repetitious format with little more than a reactionary response from the user.[149] The user also has much less control over the sequence of the audiovisual images in video games,[150] than in application programs.[151]

Mfg. Co. v. Artic Int'l, Inc., 704 F.2d 1009, 1010 (7th Cir.), *cert. denied*, 464 U.S. 823 (1983); Midway Mfg. Co. v. Bandai-America, Inc., 546 F. Supp. 125, 139 (D. N.J. 1982); Midway Mfg. Co. Dirkschneider, 543 F. Supp. 466, 479 (D. Neb. 1981), *aff'd*, 775 F.2d 70 (3d Cir. 1985), *cert. denied*, 106 S.Ct. 1265 (1986); Stern Elecs., Inc. v. Kaufman, 669 F.2d 852, 857 (2d Cir. 1982) (video game copyrightable as an audiovisual work). *See also* Hemnes, *supra* note 50, at 179-80, 182.

146. Stern Elecs., Inc. v. Kaufman, 669 F.2d at 855-57.

147. "[M]any aspects of the sights and the sequence of their appearance remain constant during each play of the game. . . . The repetitive sequence of a substantial portion of the sights and sounds of the game qualifies for copyright protection as an audiovisual work." *Id.* at 856.

148. The court also argued that the display was fixed in the computer program. *Id. See* Kramer v. Andrews, 783 F.2d at 433.

149. Davis argues vigorously that the rule in the video game cases cannot be applied to applications software in Amici Curiae Brief filed in *Broderbund* and reprinted in 5 COMPUTER L. REP., July 1986, at 126. Professor Raymond Nimmer seems to agree, at least for spreadsheets. R. NIMMER, *supra* note 18, ¶ 1.03[4], at 1-15 to -16.

150. The Seventh Circuit, in rejecting identical arguments as those made by the defendants in *Stern*, explicitly distinguished playing a video game from creative activities such as painting or writing, which is precisely the function of MacWrite and MacPaint. Midway Mfg. Co. v. Artic Int'l, Inc., 704 F.2d 1009, 1011-12 (7th Cir. 1983).

151. "[I]f the program merely provides tools to convey the user's expression, the program output is not copyrightable by the program author." R. NIMMER, *supra* note 18, ¶

These criticisms are not entirely persuasive. While look and feel is less repetitive than the audiovisual images of video games, the images constituting look and feel recurrently appear and are arguably fixed in the display monitor. In fact, the court in *Broderbund* chose to protect software as an audiovisual display without even addressing these criticisms.[152]

Unfortunately, categorizing look and feel as an audiovisual work does not resolve the problem of distinguishing idea from expression. The analysis used to separate ideas from expressions in video games provides little guidance for making this distinction with look and feel. In the area of video games software courts invoke the traditional rule that while the rules of a game are ideas that are not copyrightable, the design of the game board or playing cards are copyrightable as artistic works.[153] According to this rule, the shapes, colors, arrangement, size, and sequence of the images, as well as the sounds are copyrightable, while the idea of a maze chase game or a spaceship firing on aliens is not.[154]

Such an approach proves little help in the context of operating systems and application software, such as FINDER or MacWrite. Since these programs are not games, they cannot benefit from the traditional precedent that distinguishes between the rules of a game and the artistic expression contained in the game's physical components.

Moreover, the shapes, colors, arrangement, size, and sequence of the images, as well as the sounds, are more subordinate to the utilitarian functions and processes in application programs than in video games. That is, the creator of a video game has significant discretion in choosing the colors, shapes, and sounds of a video game, whereas a word processor's colors and shapes are more or less dictated by the program's function — word processing. This difference is perceptible in several elements of the look and feel involved in the Apple/DRI dispute including the commands, the use of inverse video to indicate activated icons, and the icon animation sequences.[155] By contrast, the distinction between idea and expression in video games is not overly complex. (The

1.03[4][c], at 1-22.

152. *Broderbund, supra* note 13, at 1.

153. *See, e.g.*, Atari v. North American, 672 F.2d at 615.

154. *Id.;* Kramer v. Andrews, 783 F.2d at 435.

155. An argument can be made that idea and expression are distinguishable for the trash can icon used in FINDER because its expression as a trash can is not completely dictated by functional considerations. The same is true for the chalkboard eraser used in MacPaint. *See supra* note 104 and accompanying text. Realize, however, that an argument for protection of particular attributes does not justify protecting look and feel as a broad, inclusive concept.

audiovisual display is almost pure expression.) As a result, the analysis used in the video game cases is not helpful in a look and feel dispute such as the Apple/DRI dispute, where the utilitarian and interactive aspects of the work blur the distinction between idea and expression.

Even if a particular program's look and feel is held to be copyrightable, an issue still remains: what is the scope of protection the author enjoys in relation to subsequent infringement?

IV. INFRINGEMENT

In order to maintain an infringement claim, the plaintiff must prove ownership of a valid copyright and copying by the defendant.[156] Since it is often impossible to obtain direct evidence of copying,[157] a court may infer copying where: (1) the defendant had "access" to the copyrighted work; and (2) the allegedly infringing work is "substantially similar" to the copyrighted work.[158]

A. Access

Proving access is easy[159] because the plaintiff need only prove that the defendant had a reasonable opportunity to view the original work.[160] In the domain of literary works, publication is usually sufficient to establish access.[161] This standard is also applied to software. In *Midway Mfg. Co. v. Bandai-America, Inc.*,[162] the court held that the defendant's awareness of the existence of a widely distributed

156. 3 M. NIMMER, *supra* note 2, § 13.01, at 13-3; Reback & Siegal, *supra* note 50, at 2. Another preliminary issue concerns display of copyright notice. The defendant in the *Broderbund* case argues that plaintiffs' copyright notice fails to provide reasonable warning to others that the audiovisual displays, and not just the literal aspects of the program are copyrighted. The court rejected this argument stating:

> [i]t would be unreasonable to expect copyright holders to list on each copy of their works every single aspect or element of the work for which they claim protection. It would also be unreasonable to expect copyright holders to know at any given time the exact state of law on the scope of copyright protection.

Broderbund, supra note 13, at 15.

157. The facts in *Broderbund* differ from the Apple/DRI model in that they justify a determination of infringement because the plaintiffs produced "sufficient direct evidence of copying." *Id.* at 15-16.

158. Warner Bros. v. American Broadcasting Co., 654 F.2d 204, 207 (2d Cir. 1981); 3 M. NIMMER, *supra* note 2, § 13.01[B], at 13-6.

159. *See* Reback & Siegal, *supra* note 50, at 10.

160. Furgeson v. National Broadcasting Co., 584 F.2d 111, 113 (5th Cir. 1978). In *Broderbund*, the court held that access to the literal aspects (source code and object code) are not necessary to copy the plaintiff's program. Plaintiff need only prove "that defendant had access to the protected work." *Broderbund, supra* note 13, at 17.

161. Stratchborneo v. Arc Music Corp., 357 F. Supp. 1393, 1403 (S.D.N.Y. 1973).

162. 546 F. Supp. 125 (D. N.J. 1982).

copyrighted video game constituted proof of access to that game.[163] Applying this rule to the Apple/DRI dispute, a court would conclude that DRI had access to the distributed Macintosh software. Every user of a program, by definition, has access to the program's look and feel.[164] Thus, access is of minimal importance in look and feel infringement cases.

B. Substantial Similarity

Once the plaintiff establishes access, the plaintiff must then prove that there is "substantial similarity" between the two programs.[165] Most of the difficulties in this area arise because this inquiry confronts the troublesome idea/expression issue.[166] As Professor Melville Nimmer explains, the distinction between idea and expression "constitutes not so much a limitation on the copyrightability of works, as . . . a measure of the degree of similarity which must exist as between a copyrightable work and an unauthorized copy, in order to constitute the latter an infringement."[167] As a result, there is no method to determine the substantial similarity of two programs' look and feel without first undertaking an idea/expression analysis.

1. *The "Audience" Test*

Proponents of extending blanket copyright protection to the look and feel of software base substantial similarity on the two programs' overall design, presentation, output, and user interface, otherwise referred to as their total look and feel.[168] In other words, such proponents use the term "look and feel" to describe an approach for determining infringement.[169]

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163. *Id.* at 145; *see also* 3 M. NIMMER, *supra* note 2, § 13.02[A], at 13-12.

164. In the first generation of copyright cases access was a more critical issue because the programming code, which is inaccessible to the average user, contains the technical instructions that operate the program.

165. *See supra* note 158 and accompanying text.

166. *See supra* Section II.

167. 1 M. NIMMER, *supra* note 2, § 2.03[D], at 2-32 to -33.

168. Some literature refers to this as the "look and feel approach" to determining infringement. *See* Russo & Derwin, *supra* note 8. However, Russo and Derwin's terminology is confusing because look and feel also describes the attributes of the user interface. Furthermore the "look and feel approach" to infringement is essentially the same as the audience test.

169. *See supra* note 29 and accompanying text.

They usually rely on two Ninth Circuit cases as support.[170] In *Roth Greeting Cards v. United Card Co.*,[171] the plaintiff alleged that the defendant had copied his greeting cards.[172] The Ninth Circuit agreed, holding that even though the wording of the plaintiff's cards was in the public domain, "proper analysis [required] that all elements of each card, including text, arrangement of text, art work, and association between artwork and text, be considered as a whole."[173] Applying this approach, the court found that "in total concept and feel" the defendant's cards were the same as the plaintiff's.[174] The Ninth Circuit later cited with approval the *Roth* analysis in *Sid & Marty Krofft Television Products, v. McDonald's Corp.*,[175] in which the court held that the defendant had infringed on the plaintiff's television show character.[176]

This "total look and feel" language merely reformulates the "audience" test found in the 1886 case of *Daly v. Palmer.*[177] According to the audience approach, the two works should be compared globally to test for substantial similarity.

> [T]he question really involved in such comparison is to ascertain the effect of the alleged [infringing work] upon the public, that is, upon the average reasonable man . . . . If there had been literary piracy of the story, *[the reasonable man] should detect that fact without any aid or suggestion or critical analysis by others. The reaction of the public to the matter should be spontaneous and immediate.*[178]

Likewise in *Arnstein v. Porter*, the court explained that "the test is the response of the ordinary lay [person]; accordingly . . . 'dissection'

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170. *See* Reback & Siegal, *supra* note 50, at 3, where the authors state that the most recent copyright cases have emphasized the totality of the work—the "total concept and feel" or the "total perception" (quoting *Krofft*, 562 F.2d 1157, 1167 (9th Cir. 1977)). "The substantial similarity of expression standard should be applied to computer programs . . . with emphasis on the overall structure, substance, concept and techniques of the work . . . ." Russo & Derwin, *supra* note 8, at 7, *citing Krofft* and Roth Greeting Cards v. United Card Co., 429 F.2d 1106 (9th Cir. 1970).

171. 429 F.2d 1106 (9th Cir. 1970).

172. *Id.* at 1110.

173. *Id.* at 1109.

174. *Id.* at 1110.

175. 562 F.2d 1157 (9th Cir. 1977).

176. *Id.* at 1167. *See also* Evans Newton, Inc. v. Chicago Systems Software, No. 81-C-3564 (N.D. Ill. Sept. 11, 1984).

"In such products [as greeting cards and television shows] the look and feel is everything. In computer software the look and feel is only one component of the total package." Davis, *supra* note 8, at 387.

177. Daly v. Palmer, 6 F. Cas. 1132 (C.C.S.D.N.Y. 1868) (No. 3,552). *See* 3 M. NIMMER, *supra* note 2, § 13.03[E], at 13-48.

Both *Roth* and *Krofft* expressly refer to this audience test. *Roth*, 429 F.2d at 1110; *Krofft*, 562 F.2d at 1164.

178. Harold Lloyd Corp. v. Witwer, 65 F.2d 1, 18 (9th Cir. 1933) (emphasis added).

and expert testimony are irrelevant [to the determination of substantial similarity]."[179]

2. *Rejecting the "Audience" Test*

The audience test incorrectly determines the degree of substantial similarity between two works. Not only is the test of dubious origin,[180] but it suffers from three critical weaknesses. First, the audience test misunderstands the Copyright Act's purpose which is to protect an author from the theft of his work, not from the "public's 'spontaneous and immediate' *impression* that the fruits of her labor has been stolen."[181] Second, courts have difficulty applying a test that replaces doctrinal legal analysis with subjective first impressions. In the video game case of *Midway Manufacturing Co. v. Bandai-America, Inc.*[182] the court, while purporting to be "spontaneous," nevertheless engaged in a detailed comparison of the works at issue.[183]

These failings are venial in comparison to the audience test's main flaw: it fails to systematically address the crucial distinction between ideas and expressions. *Roth* and *Arnstein* both fail to deal with this issue in a systematic fashion because the lay person's global first impressions inherently fail to separate the uncopyrightable ideas from the protected expressions. Such an omission fails to vindicate the fundamental policies underlying the Act and dooms the audience test as an analytical tool.[184]

Furthermore, a court would face nearly insurmountable difficulties reconciling the idea/expression analysis with the audience test. In

179. Arnstein v. Porter, 154 F.2d 464, 468 (2d Cir. 1946) *cert. denied*, 330 U.S. 851 (1947). Actually *Arnstein* purported to transform the audience test into a two pronged standard. 154 F.2d at 468. Under the *Arnstein* doctrine, the plaintiff must first establish that the defendant copied from its work. This question is answered by "dissecting" the two works and resorting to expert testimony. The second prong asks whether the defendant's copying went so far as to constitute an illegal appropriation of the plaintiff's work. This question is answered by applying the audience test. *See also* Universal Athletic Sales v. Salkeld, 511 F.2d 904 (3d Cir. 1975), *cert. denied*, 423 U.S. 863 (1975). Not content with the dubious modifications in *Arnstein*, *Krofft* muddied the waters even further by proposing its own bifurcated test. Krofft, 562 F.2d at 1164. The *Krofft* court determined that substantial similarity existed when there was *both* similarity of ideas and similarity of expression between the works. According to *Krofft*, similarity of ideas can be determined by dissection and expert testimony, while similarity of expression is determined by using the audience test.

180. Professor Melville Nimmer convincingly argues that the audience test is really a misinterpretation of dicta found in *Daly*. 3 M. NIMMER, *supra* note 2, § 13.03[E], at 13-48 to -49.

181. *Id.* at 13-49 (emphasis in original); *see* Note, *supra* note 1, at 514.

182. 546 F. Supp. 125 (D. N.J. 1982).

183. *Id.* at 134-38, 144-53.

184. *See supra* notes 48-50 and accompanying text.

Midway Manufacturing Co., for instance, the court buried its examination of the idea/expression question in the middle of its comparison of the programs under the audience test.[185] *Krofft* exhibits similar "mashed potatoes reasoning."[186] Such confusion is a consequence of the impossibility of distinguishing between ideas and expressions without submitting the work to some form of analytical dissection.[187] Thus, determining substantial similarity based upon the total look and feel of two programs fails to address the central issue of the Act.

Conceptually, a substantial similarity test based upon look and feel fundamentally conflicts with any effort to distinguish idea from expression. Look and feel implicitly assumes a macroscopic or Gestalt view of the protected work.[188] In contrast, the Act requires a microscopic, analytical method of separating ideas from expressions.[189] Ultimately, infringement based upon look and feel as a global concept is not useful and is potentially misleading in the realm of complex computer programs.

3. *The Atari v. North American Approach*

The audience test is more appropriate, however, when used in a limited fashion in conjunction with a more thorough idea/expression analysis. In *Atari v. North American Philips Consumer Electronics Corp.*,[190] in which the defendant's video game, "K.C. Munchkin," allegedly infringed the plaintiff's "PAC-MAN," the Seventh Circuit restricted its comparison of substantial similarity to those elements of the work that are properly protected by copyright, i.e., the expressions.[191] In a first step, the *Atari v. North American* court "dissected" the work, carefully distinguishing the ideas from the expressions.[192] While the idea of

185. *Midway Mfg. Co.*, 546 F. Supp. at 148.

186. *Krofft*, 562 F.2d at 1157.

187. *See* Davis, *supra* note 89, at 7. The court in *Whelan*, "joined the 'growing number of courts' that have abandoned the bifurcated test of substantial similarity in complex copyright actions such as those involving computer programs." *Broderbund*, *supra* note 13, at 17-18. Instead *Whelan* adopted an integrated substantial similarity test in which both lay and expert testimony would be admissible. *Id.* at 18; *Whelan*, 797 F.2d at 1233. This approach is subject to the same criticisms as *Roth* and *Krofft* as long as the infringement determination occurs without prior examination of the idea/expression distinction.

188. *See supra* notes 26-31 and accompanying text.

189. *See supra* text accompanying notes 93-105 (discussion of the plurality test).

190. 672 F.2d 607 (7th Cir.), *cert. denied*, 459 U.S. 880 (1982).

191. *Id.* at 615. *See also* Williams Elecs., Inc. v. Bally Mfg. Corp., 568 F. Supp. 1274, 1277 (N.D. Ill. 1983); Atari v. Amusement World, Inc., 547 F. Supp. 222, 228 (D. Md. 1982). For other examples of the same approach see Atari v. Amusement World, Inc., 547 F. Supp. at 227.

192. Atari v. North American Philips Consumer Elecs. Corp., 672 F.2d 607, 615-18 (7th Cir.), *cert. denied*, 459 U.S. 880 (1982).

a maze chase game was not copyrightable, the court did extend protection to the sizes, shapes, colors, and sequences of the images as well as the sounds as expressions.[193] In a second step, the court compared the expressive elements of the two games at issue and determined that these elements were substantially similar.[194] Although the court essentially disregarded the audience test,[195] the court did use it as a means of dismissing the defendant's laundry list of minor differences between the two games.[196] Restricted to this subordinate role, the audience test serves the useful function of preventing the plagiarist from avoiding liability by inserting minimal variations from the original work.[197]

The *Atari v. North American* doctrine has the advantage of placing the issues in their proper sequence: first, the idea/expression analysis; second, a judgment as to substantial similarity.[198] When a court performs the substantial similarity analysis first, it is incapable of determining in retrospect whether the adjudged similarity was based on similar ideas or similar expressions. The *Atari* doctrine allows a court to compare only the protectable expression in the two works for similarity. Thus, courts confronting look and feel cases should initially distill the ideas from expressions and then determine the extent of similarity between the works.

CONCLUSION

The Copyright Act seeks to infuse the arts and sciences with creative vigor by providing a solid incentive for publication of new works and by maintaining competition through a free zone of discourse.

193. *Id.* at 617.

194. *Id.* at 618.

195. *Id.* at 614.

196. *Id.* at 618.

197. The court in *Broderbund* employed a similar approach. First, the court identified the idea of "Print Shop" as the creation of greeting cards, banners, posters, and signs; while the expressions included the structure and organization of the user interfaces that contain infinitely variable combinations of text, graphics, and borders. *Broderbund, supra* note 13, at 10. Following this analysis, the court addressed the substantial similarity question and listed numerous examples of expressions that were substantially similar even though the defendant could have expressed them in a plurality of alternative ways. *Id.* at 19-20. However, the court should have linked the specific details in these two areas more directly.

Overall, the holding in *Broderbund* should not stand for the proposition that the total look and feel of software is protected by the copyright laws. Rather, this decision stands for the importance of distinguishing ideas and expressions, and limiting copyright protection to expressions that can be represented in a plurality of ways.

198. *Accord* Warner Bros. v. American Broadcasting Cos., 530 F. Supp. 1187, 1190 (S.D.N.Y. 1982), *aff'd*, 720 F.2d 231 (2d Cir. 1983) (to resolve the issue of substantial similarity the court must first distill the protected parts from the unprotected).

The tension between these two efforts mandates that the Act distinguish between ideas and expressions so that only expressions receive copyright protection. This policy directs a court to treat the look and feel of computer software as an unprotectable concept because look and feel merges ideas and expressions. This Comment concludes that courts should dissect look and feel into its component parts and identify which elements deserve copyright protection.

Drawing a line between ideas and expressions remains a delicate exercise, especially with respect to the amorphous notions that characterize the look and feel of a program. Of all the methods for separating ideas and their expressions, the plurality of expressions test most appropriately balances the interests within the computer industry by providing an incentive for developing new software without overly restricting subsequent creativity.

Much of this Comment's preceding analysis devotes itself to the technical meandering of the Copyright Act in a search for a proper analogy to a currently protected category of works of authorship. Unfortunately software simply does not fit within the Act's basic framework. The limitations of the old concepts fail to reconcile the competing commercial and scientific interests of a modern industry.[199] When innovation forces new issues to the forefront—issues that arise beyond the narrow wording of the amendments specifically designed for software—the Act's basic concepts provide little concrete guidance.[200]

The courts must confront the challenging issues posed by rapid technological change. Before undertaking complex legal reasoning, however, they must make a concerted effort to understand the technology and the implications of their rulings. Fortunately, when armed with the plurality of expressions test, the courts can pursue the policies of the Copyright Act by protecting only those elements of look and feel that constitute an expression and not an idea.

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199. *See* R. NIMMER, *supra* note 18, ¶ 1.03[1], at 1-10. *Cf.* Reback & Siegal, *supra* note 50, at 1.

200.

> It's not at all clear to either 'trained copyright counsel' or the man at the keyboard to what extent 'look and feel' will be copyrightable. Copyright law is extremely malleable, and in gray areas such as this, the legal outcome turns largely on the federal judiciary's ad hoc judgments about net social utility.

Ryland, *To the Editor*, INFOWORLD, Jan. 26, 1987, at 37.

IS THERE A PROPERTY INTEREST IN SCIENTIFIC RESEARCH DATA?

BY RICHARD H. JONES †

When scientists perform experiments or make observations, they record information in the form of computer printouts, handwritten lists of data, and photographs. This kind of research data is commonly thought to be copyrightable. For example, technical and professional journals routinely attach copyright notices to articles reporting data. The provisions of the Code of Federal Regulations presuppose that "technical data" first produced pursuant to a contract with a federal agency are copyrightable.[1] Similarly, federal law provides copyright protection for handbooks of standardized scientific and technical research data prepared by the Secretary of Commerce.[2] Because many of the institutions responsible for sponsoring research and for publishing research results assume that data are copyrightable, scientists may also assume that copyright provides sufficient protection. If this common belief that research data are copyrightable is inaccurate, the ramifications would profoundly affect the scientific community.

Scientists are concerned with protecting research data from competitors, especially prior to publication. Researchers may want to preserve claims to priority in discoveries, and retain the first opportunity

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1. Fed. Acquisition Regulation Sys., 48 C.F.R. §§ 252.227-7014(c)(1), 252.227-7015(c)(1), 952.227-75(c)(1), 952.227-78(c)(1), 1227.401-471(b)(6), 1252.227-71(c)(1), 1252.227-71(e), 1252.227-74(b)(2), 1552.227-71(c)(1), 1827.473-2(f), 1852.227-74(c)(1), 1852.227-77(c)(1) (1985). "Technical data" in these provisions is defined (with slight variations) as "recorded information, regardless of form or characteristic, of a scientific or technical nature." 48 C.F.R. § 252.227-7013(a); *see also* §§ 252.227-7015(a), 927.401, 952.227-75(a)(1), 952.227-76(a), 952.227-78(a)(1), 1227.401-70(a), 1252.227-71(a), 1252.227-74(a), 1527.7001, 1552.227-71(a), 1552.227-72(a), 1852.227-74(a), 1852.227-77(a) (1985).

2. 15 U.S.C. § 290e (1982), providing an exception to 17 U.S.C. § 105. "Standard reference data" is defined as "quantitative information, related to a measurable physical or chemical property of a substance or system of substances of known composition and structure, which is critically evaluated as to its reliability . . . ." 15 U.S.C. § 290a (1982).

to theorize about the data.[3] They may also want to control and profit from commercial exploitation of their discoveries, or use the raw data to substantiate the quantity and quality of their work when applying for research grants. Thus, copyright protection is attractive to scientists because it secures protection from the time the work is recorded, and it gives the author exclusive rights to make copies and produce derivative works.[4] Copyright in their research data would give scientists the right to reproduce and distribute their material publicly, as well as the right to make derivative works, such as articles summarizing their results. Because of this apparent protection, scientists may depend on copyright in the intangible research data.[5]

Similarly, employers of scientists may have expectations that the "work-for-hire" provision of copyright law will give them control over employees' data.[6] If this reliance on copyright is misplaced, research data collected in both private and academic research programs may be unprotected. Therefore, it is important to examine the exact basis in statutes and case law for the claim that research data are protectable as property.

The focus for this paper is on "raw" scientific research data, defined here to include any unedited recording of information concerning measurable properties of physical objects resulting from experimentation or controlled observation.[7] This does not include charts, graphs, tables, and models which express data in summary form.[8]

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3. On the tensions involved in trying to control scientific research data, see generally D. NELKIN, SCIENCE AS INTELLECTUAL PROPERTY: WHO CONTROLS RESEARCH? (1984) and Nelkin, *Intellectual Property: The Control of Scientific Information*, 216 SCIENCE 704 (1982). On the importance of priority discovery and publication for scientific careers, see R. MERTON, THE SOCIOLOGY OF SCIENCE 293 (1973).

4. 17 U.S.C § 102 (protection subsists from time work is "fixed"); 17 U.S.C. § 106(1)-(3) (1982) (exclusive rights to reproduce a work, prepare derivative works, and distribute copies publicly). The definition of "derivative work" in 17 U.S.C. § 101 (1982) includes "abridgement, condensation, or any other form in which a work may be recast, transformed, or adapted." Preparing research data for publication in an article or presentation at a professional meeting would fall squarely within this definition since such a summary contains the "essence" of the data in detail.

5. Alternatively, scientists might rely on ownership of the physical objects that generate data to protect scientific endeavors. However, any protection provided by ownership of physical objects is beyond the scope of this Comment.

6. The work-for-hire doctrine, codified at 17 U.S.C. § 201(b) (1982), grants a copyright interest in a work to the author's employer, rather than the author himself, under certain circumstances.

7. *See supra* notes 1 and 2 (definitions of "technical data" and "standard reference data").

8. Raw data are distinguishable from conclusions drawn from the examination of the data and from summaries of data. Conclusions involve intellectual effort rather than the mere recitation of data, and summaries involve at least a minimal transformation of the data. *See infra* notes 31-65 and accompanying text on the copyrightability of compilations and maps. Articles based upon research data and containing that data are copy-

The two-fold thesis of this Comment is that raw data are not copyrightable and that federal copyright law preempts the states from providing a property or quasi-property interest in raw data. Section I sets forth the basic argument for copyrightability of raw data and then counters with the problems that would result from allowing raw data to be copyrighted. In particular, Section I discusses the potential inclusion of raw data in the statutory subject matter categories, the requirement of originality as applied to factual works, the merger of idea and expression in raw data, the issue of dissemination of information versus control, and fair use of raw data. In Section II, potential forms of state protection of raw data are considered. As will become apparent, the developers of copyright case law, as well as the federal statute, did not have scientific research data in mind.

I. COPYRIGHT

The basic requirement for copyrightability under the Copyright Act of 1976 is that protection only extends to "original works of authorship fixed in any tangible medium of expression."[9] Thus, the argument for the copyrightability of scientific research data is simple. Recorded data are "fixed" in a "tangible medium of expression" when they are written down or photographed. Furthermore, the fixed raw data constitute a "writing" within the scope of copyright[10] because fixation is either a "literary work"[11] under section 102(a) or a "compilation" under section 103(a). The required originality of authorship is supplied by the creativity and labor of scientists in devising experiments and collecting the data the experiments generate. In short, the argument is that raw data are writings that result from originality and thus satisfy the requirements for copyrightability. One could argue further that the constitutional objective of promoting the "Progress of Science . . . by securing for limited Times to Authors . . . the exclusive Right to their . . . Writings"[12] favors granting copyright protection to raw data. No underlying "idea, procedure, process, system, method of operation, concept,

rightable; the issue for this Comment is whether copyright protection extends to the data contained therein or whether the data are public domain material.

9. 17 U.S.C. § 102(a) (1982).

10. U.S. CONST. art. I, § 8, cl. 8 gives Congress the power to give limited monopolies to "Authors" on their "Writings."

11. 17 U.S.C. § 101 (1982) defines "literary works" as "works, other than audiovisual works, expressed in words, numbers, or other verbal or numerical symbols or indicia, regardless of the nature of the material objects . . . in which they are embodied."

12. U.S. CONST. art. I, § 8, cl. 8. "Science" in this clause is "used in the sense of general knowledge rather than the modern sense of physical or biological science." Williams & Wilkins Co. v. United States, 487 F.2d 1345 (Ct.Cl. 1973), *aff'd by an equally divided Court*, 420 U.S. 376 (1975) (*per curiam*).

principle, or discovery"[13] can be protected by copyright—protection can be claimed only for a particular "expression" that the author has produced. Even if raw data is copyrightable, other scientists would still be free to duplicate the data by conducting their own experiments. Thus, no "principle or discovery" would be protected by giving copyright protection to raw data.

A. Problems with Potential Subject Matter Categories

Unfortunately, there are various problems with the argument that raw data are copyrightable. The first problem is determining in which category of copyrightable subject matter, listed in section 102(a) of the Copyright Act, raw data belong.[14] The categories in section 102(a) do not neatly encompass the arrays of numbers which constitute most scientific data. For example, one category that might be applicable is "literary works."[15] However, despite the fact that the congressional reports include compilations of data within this category,[16] scientific research data are less self-evidently "literary works" than most other factual works. Neither Congress nor the courts have addressed the particular issue of how to categorize scientific research data.

The following discussion examines three categories of copyrightable subject matter. The first category is photographs. The second and third are two broad categories of fact-gathering works—collections of facts, and non-fictional narratives.[17] However, there are significant problems

13. 17 U.S.C. § 102(b) (1982); *see* Greenbie v. Noble, 151 F. Supp. 45, 66 (S.D.N.Y. 1957) (concerning factual literary works).

14. 17 U.S.C. § 102(a) (1982) provides the following categories of copyrightable subject matter: "literary works," "musical works," "dramatic works," "pantomimes and choreographic works," "pictorial, graphic, and sculptural works," "motion pictures and other audiovisual works," and "sound recordings."

15. H.R. REP. NO. 1476, 94th Cong., 2nd Sess. 47, 54 (1976); S. REP. NO. 473, 94th Cong., 1st Sess. 115, *reprinted in* 1976 U.S. CODE CONG. & ADMIN. NEWS 5659, 5667 [hereinafter USCCAN].

16. *Id.*

17. General works on fact-gathering works include: Denicola, *Copyright in Collections of Facts: A Theory for the Protection of Nonfiction Literary Works*, 81 COLUM. L. REV. 516 (1981), *reprinted in* 6 ART & L. 96 (1981); Gorman, *Fact or Fancy? The Implications for Copyright*, 29 J. COPYRIGHT SOC'Y 560 (1982) [hereinafter *Implications for Copyright*]; Gorman, *Copyright Protection for the Collection and Representation of Facts*, 76 HARV. L. REV. 1569 (1963); Hill, *Copyright Protection for Historical Research: A Defense of the Minority View*, 31 COPYRIGHT L. SYMP. 45 (1984) (ASCAP); Shipley & Hay, *Protecting Research: Copyright, Common-Law Alternatives, and Federal Pre-emption*, 63 N.C.L. REV. 125 (1984); Taylor, *The Uncopyrightability of Historical Matters: Protecting Form Over Substance and Fiction Over Fact*, 30 COPYRIGHT L. SYMP. 33 (1983) (ASCAP). None of these works deal with scientific research data. In fact, some studies of scientific narrative works do not even deal with data, see, e.g., Bovard, *Copyright Protection in the Area of Scientific and Technical Works*, 5 COPYRIGHT L. SYMP. 68, 83 (1954).

with each potential category. Both collections of facts and non-fictional narratives raise the issue of whether to protect only a researcher's original contribution or, because of the vast effort expended, all the facts the researcher uncovers.

1. Photographs

Scientifically significant photographs such as those of astronomical events or Wilson cloud-chamber events appear to fall within the meaning of the statute.[18] Photographs of nature are copyrightable.[19] However, the case law on photographs presumes they are the result of artistic creativity. None of these cases involve photographs produced strictly for their informational content.[20] Courts in photograph cases emphasize the artistic element of selecting and arranging the objects to be photographed.[21] Such creative decisions make a photograph an original work of authorship. It can be argued that the reason the requirement of creativity is greater here than in other areas of copyright protection is that without some creativity a photograph is not an "original work" of an "author" but merely a mechanical reproduction of material in the public domain.[22]

Some of the concerns expressed in early cases about granting copyright to photographs are relevant in the scientific setting because scientific photographs are media for recording data, rather than works of art. In one early photograph case, upholding the copyright on a posed photograph, the Supreme Court left open the issue of whether an "ordinary production of a photograph" (i.e., one involving no arrangement of the subject) is copyrightable.[23] Such photography "is merely mechanical, with no place for novelty, invention, or originality. It is simply the

18. The 1976 Act, 17 U.S.C. § 101 (1982), includes photographs in the category of "pictorial, graphic, and sculptural" works of authorship.

19. Cleland v. Thayer, 121 F. 71, 72 (8th Cir. 1903). The photograph in question, of Colorado scenery, was "artistically colored," and "used various original, ingenious, and artistic ideas" (e.g., arranging light and shadow).

20. *But see* Time Inc. v. Bernard Geis Assocs., 293 F. Supp. 130, 143 (S.D.N.Y. 1968) (sufficient originality in camera operator's choice of camera, film, lens, and camera placement).

21. *See, e.g.*, Bleistein v. Donaldson Lithographic Co., 188 U.S. 239, 250 (1903) (the least pretentious picture has more originality in it than directories which may be copyrighted); Burrow-Giles Lithographic Co. v. Sarony, 111 U.S. 53, 60 (1884); Jewelers' Circular Publishing Co. v. Keystone Publishing Co., 274 F. 932, 934 (S.D.N.Y. 1921), *aff'd*, 281 F. 83 (2d Cir.), *cert. denied*, 259 U.S. 581 (1922) (no photograph, however simple, can be unaffected by the personal influence of the author, and no two will be absolutely alike).

22. *See* Note, *"Expression" and "Originality" in Copyright Law*, 11 WASHBURN L.J. 400, 404 (1972).

23. Burrow-Giles Lithographic Co. v. Sarony, 111 U.S. 53 (1884).

manual operation, by the use of these instruments and preparations, of transferring to the plate the visible representation of some existing object, the accuracy of this representation being its highest merit."[24]

Blindly snapping a camera lens is precisely what occurs in scientific experiments. Scientists do select the area of study and prepare experiments, but they exercise no further control over what is revealed by their experiments. The scientists must, in the sense important to the issue at hand, blindly snap the shutter once the topic of the experiment is prepared for the experiment to be valid. If scientists were more manipulative, their experimental results would reflect only their theories and would not be "objective."[25] Thus, research photographs do not fit within the Supreme Court's characterization of a photograph as "the personal reaction of an individual upon nature."[26]

With regard to scientific photographs, the issue is whether the originality requirement of copyright can be satisfied by the preparation and design of experiments.[27] Research photographs are the product of "creative intellectual or aesthetic labor."[28] But it is only creativity of expression, rather than labor, which is relevant to copyright law. Research photographs, like research data in general, do not contain creativity of expression.[29]

Photograph cases under the Copyright Act offer no guidance on whether the resulting data embodied in the picture are copyrightable. Because research photographs are devices for recording data and are not intended to be works of art,[30] it may make more sense to treat scientific research photographs, along with computer printouts and handwritten arrays of data, as "fact-gathering" works.

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24. *Burrow-Giles*, 111 U.S. at 59. *See also Bleistein*, 188 U.S. at 249-50; *Time Inc.*, 293 F. Supp. at 141-43; 17 U.S.C. § 5(j) (1909) (repealed 1976). However, some cases have found photographs protectable with a very low threshold for originality, e.g., Pagano v. Charles Beseler Co., 234 F. 963, 964 (S.D.N.Y. 1916), or without raising this issue, e.g., Rockford Map Publishers v. Directory Serv. Co. of Colo., 768 F.2d 145, 148 (7th Cir.)(dictum), *cert. denied*, 106 S.Ct. 806 (1986).

25. On the nature of scientific experimentation, see I. HACKING, REPRESENTING AND INTERVENING: INTRODUCTORY TOPICS IN THE PHILOSOPHY OF NATURAL SCIENCE 149-66 (1983).

26. *Bleistein*, 188 U.S. at 250.

27. Concerning the photograph of a street scene, the court in *Pagano v. Beseler Co.* said: "[i]t undoubtedly requires originality to determine just when to take the photograph, so as to bring out the proper setting for both animate and inanimate objects, with the adjunctive features of light, shade, position, etc." 234 F. 963, 964 (S.D.N.Y. 1916).

28. Goldstein v. California, 412 U.S. 546, 561 (1973).

29. *See also infra* notes 53-56 and accompanying text on the selection and arrangement rationale.

30. In general, scientists are only interested in the factual context of their photographs. However, scientists may also want to copyright research photographs as *art* in order to exploit them commercially (e.g. in the form of posters or books). This raises problems different from those discussed in this Comment.

2. Compilations and Maps

Although the general rule is that facts are not protected by copyright, certain types of fact-gathering works, such as compilations and maps, are protectable.[31] The 1976 Act defines compilations as works "formed by the collection and assembly of preexisting materials or of data that are selected, coordinated, or arranged in such a way that the resulting work as a whole constitutes an original work of authorship."[32] Maps are pertinent to research data issues because courts sometimes require actual field observations to support claims for copyright protection.[33] However, while maps are technically within the category of "pictorial, graphic, and sculptural" works,[34] they can be analyzed as compilations because they involve selection, synthesis, and judgment like other fact-gathering works.[35] Accordingly, no separate discussion is required.

There are two distinct lines of cases that ascribe different degrees of protection to compilations of facts. The first line of cases[36] follows the literal words of the 1976 Act, which states that: "[t]he copyright in a compilation . . . extends only to the material contributed by the author of such work, as distinguished from the preexisting material employed in the work, and does not imply any exclusive right in the preexisting material."[37] Thus, under this line of cases, it is the *selection* and *arrangement* of material by the researcher which, if more than trivial,[38] is the

31. Financial Information v. Moody's Investors Serv., 751 F.2d 501, 504 (1984), *district court opinion on remand aff'd*, 808 F.2d 204 (2d Cir. 1986); Miller v. Universal City Studios, 650 F.2d 1365, 1368 (5th Cir. July 1981); Hoehling v. Universal City Studios, 618 F.2d 972, 974 (2d Cir.), *cert. denied*, 449 U.S. 841 (1980); Schroeder v. William Morrow & Co., 566 F.2d 3, 5 (7th Cir. 1977); Rosemont Enters. v. Random House, Inc., 366 F.2d 303, 309 (2d Cir. 1966), *cert. denied*, 385 U.S. 1009 (1967); Rand McNally & Co. v. Fleet Management Sys., 591 F. Supp. 726, 731 (N.D. Ill. 1983), *reh'g denied*, 634 F. Supp. 604 (1986).

32. 17 U.S.C. § 101 (1982) (definition of compilation). *See also* Patry, *Copyright in Collections of Facts: A Reply*, 6 COMM. & L. 11, 14 (1984).

33. For example, one court held that the requirement of a "modicum of creative work" is satisfied only where the "publisher of the map in question obtains some of that information by the sweat of his own brow." Amsterdam v. Triangle Publications, 189 F.2d 104, 106 (3d Cir. 1951).

34. 17 U.S.C. § 101 (1982).

35. *See, e.g.*, Rockford Map Publishers v. Directory Serv. Co. of Colo., 768 F.2d 145, 148 (7th Cir.) *cert. denied*, 106 S.Ct. 806 (1986) (relating maps to compilations).

36. *See, e.g.*, Dow Jones v. Chicago Bd. of Trade, 546 F. Supp. 113, 115 (S.D.N.Y. 1982).

37. 17 U.S.C. § 103(b) (1982).

38. Alphabetical and numerical ordering are especially problematic. *See* Financial Information v. Moody's Investors Serv., 751 F.2d 501 (2d Cir. 1984); Schroeder v. William Morrow & Co., 566 F.2d 3, 4-5 (7th Cir. 1977); Leon v. Pacific Tel. & Tel. Co., 91 F.2d 484, 485 (9th Cir. 1937); Jeweler's Circular Publishing Co. v. Keystone Publishing Co., 281 F. 83, 84-86 (2d Cir.), *cert. denied*, 259 U.S. 581 (1922); Rand McNally & Co. v. Fleet Management Sys., 591 F. Supp. 726, 735 (N.D. Ill. 1984), *reh'g denied*, 634 F. Supp. 604 (1986); National Business Lists v. Dun & Bradstreet, Inc., 552 F. Supp. 89, 94

protectable element in a collection of preexisting material.[39] As a result, the facts gathered can be used by any person who does not also take the researcher's intellectual efforts of selecting those particular facts and arranging them in that particular order.[40]

The second line of compilation cases rewards the *labor* of the researcher by giving him a property interest in the material gathered.[41] This material is protected from substantial copying, although anyone is free to duplicate the research provided she does not copy the prior results. In other words, in this line of cases protection for labor expended extends to the content of fact-gathering works (the facts themselves) rather than merely to the author's expression (selection and arrangement).

However, the "rationale behind protecting such compilations . . . is not clear"[42] since copyright in compilations is supposed to protect only original material contributed by an author.[43] One court explained the rationale for such extensive protection as follows:

> The compiler's contribution to knowledge normally is the collection of the information, not its arrangement. If his protection is limited solely to the form of expression, the economic incentives underlying

(N.D. Ill. 1982); Southwestern Bell Tel. Co. v. Nationwide Indep. Directory Serv., 371 F. Supp. 900 (W.D. Ark. 1974); Triangle Publications v. New England Newspaper Publishing Co., 46 F. Supp. 198, 201 (D. Mass. 1942). *Cf. Dow Jones*, 546 F. Supp. at 115.

39. *See, e.g.*, Eckes v. Card Prices Update, 736 F.2d 859, 862 (2d Cir. 1984). Compilations are protected "regardless of whether the individual items in the material have been or ever could have been subject to copyright." USCCAN, *supra* note 15, at 57. Therefore, even if each scientific datum is uncopyrightable because it is a fact, the compilation may still be copyrightable. *See infra* notes 79-112 and accompanying text. Protecting a compilation when the compiler selects and arranges from items already assembled by another, rather than also initially assembling the items, is open to the criticism that it emphasizes selection to the exclusion of the "collection and assembly" element in the definition of "compilations." *See* Ginsburg, *Fact Works Revisited*, 192 N.Y.L.J. 22 (1984); Patry, *supra* note 32, at 14. The raw data resulting from scientific experimentation fulfills this "collection" requirement.

40. *See, e.g.*, Hartfield v. Peterson, 91 F.2d 998 (2d Cir. 1937); *Dow Jones*, 546 F. Supp. at 116; PIC Design Corp. v. Sterling Precision Corp., 231 F. Supp. 106 (S.D.N.Y. 1964). *See also* Latman & Ginsburg, *Copyright Law: Facts, Phone Books*, 191 N.Y.L.J., at 1, col. 1 (May 18, 1984).

41. *See, e.g., Schroeder*, 566 F.2d at 5; *Leon*, 91 F.2d at 486; *Jeweler's Circular*, 281 F. at 88 (a compiler of a directory produces by his labor a meritorious composition in which he may obtain a copyright); *Rand McNally*, 591 F. Supp. at 736; *Financial Information*, 599 F. Supp. at 999 n.7 (copyright protection should be afforded the compiler's industry even when his arrangement is not copied because often that is the only way that protection will prove meaningful); *National Business Lists*, 552 F. Supp. at 94; *Southwestern Bell*, 371 F. Supp. at 906; Triangle Publications v. New England Newspaper Publishing Co., 46 F. Supp. at 198. *Cf. Dow Jones*, 546 F. Supp. at 115.

42. *Rand McNally*, 591 F. Supp. at 731.

43. Yet the court in *Rand McNally* followed Seventh Circuit precedents and granted copyright protection to "industrious collections." *Id.* at 731-32.

> the copyright laws are largely swept away. Recognizing this, the courts have long afforded protection under the copyright laws against appropriation of the fruits of the compiler's industry.[44]

However, that court recognized that such "protection does not fit nicely into the conceptual framework of copyright law and has for that reason been criticized."[45] Indeed, granting protection on the basis of the labor expended in making a compilation has been criticized by Professors Nimmer and Gorman for expanding copyright protection by importing ideas into the field of copyright which are unrelated to the protection of expression.[46]

Recently, courts have rejected the "sweat of the brow" rationale in both a classic factual compilation case and a classic map case.[47] In the former, the Court of Appeals for the Second Circuit recently stated: "[t]o grant copyright protection based merely on the 'sweat of the author's brow' would risk putting large areas of factual research material off limits and threaten the public's unrestrained access to information."[48] In the latter, the court explicitly rejected the sweat of the brow requirement stating that authorship for maps exists in "selection, design, and synthesis."[49]

Moreover, scientific research data do not fit either the "selection and arrangement" or the sweat of the brow rationale well. Consider first the selection and arrangement rationale. Raw data consists of very large collections of informational items. Attempting to characterize raw data as a "compilation" is problematic, however, because the order of raw data is dictated by the laws of nature, not by the creativity of the scientist.[50] A scientist does not synthesize data, he only records it.[51] The arrangement of data is predetermined as intractably as is the

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44. *National Business Lists*, 552 F. Supp. at 92.

45. *Id. See supra* text accompanying note 32 (definition of compilation).

46. 1 M. NIMMER, THE LAW OF COPYRIGHT § 3.04, at 3-19 to -20 (1983); *Implications for Copyright*, *supra* note 17, at 572. *But see*, Denicola, *supra* note 23, at 519-24; Hill, *supra* note 17. *See also, National Business Lists*, 552 F. Supp. at 95 (directory cases illustrate that misappropriation doctrine has long found a house, if not a home, in copyright law and that notions of unfair competition are implicit in copyright protection of diligent application).

47. Financial Information v. Moody's Investor Serv., 808 F.2d 204 (2d Cir. 1986) (compilation); United States v. Hamilton, 583 F.2d 448 (9th Cir. 1978) (map).

48. Financial Information v. Moody's Investor Serv., 808 F.2d at 207. *See also* Triangle Publications v. Sports Eye, Inc., 415 F. Supp. at 685-86 (copyright protection extends only to the method or form for expressing the data).

49. *Hamilton*, 583 F.2d at 452.

50. Because data are generated in an automatic manner, if each datum is not individually copyrightable, no quantity of data will be copyrightable. *See infra* notes 90-112 and accompanying text.

51. Even maps which disclose previously unknown facts involve skill and discretion in the selection process. Nothing similar occurs in the production of scientific data.

chronological ordering of historical events. The only scientifically significant order is one which illustrates the law of nature or other phenomenon discovered by the scientist. There is no room for variation in the presentation and thus none for individual choice.[52]

The higher the degree of selectivity and judgment in creating a compilation, the stronger the claim is to copyright protection. However, collection of raw data involves little creativity. From the point of view of copyright law, a scientist's only contribution to the data collected is the exercise of creativity and effort in determining which phenomena to study and which variables to correlate.[53] This effort amounts to no more than choosing a subject within the public domain to copy and determining a framework for copying. As Judge Wyzanski put the point: "[t]o constitute a copyrightable compilation, a compendium must ordinarily result from the labor of assembling, connecting, and categorizing disparate facts which in nature occurred in isolation. A compilation, in short, is a synthesis."[54]

Yet it is not always clear whether scientific experimental and observational data can be characterized as an analysis of a series of events rather than an analysis of a single, larger event. Often research data consist only of a picture or record of a single occurrence. Such data do not fit easily into the subject matter category of fact compilations. As Judge Wyzanski stated: "[i]t is rare indeed that an analysis of any one actual occurrence should be regarded as a compilation."[55]

There is no copyrightable element of transformation or synthesis of the public domain material recorded during a scientific experiment or observation even if there is creativity in designing the experiment. Although, "practically anything novel can be copyrighted," some novelty in expression is needed.[56] As a result, research data are not copyrightable as fact compilations under the selection and arrangement criteria.

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52. The order in which data from different experiments is reported is open to variation but is scientifically insignificant if chronological order is not involved; if chronological order is relevant, the order is dictated by the data.

53. The simple correlation of names and telephone numbers was held to be a copyrightable element of a directory in New York Times Co. v. Roxbury Data Interface, 434 F. Supp. 217 (D.N.J. 1977). The selection of variables in science may involve comparable creativity, and thus support copyrightability of research data in some jurisdictions. However, no other court has placed strong emphasis on correlation of variables. Nor has any court granted copyright protection solely based on the existence of a correlation pattern, without evidence of significant effort, selection, or arrangement.

54. Triangle Publications v. New England Newspaper Publishing Co., 46 F. Supp. at 201.

55. *Id. Accord Financial Information*, 599 F. Supp. at 997 (assembling a handful of statistics about a single, solitary occurrence not copyrightable).

56. Dan Kasoff, Inc. v. Novelty Jewelry Co., 309 F.2d 745, 746 (2d Cir. 1962).

At first glance the sweat of the brow rationale seems to provide a better basis for copyright protection for scientific data. The standard of originality is not especially high. For example, under the sweat of the brow rationale, telephone books have been given protection for merely placing names submitted to the telephone company in conventional alphabetical order.[57] As Judge Learned Hand stated: "[t]he man who goes through the streets of a town and puts down the names of each of the inhabitants, with their occupations and their street numbers, acquires material of which he is the author."[58] In addition, computer data-bases are copyrightable[59] although it makes little sense to speak of an "order" in these automated compilations.

One can argue that scientists should be given copyright protection for data resulting from their experiments, which are often carried out at great time and expense, because compilations "have value because the compiler has collected data which otherwise would not be available."[60] Even where the order of data is dictated by nature, scientists frequently reveal information not otherwise available to the public. In addition, giving protection would force other scientists to repeat experiments, thereby checking their predecessors' results. One can argue that the practice of checking previous results by replication would lead to more reliable theories, and should be encouraged.

Unfortunately, under current practice repeating experiments to test their validity "is a myth, a theoretical construct dreamed up by the philosophers and sociologists of science."[61] Grants are not normally awarded for checking other scientists' results. Scientists repeat experiments only if the earlier results are controversial; otherwise, scientists accept the findings and build upon them.[62] Thus, one could argue that an incentive to duplicate research is needed.

However, the reasons enunciated for protecting works of diligence do not carry over to the domain of scientific research. The "sweat of the brow" rationale is invoked only when it is necessary to provide the incentive of a property interest for a socially valuable but otherwise

57. It has been suggested that this feature makes telephone books the outer limit of a copyrightable compilation. Latman & Ginsburg, *supra* note 40, at 2, col. 1.

58. *Jeweler's Circular*, 281 F. at 88. This approach finds "authorship in the act of aggregating isolated pieces of information." Denicola, *supra* note 17, at 530.

59. 17 U.S.C. at § 101-102 (1982); USCCAN, *supra* note 15, at 54. Stating a set of facts in a form that is computer-usable may not involve the authorship necessary for copyright protection. But most data-bases, unlike scientific experiments which produce data, also involve the selection of data.

60. *National Business Lists*, 552 F. Supp. at 92.

61. W. BROAD & N. WADE, BETRAYERS OF THE TRUTH: FRAUD AND DECEIT IN THE HALLS OF SCIENCE 77 (1982).

62. *See id.* at 60-87.

unprotectable work resulting from mere diligence and tedious labor. Although scientists must pay great attention to exacting detail, scientific experiments involve great creativity in their design and in their interaction with theory. Thus, scientific experiments involve more imagination and inventiveness than do works of mere diligence. Scientists attempt to find new phenomena and develop new theories for understanding nature. In this sense, the research process is more of an "art" than is fact-gathering. Conducting experiments is not an end in itself but only one component of a creative enterprise; a separate incentive for the production of research data is not required. Especially since the legitimacy of the "sweat of the brow" rationale in copyright law has been questioned,[63] this rationale should not be expanded into a creative field such as scientific research.

Furthermore, scientific research differs from other fact-gathering activities in that the resulting data cannot be used piecemeal, whereas facts in directories or parts of a map can be so used. It is the whole of the data that is important to scientists. An individual datum revealed by an experiment is usually of little use apart from the pattern disclosed. A useful directory can either be limited to selected highlights of a subject or can be comprehensive.[64] On the other hand, enough scientific data on a particular subject must be produced to support claims concerning alleged discoveries, although not all instances of the alleged phenomena need be produced. In other words, scientific data must be comprehensive, but not exhaustive. Thus, the protection copyright gives against use of even a portion of a copyrighted work is not necessary.

In short, a collection of scientific data does not easily fit the definition of a "compilation" within the meaning of the 1976 Act.[65] The "sweat of the brow" approach has been used in cases involving fact-gathering activity which are significantly different from scientific research. Scientists simply do not string together facts in the manner contemplated by courts in providing protection for compilations.

63. *See supra* text accompanying note 17 for discussion of criticism of the "sweat of the brow" rationale. As noted, some current cases and scholarly studies support the rationale.

64. Directories are also end-products in themselves; raw data are the subject matter for further scientific study insofar as experiments and theories interact with each other in the scientific process.

65. *See supra* text accompanying note 32 (defining "compilation").

3. *Non-Fictional Narrative Works*

The third branch of fact-gathering cases involves narrative works of fact: news, biography, and history.[66] There are two schools of thought about whether the research supporting such works can be copyrighted. The less popular school of thought protects the fruit of a researcher's labor by requiring that subsequent authors do independent research from the original sources and that they not make "substantial and unfair use" of the first researcher's work.[67] The justification given is that the "substantial investment of time, money, and labor" expended in researching for a work should be protected from appropriators.[68]

For example, the district court in *Miller v. Universal City Studios* held that "[t]he law is clear that research can be copyrightable."[69] That court viewed "the labor and expense of the research involved in . . . obtaining . . . those uncopyrightable facts to be intellectually distinct from those facts and more similar to the expression of the facts than to the facts themselves."[70] On appeal, however, the holding that research is copyrightable was reversed. The appellate decision typifies the second school of thought, which is the majority view regarding the copyrightability of research.

> The valuable distinction in copyright law between facts and the expression of facts cannot be maintained if research is held to be copyrightable. There is no rational basis for distinguishing between facts and the research involved in obtaining facts. To hold that research is copyrightable is no more or no less than to hold that the facts discovered as a result of research are entitled to copyright protection. . . . [T]he law is clear that facts are not entitled to such protection.[71]

66. The "expression" of any findings or theories in narrative form is copyrightable. "One who narrates matters of fact may be protected by copyright as to his arrangement, manner and style, but not as to material of ideas therein set forth." Oliver v. Saint Germain Found., 41 F. Supp. 296, 299 (S.D. Cal. 1941).

67. Toksvig v. Bruce Publishing Co., 181 F.2d 664, 667 (7th Cir. 1957) (one author's use of another's biography infringed copyright). *See also* MCA, Inc. v. Wilson, 677 F.2d 180, 183 (2d Cir. 1981) (dictum) (use of copyrighted material without owner's consent generally not considered reasonable if it extensively copies or paraphrases the original or bodily appropriates the research upon which the original was based); Eisenschiml v. Fawcett Publications, 246 F.2d 598 (7th Cir.), *cert. denied*, 355 U.S. 907 (1957); Holdredge v. Knight Publishing Corp., 214 F. Supp. 921, 922-23 (S.D. Cal. 1963); Huie v. Nat'l Broadcasting Co., 184 F. Supp. 198, 200 (S.D.N.Y. 1960) (dictum) (publishing a history re-written from another historian's book without any independent research constitutes infringement).

68. Wainwright Secs. v. Wall Street Transcript Corp., 558 F.2d 91, 96 (2d Cir. 1977), *cert. denied*, 434 U.S. 1014 (1978).

69. 460 F. Supp. 984, 987 (D.C. Fla. 1978) (citations omitted) (arguing that this protection rewards individual effort and ingenuity in obtaining knowledge), *rev'd*, 650 F.2d 1365, 1372 (5th Cir. 1981).

70. *Miller*, 460 F. Supp. at 987.

71. Miller v. Universal City Studios, 650 F.2d 1365, 1372 (5th Cir. July 1981). The

Similarly, in *Harper & Row v. Nation Enterprises*[72] Justice Brennan, in his dissent, discussed whether the use of factual material from a manuscript describing particular historical events (but not the direct copying of the manuscript) infringed the author's copyright in the manuscript.[73] Addressing the issue of whether facts are copyrightable, Brennan noted that "[w]ere an author able to prevent subsequent authors from using . . . facts contained in his or her work, the creative process would wither and scholars would be forced into unproductive replication of the research of their predecessors."[74] Brennan went on to find that, because "[a]part from the quotations, virtually all of the material in [the allegedly infringing article] indirectly recounted [the plaintiff-author's] factual narrative, . . . [n]o copyright can be claimed in this information *qua* information."[75]

Following Justice Brennan's reasoning, allowing copyright in scientific data would amount to allowing copyright in "information *qua* information," which would stifle creative research and promote wasteful duplication of scientific effort. Thus, this school of thought rejects copyright protection for research, and instead emphasizes the factual nature of research and the waste involved in duplicating the effort of the first researcher.[76]

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district court and court of appeals agreed that "[a]s was the case with ideas, if the expression arrangement and selection of the facts must necessarily, by the nature of the facts, be formulated in given ways then they are not copyrightable." *Id.* at 1368. As discussed above, this claim is directly applicable to the situation involving scientific research data. *See supra* note 52and accompanying text. The court of appeals also stated that "[a] copyright in a directory however, is properly viewed as resting on the originality of the selection and arrangement of the factual material, rather than on the industriousness of the efforts to develop the information." *Miller*, 650 F.2d at 1369. Thus, this court also rejected the "sweat of the brow" approach to copyright protection.

72. 471 U.S. 539 (1985).

73. The majority had decided that the quotation of approximately 300 words from the manuscript was not "fair use" and therefore did not reach the question of copyrightability of the historical facts. The majority did note, however, that "[n]o author may copyright his ideas or the facts he narrates." *Id.* at 556 (*dictum*).

74. *Id.* at 582 (Brennan, J., dissenting).

75. *Id.* at 583.

76. *See also* Hoehling v. Universal City Studios, 618 F.2d 972 (2d Cir. 1980); Rosemont Enters. v. Random House, Inc., 366 F.2d 303 (2d Cir. 1966); Suid v. Newsweek Magazine, 503 F. Supp. 146 (D.D.C. 1980); Marshall v. Yates, 27 PAT. TRADEMARK & COPYRIGHT J. (BNA) 137 (C.D. Cal. 1983). The second circuit has "clearly repudiated *Toksvig* and its progeny" on the copyrightability of research. *Hoehling*, 618 F.2d at 979; *but see* MCA, Inc. v. Wilson, 677 F.2d at 180, 183 (2d Cir. 1981). In a comment on *Miller*, it has been suggested that the court's "holding that research is not copyrightable may deny protection to some works in which research is the only original element." Sato, *Copyright Law and Factual Works—Is Research Protected?*, 58 WASH. L. REV. 619, 627 (1983).

Scientific writings pose the same problems as nonfictional narratives with regard to the copyrightability of the underlying research. First, like research for other nonfictional narrative works, scientific research represents the expenditure of significant time and labor. Second, protection of raw data would force subsequent researchers to duplicate the effort of a prior researcher. Currently, when a scientist publishes an article containing theories and summaries of data, the article as a whole is copyrightable. Other scientists can criticize the results by either conducting new experiments in order to produce data indicating a position contrary to that advocated in the article, or by re-analyzing the published data to reveal an error in the original analysis. If the raw data contained in the article were copyrightable, the latter option would be unavailable.

The conflict between the two schools of thought on the copyrightability of research should be resolved in favor of the majority view precluding copyright protection for raw data, at least where scientific research is involved. Granting protection would force subsequent researchers to repeat experiments. While such duplication would serve the useful purpose of checking earlier results,[77] it would frequently result in a wasted effort. Furthermore, scientific data collection involves less of a selection process than historical or biographical works, as scientific data are collected comprehensively rather than selectively from the available data.[78] Thus, the rationale for protecting the research effort itself is weaker for scientific data than for other nonfictional works.

To summarize, the problem of placing raw data in a category of copyrightable subject matter is formidable. Raw data are too integral a part of a process involving too much imagination to justify invoking the "sweat of the brow" rationale, yet are too rigidly dictated by nature to justify the "selection and arrangement" rationale. Therefore, raw data fall outside the recognized categories of copyrightable subject matter.

B. Authorship & Originality

Copyright protects only an author's original contribution.[79] In many ways, this requirement is extremely lax. One court has said: "[a]ll

77. *See supra* note 61 and accompanying text.

78. *See supra* note 53 and accompanying text.

79. Section 102(a) of the 1976 Act extends copyright protection only to "original works of authorship." The 1909 Act had extended protection to "all the writings of an author." 17 U.S.C. § 4 (1909) (repealed 1976). "Originality" is left undefined in the 1976 Act, but it is doubtful that if scientific data are not protectable under the 1976 Act they would have been protectable under the earlier Act since the phrase "original works of authorship" is "intended to incorporate without change the standard of originality established by the courts under the present [1909] statute." USCCAN, *supra* note 15, at 51.

that is needed to satisfy both the Constitution and the statute is that the 'author' contributed something more than a 'merely trivial' variation, something that can be recognized as 'his own.'"[80] Originality in this context "means little more than a prohibition of actual copying."[81] However, if scientists merely record public domain material, they contribute nothing to the expression; if nothing has been added by an individual researcher, it makes no sense to speak of an "author" or "originality."

The Copyright Office Regulations promulgated under the 1909 Copyright Act (but still applicable under the 1976 Act) deny copyright to "[w]orks consisting entirely of information that is common property containing no original authorship, such as, for example: standard calendars, height and weight charts, tape measures and rulers, schedules of sporting events, and lists of tables taken from public documents or other common sources."[82] Like the works listed in this regulation, raw scientific research data do not contain sufficient expression and originality to be protected by copyright law.

1. *Originality of Expression*

A compiler of disconnected facts makes an original contribution by the selection and arrangement process or by the labor expended in collecting the material.[83] Such a compiler is an "author" of a writing, i.e., one "to whom anything owes its origin; originator; maker; one who completes a work of science or literature."[84]

An axiom of copyright law is that the Act protects only the expressions of ideas, not the ideas themselves.[85] Thus, "[t]here is no copyright of facts,"[86] as no one may claim original expression in facts.[87] When any expression is so "straightforward and simple" as virtually to "spring

80. Alfred Bell & Co. v. Catalda Fine Arts, 191 F.2d 99, 102-03 (2d Cir. 1951) (footnotes omitted).

81. *See generally* Olson, *Copyright Originality*, 48 MO. L. REV. 29 (1983).

82. 37 C.F.R. § 202.1(d) (1959) (cited in 1 M. NIMMER, *supra* note 46, § 2.11[A], at 2-157 to 2-158).

83. *See supra* notes 31-42 and accompanying text.

84. Burrow-Giles Lithographic Co. v. Sarony, 111 U.S. 53, 57-58 (1884); *accord* Goldstein v. California, 412 U.S. 546, 561 (1973).

85. *See* 17 U.S.C. § 102(a)-(b) (1982); Sid & Marty Krofft Television Prod. v. McDonald's Corp., 562 F.2d 1157, 1163 (9th Cir. 1977); Baker v. Selden, 101 U.S. 99, 101 (1880). For an argument that ideas should be protectable property, see Hopkins, *Ideas, Their Time Has Come: An Argument and a Proposal for Copyrighting Ideas*, 46 ALB. L. REV. 443 (1982).

86. Greenbie v. Noble, 151 F. Supp. 45, 66 (S.D.N.Y. 1957). *See also supra* note 31 and accompanying text; USCCAN, *supra* note 15, at 56 (copyright does not preclude others from using the ideas or information revealed by the author's work).

87. 1 M. NIMMER, *supra* note 46, §§ 2.11[A] and 2.11[E], at 2-158 and 2-168; *see also* Houts v. Universal City Studios, 603 F. Supp. 26, 28 (C.D. Cal. 1984) (quoting NIMMER).

directly" from uncopyrightable material, there is no "original creative authorship."[88]

The court in *Alfred Bell & Co. v. Catalda Fine Arts*[89] proposed a test for determining when a work based on public domain material will support a copyright. The court stated that "a 'copy of something in the public domain' will support a copyright if it is a 'distinguishable variation.'"[90] Scientific research data fail this distinguishable variation test. The facts expressed by the raw data are stated in the simplest language possible: scientific notation. The barest description of an event is, in the eyes of copyright law, a writing without an author.

Although facts are sometimes discovered by an author, they are not themselves works of authorship. As Professor Nimmer remarked, "[o]ne who discovers an otherwise unknown fact may well have performed a socially useful function, but the discovery as such does not render him an 'author' in either the constitutional or statutory sense."[91] Authorship requires originality of expression, not merely the discovery of a fact.

The fifth circuit has also expressed the opinion that facts are akin to discoveries, not original works:

> Obviously, a fact does not originate with the author of a book describing the fact. Neither does it originate with one who "discovers" the fact. "The discoverer merely finds and records. He may not claim that the facts are 'original' with him although there may be originality and hence authorship in the manner of reporting, i.e., the 'expression,' of the facts."[92]

A "discovery" has been judicially defined as the "disclosure of an hitherto unknown fact, principle, or theory."[93] Such discoveries are the substance of the work of scientists, but discoveries, along with ideas,

88. Morrissey v. Proctor Gamble Co., 379 F.2d 675, 679 (1st Cir. 1967). The scope of copyright protection increases with the extent that expressions can differ from the underlying idea. Sid & Marty Krofft Television Prods. v. McDonald's Corp., 562 F.2d at 1168. At the margin where expression and idea merge, there is no protection and so the work is uncopyrightable. To claim that such a work is copyrightable but that there is no protection provided against copying is conceptually wrong: it makes no sense in copyright analysis to say that a work is copyrightable but has no protection.

89. 191 F.2d 99, 102 (2d Cir. 1951).

90. *Id.* (footnote omitted). Ideas and facts are not "writings" under Article I, section 8, clause 8 of the Constitution, even though courts give "writings" an expansive interpretation. *See* Goldstein v. California, 412 U.S. at 561; Rubin v. Boston Magazine Co., 645 F.2d 80, 83 (1st Cir. 1981). The Supreme Court in *Burrow-Giles*, 111 U.S. at 58, defines "writings" for the Copyright Clause to embrace "all forms . . . by which the ideas in the mind of the author are given visible expression." However, the bare statements of facts are too minimal an "expression" to qualify.

91. 1 M. NIMMER, *supra* note 46, §§ 2.11[A] and 2.11[E], at 2-158 and 2-168.

92. Miller v. Universal City Studios, 650 F.2d at 1368 (quoting 1 M. NIMMER, *supra* note 46, § 2.03[E] at 2-34).

93. Rubin v. Boston Magazine Co., 645 F.2d at 83.

procedures, and processes, are not copyrightable "regardless of the form in which [they are] described, explained, illustrated, or embodied" in an original work of authorship.[94] Accordingly, scientific data do not meet the requirement that copyright subject matter be an expression owing its "origin" to an author.

2. *Facts as Expressions of Theory*

Post-empiricist philosophers believe that a scientist mixes theory with observation to generate facts[95] in such a manner that all data are "expressions" of an underlying theory.[96] In other words, there are no "bare facts" since every fact is "an event as we see it"[97] reflecting the theory of a particular scientist. The copyright argument is thus that a scientist's world view influences what she deems "facts"[98] and that therefore, her observation and record of data creates a tangible "expression" of her ideas and theories.

However, even if raw data are theory-laden, the data present the facts from one point of view in a very simple manner. Scientists select questions to answer and experiments to perform, thereby preselecting the type of data that will result and providing in advance a framework with which to interpret the data. This preselection does not mean that the recorded data have any additional "expression" in them. Every fact requires some conceptualization, but raw data includes no expression apart from this bare conceptualization.[99] Through creativity and labor, scientists carefully phrase their questions, but nature supplies the answers.

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94. 17 U.S.C. § 102(b) (1982). This principle simply makes clear that ideas are absolutely not protectable. Thus, while discoveries are not copyrightable, an original expression describing one would be. *Rubin*, 645 F.2d at 82.

95. N. HANSON, OBSERVATION & EXPLANATION: A GUIDE TO PHILOSOPHY OF SCIENCE 1, 9 (1971).

96. One author argues that research is more than the "mindless collection of facts." He asserts that financial research is analysis and interpretation of events in addition to the organization the author imposes on the raw facts. Note, *Copyright Law—Will the Denial of Copyright to an Author's Research Impede Scholarship?* Miller v. Universal City Studios, Inc., 605 F.2d 1365 (5th Cir. Jul. 1981), 5 W. NEW ENG. L. REV. 103, 116-17 (1982).

97. S. LANGER, PHILOSOPHY IN A NEW KEY 227 (1951).

98. N. HANSON, *supra* note 95, at 11-12.

99. For each fact, some conceptual element is required. It makes no sense to speak of "unexpressed facts" or of informational content apart from expression. For example, the sun exists apart from expressions of it, but our use of language requires us to speak of facts in expressive language, such as, "the sun exists" or "the sun is a star." In this sense, facts are always "expressions."

To produce a copyrightable expression describing a single event, the account of the event must either have individuality of expression or reflect the author's "peculiar skill and judgment."[100] The bare reporting of events that occurs in scientific experimentation lacks such skill and judgment. Designing an experiment preselects certain data for expression, but this is comparable only to choosing which public domain fact to copy—nothing separately copyrightable is involved. There might be more complicated ways to express simple facts: for example, Einstein could copyright books written in a standard language explaining the significance of the formula "$E = mc^2$" but the formula itself is not copyrightable.[101] Likewise, the simplest expression in scientific language of any idea or fact is not copyrightable, although a complicated expression would be.

Each scientific datum gives a simple (usually mathematical) description of one fact. In addition to each individual datum describing one fact, the data collectively "merge" into a single fact which the observer can understand as an automatic expression of a natural law or pattern.[102] The expression embodied in the data is inseparable from the underlying fact. In particular, one court has treated such expression as uncopyrightable because, "[c]opyright protection will not be given to a form of expression necessarily dictated by the underlying subject matter."[103] Similarly, in a historical research case a court held that "if the expression arrangement and selection of the facts must necessarily, by the nature of the facts, be formulated in given ways then they are not copyrightable."[104]

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100. Triangle Publications v. New England Newspaper Publishing Co., 46 F. Supp. 198, 201 (D. Mass. 1942).

101. *See* 17 U.S.C. § 102(b) (providing that no "principle" or "discovery" can be copyrighted). *See also* Miller v. Universal City Studios, Inc., 650 F.2d 1365 (5th Cir. July 1981); Rubin v. Boston Magazine Co., 645 F.2d 80 (1st Cir. 1981).

102. *See* 1 M. NIMMER, *supra* note 46, § 2.11[A] (data collectively "express" one fact or idea, and this itself is another fact). Note that protectable compilations as a class are not exceptions to the merger doctrine if the "sweat of the brow" rationale is rejected in favor of the "selection, and arrangement" rationale. *See supra* notes 31-49 and accompanying text. Different "expressions" are then possible from the same facts.

103. Freedman v. Grolier Enters., 179 U.S.P.Q. (BNA) 476, 478 (S.D.N.Y. 1973).

104. Miller v. Universal City Studios, 650 F.2d at 1368 (part of jury instruction not challenged on appeal). *See also* 1 M. NIMMER, *supra* note 46, § 2.11[B] (no protection will be accorded to the literal form of expression of a fact if such form does not evidence originality); *see also* Nichols v. Universal Pictures Corp., 45 F.2d 119, 121 (2d Cir. 1930) (Learned Hand, J.) (distinguishing ideas and expression in a play). Justice Brennan cited *Nichols* to support the notion that copyright law must proscribe more than literal appropriation of the author's work. Otherwise, "a plagiarist could avoid infringement by immaterial variations." Harper & Row, Publishers v. Nation Enters., 471 U.S. 539, 583 n.5 (1985) (Brennan, J., dissenting).

One important corollary to the idea/expression distinction[105] is that an expression will receive copyright protection only if it is possible to create alternative expressions of the same idea involving substantial variation.[106] An expression of uncopyrightable subject matter is itself uncopyrightable if only a limited number of ways to express the given subject matter are available.[107] If any one expression were given copyright protection, a virtual monopoly over an idea or fact would result.[108]

Therefore, because the primary concern with the free flow of ideas prevails over the property interest, the law denies copyright protection.

> When the "idea" and its "expression" are thus inseparable, copying the "expression" will not be barred, since protecting the "expression" in such circumstances would confer a monopoly of the "idea" upon the copyright owner free of the conditions and limitations imposed by patent law.[109]

Thus, where idea and expression merge, neither is protected by copyright law.

Scientific research data are the paradigm of the merger of idea (or fact) and expression—the information expressed is the data. Idea and expression coincide when "the expression provides nothing new or additional over the idea,"[110] and this is precisely what occurs with scientific

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105. *See supra* notes 85-94 and accompanying text (discussing idea/expression distinction).

106. *See* Morrissey v. Proctor Gamble Co., 379 F.2d 675, 678-79 (1st Cir. 1967).

107. *Id.* at 678-79. *See also* Landsberg v. Scrabble Crossword Game Players, Inc., 736 F.2d 485, 488-89 (9th Cir. 1984), *cert. denied*, 469 U.S. 1037, *appeal after remand*, 802 F.2d 1193 (9th Cir. 1986) (infringement of factual works).

The same is true in the area of art: if a form is dictated solely from functional considerations or if there is no room for significant variation, the court will not grant copyright protection. *See, e.g.*, Herbert Rosenthal Jewelry Corp. v. Kalpakian, 446 F.2d 738 (9th Cir. 1971); Trifari, Krussman & Fishel, Inc. v. Charel Co., 134 F. Supp. 551 (S.D.N.Y. 1955).

Fact-gathering photographs may be different because research photographs are usually not the only expression of an event. *See* Time, Inc. v. Bernard Geis Assocs., 293 F. Supp. 130, 143-44 (S.D.N.Y. 1968)(protected photographs of the assassination of Kennedy). If the photographed event is also somehow uniquely important and integral to a theory, under the doctrine of *Time* it may be copyrightable but open to a "fair use" exception. *Id.* at 146. To be scientifically significant, events must have unrepeatable features (i.e., features revealing lawful aspects to events). Thus, only events which occur rarely (e.g., certain rarely observed astronomical events) would in principle qualify for such an exception if copyright protection is permitted.

108. However, arriving at the same idea or fact through completely independent research would still be allowed. *See supra* text accompanying notes 41-43.

109. Herbert Rosenthal Jewelry Corp. v. Kalpakian, 446 F.2d at 742. *See also* M. Kramer Mfg. Co. v. Andrews, 783 F.2d 421, 436 (4th Cir. 1986); Atari, Inc. v. Amusement World, Inc., 547 F. Supp. 222, 228 (D. Md. 1981).

110. Sid & Marty Krofft Television v. McDonald's Corp., 562 F.2d 1157, 1168 (9th Cir. 1977). The court goes on to say that "[w]hen idea and expression coincide, there will be protection against nothing other than identical copying of the work." *Id.* This conflicts with the notion that when idea and expression merge, "protecting the expres-

data and facts. Conjectures concerning new discoveries or theories are interpretations of the data, not something already "in" the data themselves. If the idea is taken to be the experimental procedure, then the idea is so detailed that only one pattern of data could result. In this case, the variation in expressions represented by differing sets of data would be trivial, and thus the expression would collapse into the idea. In simplest terms, the data as a whole express a law or pattern of nature which the underlying reality produces. Thus, the data collectively express one idea in addition to each datum reporting an individual fact.[111] Therefore, protecting the data collectively or individually proves just as difficult as protecting the data individually because there is no protectable expression distinct from the underlying unprotectable facts.

Such data are forms of expression which cannot be varied without altering the facts expressed.[112] There is no room for a plurality of expressions, and hence no room for the creativity protected by the copyright laws. Thus, based on the statutory and case law, copyright protection probably does not extend to raw scientific data. However, because the law is not entirely clear on this issue, the policy considerations which influence copyright doctrine should be examined.

C. Policy considerations: Dissemination of Information Versus Control

Copyright law has two basic goals: (1) to encourage the dissemination of information; and (2) to provide an incentive to authors by granting them property rights in their works for a limited period of time.[113] Accordingly, the decision to grant or deny copyright protection to research data follows from analyzing the tension between the free flow of information and the great control which results from providing a property interest in original works of authorship. Scientists need control of their data for research and theorizing, and copyright protection could provide that control. On the other hand, society has an interest in the dissemination of research data.

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sion . . . would confer a monopoly of the idea upon the copyright owner." *Id.* (quoting Herbert Rosenthal Jewelry Corp. v. Kalpakian, 446 F.2d at 742). It also conflicts with the copyright axiom that if nothing protectable has been added, anyone is free to copy the unprotected idea.

111. To argue that individual data must be copyrightable in order to protect the compilation of them is to "boot-strap" protection of the compilation. *See* Financial Information v. Moody's Investor Serv., 751 F.2d 501, 511 (1984) (Newman, J., concurring), *district court opinion on remand aff'd.*, 808 F.2d 204 (2d Cir. 1986). Without an original contribution to the expression in the compilation, the "whole" is not greater than the sum of the "parts."

112. Atari v. Amusement World, 547 F. Supp. at 228 (concerning ideas).

113. *See* 1 M. NIMMER, *supra* note 46, § 1.03[A], at 1-31 to -32.2.

Copyright law attempts to resolve this tension by granting protection only to "expressions" and not to the underlying "ideas."[114] Society's interest in the free dissemination of ideas is promoted, while at the same time, creative endeavors are encouraged through the protection of their expression. Thus, "[t]he public interest in the free flow of information is assured by the law's refusal to recognize a valid copyright in facts."[115]

One may argue, however, that copyright protection of raw data would actually aid, rather than hinder, the free flow of information. In other words, the two primary goals of copyright law may be complementary rather than conflicting. For example, the Code of Federal Regulations provides that: "[i]n order to enhance the transfer or dissemination of information produced at Government expense, contractors may be permitted to establish copyright in the data first produced in the performance of work under a contract containing [a specific clause]."[116] This provision evidences Congress' concern that private publishers of handbooks of standardized reference data need some incentive to publish data produced at government expense. Copyright protection makes feasible the participation of private publishers in the program by protecting a publisher's investment.[117]

114. The expression/idea distinction also resolves the tension between copyright and the First Amendment, i.e. the tension between restricting an individual's ability to express himself and protecting a previous author's work. *See* Harper & Row Publishers v. Nation Enters., 471 U.S. 539, 556 (1985); *Sid & Marty Krofft Television*, 562 F.2d at 1170 (the idea-expression dichotomy already serves to accommodate the competing interests of copyright and the first amendment); Pacific and Southern Co. v. Duncan, 572 F. Supp. 1186, 1192-93 (N.D. Ga. 1983); Denicola, *Copyright and Free Speech: Constitutional Limitations on the Protection of Expression*, 67 CALIF. L. REV. 283 (1979); Nimmer, *Does Copyright Abridge the First Amendment Guarantees of Free Speech and Press?*, 17 UCLA L. REV. 1180 (1970); 1 M. NIMMER, *supra* note 46, § 2.11[E]; Comment, *Copyright and the First Amendment: Where Lies the Public Interest?*, 59 TUL. L. REV. 135 (1984). On the importance of keeping scientific expression free from restrictions, see Ferguson, *Scientific and Technological Expression: A Problem in First Amendment Theory*, 16 HARV. C.R.-C.L. L. REV. 519 (1980) (copyright issue not considered).

115. Iowa State Univ. v. Am. Broadcasting Co., 621 F.2d 57, 61 (2d Cir. 1980). *See also* Baker v. Selden, 101 U.S. 99, 101 (1880); Sampson & Murdock v. Seaver-Radford Co., 140 F. 539, 541 (1st Cir. 1905).

116. Fed. Acquisition Regulation Sys., 48 C.F.R. § 1227.401-71(b)(6)(i)(A) (1985).

117. S. REP. NO. 1230, 90th Cong., 2nd Sess. (1968), *reprinted in* 1968 U.S. CODE CONG. & ADMIN. NEWS 2580, 2585-86. Research data produced under government research grants independent of the program envisioned by the Standard Data Reference Program probably do not qualify as works of the United States Government under § 105 of the 1976 Act (which would disqualify the works for copyright protection) unless the contract so provides. But the exact intent of § 105 of the 1976 Act in this regard is not clear. *See* USCCAN, *supra* note 15, at 59 (§ 105 deliberately avoids making any sort of outright, unqualified prohibition against copyright in works prepared under Government contract or grant); S & H Computer Sys. v. SAS Institute, 568 F. Supp. 416, 419 (M.D. Tenn. 1983) (government funding of a project does not prohibit a copyright for any developments under the project). *See also* 1 M. NIMMER, *supra* note 46, § 5.06[B][2].

A similar economic consideration may apply to the initial publication of research articles by professional journals.[118] Incentives to undertake expensive and time-consuming research may be increased by allowing scientists to copyright raw data. Furthermore, requiring scientists to replicate experiments and observations in previously explored areas will produce a checking procedure for the original data. Arguably, then, providing copyright protection would contribute to the advancement of knowledge.

However, allowing copyright of research data would more likely impede, rather than encourage, the dissemination of data. First, the replication argument has been discredited.[119] Second, because "expression" and "fact" merge in research data,[120] granting copyright protection to the data will have the effect of giving a scientist virtual monopolistic control over facts which would otherwise be part of the public domain. Other scientists would, of course, have the right to reinvestigate a field of study by conducting their own experiments, but subsequent researchers would not be able to copy data without the first researcher's permission.[121] If the experiments are too costly and time-consuming to replicate, as is likely with many research topics today, the actual results of any scientific experiment would be monopolized to the detriment of both the scientific and general community.

Furthermore, because little replicative research is done, copyrighting raw data would result in a significant detrimental impact on surveys of scientific subjects. No scientifically useful comprehensive summary of data would be available because any such subject would be a "derivative work"[122] to which the original copyright owner has exclusive rights.[123]

118. *But see* Williams & Wilkins Co. v. United States, 487 F.2d 1345 (Ct.Cl. 1973), *aff'd by an equally divided Court*, 420 U.S. 376 (1975) (per curiam) (extensive photocopying and distribution of articles from medical journals constitutes "fair use" under particular circumstances related to the advancement and dissemination of medical knowledge). Justice Blackmun did not participate, and later suggested that he would disapprove of the "fair use" rationale in this case. *See* Sony Corp. v. Universal City Studios, 464 U.S. 417, 467 n.16 (1984) (Blackmun, J., dissenting).

119. *See supra* note 61 and accompanying text.

120. *See supra* notes 105-12 and accompanying text.

121. "Others are free to copy the original. They are not free to copy the copy." Bleistein v. Donaldson Lithographic Co., 188 U.S. 239, 249 (1903). If scientific research data were copyrightable, there would be no public domain material in the data which other scientists would be entitled to copy.

122. "A derivative work is a work based upon one or more preexisting works such as a translation . . . abridgement, condensation or any other form in which a work can be recast, transformed, or adapted." 17 U.S.C. § 101 (1982). The issue of whether derivative works in matters where expression and fact converge should also be unprotectable by copyright law is beyond the scope of this Comment.

123. 17 U.S.C. § 106(2).

At best, copyrighting of raw data would lead to repeated, needless experiments to duplicate the copyrighted data.[124] Scientists would not be able to extend the research of their predecessors where old research is necessary to establish support for further findings.[125] This kind of restrictive control of data would be a great hindrance to the progress of knowledge[126] —especially in an enterprise such as scientific research where each scientist relies so extensively upon the contributions of other scientists.

Furthermore, the policy of granting protection as an economic incentive[127] is not as central in scientific research as in the realm of directories and other fact-gathering works, because there are incentives and rewards for scientific research other than the commercial exploitation of the collected data.[128]

In short, the decision whether to grant copyright protection to research data is informed by conflicting motivations. In general, when there is a conflict between public interest and the potential copyright owner's interest, the former will prevail since the primary objective of copyright protection is to serve the public interest.[129] Thus, when "expression" and "fact" merge,[130] as in research data, considerations related to the free flow of information should prevail over the other policy

124. Congress expressed concern with the needless repetition of measurements in research and engineering programs in a different setting. *See* S. REP. NO. 1230, *supra* note 117, at 2581. Congress' concern was with scientists unknowingly and needlessly duplicating the work of other scientists, not with replications of experiments to check or expand the work of others.

125. Making use of data without copying it, however, would not infringe any right set forth in the 1976 Act. *Cf.* Mazer v. Stein, 347 U.S. 201, 218, *reh'g denied*, 347 U.S. 949 (1954).

126. Other authors may begin work where the prior author has stopped and may use the copyrighted work as a means of reference to the original sources. *See* Greenbie v. Noble, 151 F. Supp. 45, 67 (S.D.N.Y. 1957); Sampson & Murdock v. Seaver-Radford Co., 140 F. 539, 540 (1st Cir. 1905). In the words of Professor Chafee: "[t]he world goes ahead because each of us builds on the work of our predecessors. 'A dwarf standing on the shoulders of a giant can see farther than the giant himself.'" Chafee, *Reflections on the Law of Copyright*, 45 COLUM. L. REV. 503, 511 (1945).

127. *See supra* text accompanying notes 117-18.

128. For example, other rewards may include such things as improved reputation within the scientific community and research grants.

129. Shipley & Hay, *supra* note 17, at 129 n.33. A major consideration in *Williams & Wilkins*, 487 F.2d 1354, was the possible injury to medical and scientific research of photocopying and distributing individual articles without the copyright owners' permission. *See also* Twentieth Century Music Corp. v. Aiken, 422 U.S. 151, 156 (1975); United States v. Paramount Pictures, Inc., 334 U.S. 131, 138 (1947). Concerning the economic theory behind copyright protection, see Mazer v. Stein, 347 U.S. at 219; Fox Film Corp. v. Doyal, 286 U.S. 123, 127 (1932); Washington Publishing Co. v. Pearson, 306 U.S. 30, 36, *reh'g denied*, 306 U.S. 668 (1939).

130. *See supra* notes 105-12 and accompanying text.

considerations embodied in copyright law.

As the Supreme Court said in *Baker v. Selden*:

> The very object of publishing a book on science or the useful arts is to communicate to the world the useful knowledge which it contains. But this object would be frustrated if the knowledge could not be used without incurring the guilt of piracy of the book.[131]

D. Fair Use

Before leaving the topic of copyright, it should be noted that if scientific research data were given copyright protection, other scientists who copy might not be able to avail themselves of the "fair use" defense against claims of infringement.[132] The 1976 Act limits the exclusivity of rights given to a copyright owner for purposes of, *inter alia*, scholarship and research, by permitting "fair use" by others of protected material in certain circumstances.[133]

Factors to be considered in determining whether use of a work qualifies as a fair use include:

> (1) the purpose and character of the use, including whether such use is of a commercial nature or is for nonprofit educational purposes;
>
> (2) the nature of the copyrighted work;
>
> (3) the amount and substantiality of the portion used in relation to the copyrighted work as a whole; and
>
> (4) the effect of the use upon the potential market for, or value of, the copyrighted work.[134]

Problems might arise, however, where scientists attempt to use an earlier researcher's data as corroboration of a finding or as the basis for further research. A statistically significant amount of the prior data would have to be utilized to corroborate such a claim. This would probably amount to substantial copying. Since the end result of the second researcher's efforts would probably be a substantially similar collection of data, one would be forced to conclude that there had been infringement.[135] Similarly, a useful summary of all the data would be a

131. Baker v. Selden, 101 U.S. at 103. Books or research articles would still be copyrightable even if the raw data contained therein were not.

132. *Contra* D. NELKIN, *supra* note 3, at 43.

133. 17 U.S.C. § 107 (1982). On fair use for historical research, see Taylor, *supra* note 17, at 56-68.

134. 17 U.S.C. § 107(1)-(4).

135. *See, e.g.*, Denicola, *supra* note 17, at 531-32. In a compilation case, the Court of Appeals for the Second Circuit stated that "the fruits of another's labor in lieu of independent research obtained through the sweat of a researcher's brow, does not merit copyright protection absent, perhaps, wholesale appropriation." Eckes v. Card Prices Update, 736 F.2d 859, 862 (2d Cir. 1984). "Wholesale appropriation" as the standard for infringement of compilations would be more stringent than the standard for other

protected derivative work, and hence under the control of the original copyright owner.[136]

Literal application of the factors enumerated in the Act for determining whether a particular use is "fair" discloses even more problems. The first factor, the purpose of the use would favor a claim for fair use since research is listed as a permitted purpose. Yet subsequent scientists are likely to be engaged in the same enterprise, and, in this sense, the scientists are competitors. Although the purpose of the copying is not directly "commercial," it is nonetheless not a totally disinterested, selfless desire to advance knowledge.

With regard to the second factor, the nature of the copyrighted work, one concern will be whether the original copyrighted work is unpublished or not. Under the 1976 Act, publication is no longer the crucial triggering event for copyright protection, but under section 106(3) of the new Act the copyright owner has "the right to control the first public distribution of an authorized copy . . . of his work."[137] Hence, the fair use defense is not likely to be available if the copyrighted data are *unpublished,* since use of unpublished data would supplant the copyright owner's valuable right of first publication.[138]

The third factor, the "amount and substantiality of the portion" of the copyrighted work utilized, will be a major stumbling block to a fair-use defense since any scientifically useful copying will take a significant portion of the data.[139]

The last factor, the economic effect of the use upon the value and potential market of the copyrighted work, is the most important of the four.[140] To negate a fair-use defense, "one need only show that if the challenged use 'should become widespread, it would adversely affect the *potential* market for the copyrighted work.'"[141] In the case of unpublished data, the effect of unauthorized use of data upon the discovering

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copyright works of "substantial similarity" of the copyrightable expression. *See, e.g.,* Sid & Marty Krofft Television Productions v. McDonald's Corp., 562 F.2d 1157, 1164 (9th Cir. 1977). By either standard, copying a statistically significant amount of scientific data would be infringing, assuming the data is copyrightable.

136. *See supra* notes 122-23 and accompanying text.

137. USCCAN, *supra* note 15, at 62.

138. In *Harper & Row, Publishers v. Nation Enterps.,* the Supreme Court concluded that, while the right of first publication is subject to fair use like other section 106 rights, the unpublished nature of a work is a "key" factor tending to negate a defense of fair use. "Under ordinary circumstances, the author's right to control the first public appearance of his undisseminated expression will outweigh a claim of fair use." 471 U.S. 539, 555 (1985).

139. *See supra* text accompanying note 64.

140. *See, e.g.,* Taylor, *supra* note 17, at 66.

141. Harper & Row Publishers v. Nation Enters., 471 U.S. 539, 562 (1985) (quoting Sony Corp. v. Universal City Studios, 464 U.S. 417, 451 (1984)).

scientist's career may be tremendous since there is no market for duplicative data. In addition, claims to priority and substantiation of work for research grants may be lost.

In short, the fair use defense would probably not be available to scientists who copy another's original research data. Thus, the damaging repercussions of allowing copyright protection for research data would not be abated by the existence of the fair use doctrine.

E. Conclusion

The conclusion from this discussion is that all relevant considerations lead to the same result—there is no justification for granting copyright in research data. Both courts and commentators have suggested that scientific literature in general should receive only limited protection.[142] Clearly, even that limited protection should not extend to the underlying facts and raw research data.

"[W]hen an idea is such that *any* use of that idea *necessarily* involves certain forms of expression, one may not copyright those forms of expression, because to do so would be in effect to copyright the underlying idea."[143] Scientific research data fall squarely within this prohibition.

II. MISAPPROPRIATION

Although the policy of free dissemination of information argues against, and ultimately prohibits, copyright protection of raw data, the other policy considerations discussed suggest that at least some measure of protection should be provided for research data. State causes of action might be considered an appropriate alternative for providing such protection. In particular, the states might consider providing a mechanism for protection of unpublished data. Potential claims include conversion, misappropriation, unfair competition, and causes of action based on contract and quasi-contract.[144] This Section considers only those claims which, like copyright, would provide a property interest in the abstract data.

The cause of action most suited to protecting data is a form of unfair competition called "misappropriation"—the taking of the fruit of

142. Sampson & Murdock Co. v. Seaver-Radford Co., 140 F. Supp. 539, 541 (1st Cir. 1905) (dictum) (concerning all arts and sciences); Rubin v. Boston Magazine Co., 645 F.2d 80, 84 (1st Cir. 1981) (limited protection of scientific material when used for scientific, scholarly, news reporting, or like purposes). *Cf.* 1 M. NIMMER, *supra* note 46, § 2.11[B], at 2-161 (public interest may justify copying substantial portions of literal form of expression of other kinds of factual works).

143. Atari, Inc. v. Amusement World, Inc., 547 F. Supp. 222, 228 (D. Md. 1981).

144. *See* Shipley & Hay, *supra* note 17, at 151.

another's time and effort for competitive advantage. The United States Supreme Court first articulated the doctrine of misappropriation in *International News Service v. Associated Press.*[145] In that case, the Court held actionable as misappropriation the conduct of a news-gathering organization in systematically copying and selling to clients fresh foreign news that another service had gathered abroad. The Court further held that the news service which had acquired the news items by its organized expenditure of labor, skill, and money had thereby acquired a quasi-property interest in the news, which would be valid only while the news remained "hot."[146] The court observed that no one may claim a monopoly on the gathering or distribution of news which is only the report of information in the public domain,[147] but held that even if the competitor acknowledged the source of information, when the competitor endeavors "to reap where [he] has not sown,"[148] the "transaction speaks for itself, and a court of equity ought not to hesitate long in characterizing it as unfair competition in business."[149]

The *International News Service* approach opens the possibility for the judicial recognition of quasi-property rights in scientific research data. The basis of the Court's recognition of a quasi-property right, however, does not appear to be significantly different from the "sweat of the brow" rationale for copyright in compilation cases.[150] Because this rationale has been rejected,[151] it should not be used as a basis for providing protection of raw data under the guise of quasi-property rights. In addition, raw scientific data may be sufficiently different from news so as not to justify the recognition of quasi-property rights in that data. Yesterday's news is old hat, so that the quasi-property right expires quickly. It is not nearly so simple to determine whether raw data is "hot" or "cold".

Even if the "sweat of the brow" doctrine were revived, and a suitable test developed for applying quasi-property rights to raw data, the

145. 248 U.S. 215 (1918).

146. *International News Service* held that although:

> [n]either party has any remaining property interest as against the public in uncopyrighted news matter after the moment of its publication, it by no means follows that there is no remaining property interest in it as between themselves. . . . Regarding the news, therefore, as but the material out of which both parties are seeking to make profits at the same time and in the same field, we hardly can fail to recognize that for this purpose, and as between them, it must be regarded as *quasi* property, irrespective of the rights of either as against the public.

Id. at 236.

147. *Id.* at 241.

148. *Id.* at 239.

149. *Id.* at 240.

150. *See supra* text accompanying notes 41-47 and 57-63.

151. *See supra* notes 47 and 49 and accompanying text.

states would not automatically be able to provide such protection to researchers. One must first determine whether federal copyright law has preempted misappropriation doctrine, at least as it might apply to scientific research data.

A. Doctrine of Preemption

Section 301 of the 1976 Act provides that federal copyright law preempts all state law rights and causes of action that are "equivalent" to those protected by the federal Copyright Act.[152] Section 301(b) further provides that federal law does not preempt state causes of action with respect to:

> (1) subject matter that does not come within the subject matter of copyright as specified by sections 102 and 103, including works of authorship not fixed in any tangible medium of expression; or
>
> . . .
>
> (3) activities violating legal or equitable rights that are not equivalent to any of the exclusive rights within the general scope of copyright as specified by section 106.[153]

Stated affirmatively, the Copyright Act preempts a state action if and only if two conditions are satisfied: (1) the subject matter of the work is within the scope of the Copyright Act; and (2) the protected rights are equivalent to the exclusive rights specified by section 106 of the Act.

The intention behind section 301 is to preempt and abolish any rights under state law that are equivalent to copyright and that extend to works subject to copyright protection.[154] Whether misappropriation in particular has been preempted by federal law is not clear.[155] Misappropriation was included in the original 1976 copyright bill as an example of a state action *not* preempted by the new Act.[156] The House amended the bill by deleting the reference to misappropriation[157] but

152. 17 U.S.C. § 301(a) (1982).

153. 17 U.S.C. § 301(b) (1982).

154. *See* USCCAN, *supra* note 15, at 130.

155. For discussions of preemption, see Abrams, *Copyright, Misappropriation and Preemption: Constitutional and Statutory Limits of State Law Protection*, 1983 SUP. CT. REV. 509; Baird, *Common Law Intellectual Property and the Legacy of* International News Service v. Associated Press, 50 U. CHI. L. REV. 411 (1983); Fetter, *Copyright Revision and the Preemption of State "Misappropriation" Law: A Study in Judicial and Congressional Interaction*, 27 COPYRIGHT L. SYMP. 1 (1982) (ASCAP); Mitchell, *Misappropriation and the New Copyright Act: An Overview*, 10 GOLDEN GATE L. REV. 587 (1980); Shipley & Hay, *supra* note 23, at 151-80; Comment, *The Misappropriation Doctrine After the Copyright Revision Act of 1976*, 81 DICK. L. REV. 469 (1977).

156. *See* USCCAN, *supra* note 15, at 24.

157. *See* H.R. CONF. REP. NO. 1733, 94th Cong., 2d Sess. 79, *reprinted in* 1976 U.S. CODE CONG. & ADMIN. NEWS 5810, 5820.

offered no explanation for the deletion.[158] The Act's legislative history thus leaves open to dispute whether, and to what extent, section 301 is intended to preempt misappropriation doctrine.[159] While the Senate adjudged misappropriation to be "nothing more than copyright protection under another name,"[160] the House determined that misappropriation "is not necessarily synonymous with copyright infringement."[161] In short, the legislative history is not at all conclusive regarding preemption of state misappropriation law.

Because of the absence of a clear expression of legislative intent on preemption, the following discussion examines the literal wording of section 301 and the two criteria set forth therein to determine whether the Act preempts misappropriation claims against scientists who appropriate for their own use the research data of their colleagues. This Comment concludes that federal copyright law preempts most claims based on the doctrine of misappropriation, thereby leaving scientists without intellectual property protection for their raw research data.

B. Equivalent Rights

Section 106 secures to the owner of a copyright the exclusive rights to reproduce the copyrighted work, to prepare derivative works based upon the copyrighted work, to distribute copies of the copyrighted work, and to perform or display the copyrighted work publicly.[162] Under the usual test a state right is not equivalent to a federal right and is not preempted if it requires proof of some element instead of, or in addition to, those acts enumerated in section 106.[163]

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158. *See id.*

159. On the legislative history of section 301, see 1 M. NIMMER, *supra* note 46, § 1.01[B], at 1-13 to -16. *See also* Abrams, *supra* note 155, at 537-550; Fetter, *supra* note 155, at 34-52.

160. S. REP. NO. 983, 93d Cong., 2d Sess. 167 (1974).

161. USCCAN, *supra* note 15, at 132. *Compare* Mayer v. Josiah Wedgwood & Sons, Ltd., 601 F. Supp. 1523, 1533-36 (S.D.N.Y. 1985) (discussing legislative history of section 301 and holding that it preempts misappropriation claim) *with* DC Comics, Inc. v. Filmation Assocs., 486 F. Supp. 1273 (S.D.N.Y. 1980) (holding that section 301 does not preempt misappropriation claim).

162. 17 U.S.C. § 106 (1982).

163. *See, e.g., Mayer*, 601 F. Supp. at 1535 (issue is whether plaintiff's conversion and misappropriation claims contain an 'extra element' which qualitatively distinguishes the actions and their underlying rights from those addressed by copyright law); Rand McNally & Co. v. Fleet Management Sys., 591 F. Supp. 726, 739 (N.D. Ill. 1983), *reh'g denied*, 624 F. Supp. 604 (1986) (an additional element such as breach of fiduciary duty may take misappropriation claim out of preemption reach of section 301). *See also* 1 M. NIMMER, *supra* note 46, § 1.01[B], at 1-11 to -12.

Conversely, state law claims which involve only identical elements are preempted. Orth-O-Vision, Inc. v. Home Box Office, 474 F. Supp. 672, 684 n.12 (S.D.N.Y. 1979) (state law claims preempted by the copyright act unless they involve rights not equivalent to the exclusive rights of section 106); 1 M. NIMMER, *supra* note 46, § 1.01[B].

This test is surely too permissive, countenancing far more state protection than the dissemination policy behind copyright law would allow. For example, the equivalency test would seem to allow state claims for copying of misappropriated literary works simply because misappropriation claims, unlike copyright claims, all require proof of the plaintiff's considerable time and expense and the defendant's intent to reap a competitive advantage.[164] Professor Gorman has argued that "[b]ecause it is possible to frame almost *any* state tort so as to evince a protective policy different from copyright, the proffered analysis would too often interfere with the dissemination policies of the Copyright Act and particularly of section 301."[165]

Professor Abrams has also suggested that the current approach to determining equivalency is weak, and has proposed that the appropriate way to determine if rights are equivalent is to determine what right is being asserted, rather than to compare its elements of proof.

> Whether the antecedent conditions for asserting a right under state law are identical to copyright infringement or diametrically opposed to it is simply irrelevant. The question to ask is whether the right being asserted is one of the exclusive rights listed in § 106. Thus proving that the claimant has invested great time, money, and skill, or that the claimant will suffer harm, is no more germane than proving that the claimant has blue eyes.[166]

It is clear that the rights sought by scientists through the misappropriation doctrine are exactly the same as those enumerated in the Copyright Act—protection against unauthorized reproduction or distribution of their raw factual material.[167] Even claims governing the use of unpublished research data would ordinarily involve rights equivalent to the section 106 rights against unauthorized reproduction because a scientist would actually have to publish the misappropriated and previously unpublished data in some form in order to support any conclusion based on the data.[168]

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164. *Implications for Copyright*, *supra* note 17, at 608. *But see Mayer*, 601 F. Supp. at 1535-36 (misappropriation claim against copying of snowflake design preempted, notwithstanding plaintiff's showing of her own effort and defendant's immorality); *Rand McNally*, 591 F. Supp. at 739 (commercial immorality and wrongdoing are not additional elements sufficient to avoid preemption).

165. *Implications for Copyright*, *supra* note 17, at 608.

166. Abrams, *supra* note 155, at 577.

167. *See Rand McNally*, 591 F. Supp. at 739 (misappropriation claim against copier of highway mileage information not exempt from copyright preemption); Mitchell v. Penton/Indus. Publishing Co., 486 F. Supp. 22, 25-26 (N.D. Ohio 1979) (dismissing misappropriation claim against user of factual information about business records maintenance); *cf.* Denicola, *supra* note 17, at 517 n.7 (the appropriation of factual material from non-literary works is nothing more than simply copying).

168. *See supra* notes 135-36 and accompanying text.

At best, section 301 might exempt from copyright protection some claims based on sustained and systematic misappropriation of research data. The legislative history of the Copyright Act directs that:

> state law should have the flexibility to afford a remedy (under traditional principles of equity) against a consistent pattern of unauthorized appropriation by a competitor of the facts (i.e., not the literary expression) constituting "hot" news, whether in the mold of *International News Service v. Associated Press*, 248 U.S. 215 (1918), or in the newer form of data updates from scientific, business, or financial data bases.[169]

Absent such a pattern of unauthorized appropriation, however, a state action for the misappropriation of scientific research data will reduce to the equivalent of an action against copying or reproduction.[170]

Even if the use of research data were not equivalent to any section 106 right, permitting states to protect rights in the use of scientific data clearly goes too far. Because "expression" merges with "fact" in data,[171] protecting the use of such data would allow scientists to control material in the public domain which would directly conflict with the fundamental copyright policy of encouraging the free flow of information. This cannot be justified even by a policy providing incentives to undertake scientific research. Allowing scientists to control the use of their research data would inhibit the progress of science by providing individual scientists with too much control over raw facts—even after such facts had been introduced into the public domain.

Thus, with the possible exception of extraordinary cases involving consistent, unauthorized appropriation,[172] the rights protected under a state action for misappropriation of scientific data are equivalent to those protected by the 1976 Copyright Act and therefore cannot avoid preemption under the equivalent rights test.

C. Subject Matter

The "subject matter" test of section 301(b) as applied to research data is more problematic. Section 301(b) permits state protection for subject matter falling outside sections 102 and 103; section 102(b) provides that copyright protection does not "extend to any idea, procedure, process, system, method of operation, concept, principle, or discovery, regardless of the form in which it is described, explained, illustrated, or

169. USCCAN, *supra* note 15, at 132.

170. *See* 1 M. NIMMER, *supra* note 46, § 1.01[B][2][b], at 1-19 (no substantive distinction between actions for copying and misappropriation).

171. *See supra* notes 105-12 and accompanying text.

172. *See supra* note 163.

embodied." Thus, under a literal reading, section 301(b) would permit broad state protection of ideas, processes, etc.[173]

Moreover, section 301(a) specifies that only "works of authorship that are fixed in a tangible medium of expression and come within the subject matter of copyright as specified by sections 102 and 103" are governed exclusively by the Act. Since facts and data are not "works of authorship,"[174] they would not be governed by the Copyright Act, and arguably would be open to state protection.

The difficulty with this literal reading of section 301 derives from the general goal of the Copyright Act. The House Committee Report contains the following passage.

> As long as a work fits within one of the general subject matter categories of sections 102 and 103, the bill prevents the States from protecting it even if it fails to achieve Federal statutory copyright because it is too minimal or lacking in originality to qualify, or because it has fallen into the public domain.[175]

Research data and other bald expressions of facts fixed in a tangible medium of expression seem to fall easily into this preempted category because they are "too minimal" in their expression. In addition, the Supreme Court held in *Goldstein v. California*[176] that only those areas left "unattended" by federal law—areas in which Congress had "drawn no balance"—are not preempted by federal copyright legislation.[177] The inclusion of section 102(b) in the 1976 Act strongly suggests that Congress has drawn a balance in the area of facts and intended that the

173. Rand McNally & Co. v. Fleet Management Sys., 591 F. Supp. 726, 739 (N.D. Ill. 1983), *reh'g denied*, 624 F. Supp. 604 (1986); Bromhall v. Rorvik, 478 F. Supp. 361, 366-67 (E.D. Pa. 1979); 1 M. NIMMER, *supra* note 46, § 1.01[B][2][b]; *but see Implications for Copyright*, *supra* note 17, at 602-03.

174. *See supra* notes 79-112 and accompanying text; 1 M. NIMMER, *supra* note 46, § 2.11[A] and [E].

175. USCCAN, *supra* note 15, at 131. *See* Financial Information v. Moody's Investor Serv., 808 F.2d 204 (2d Cir. 1986) (fact compilations which were denied copyright protection because of insufficient originality, selection, and arrangement were nonetheless works of authorship under the Act and therefore state misappropriation claims preempted); *but see* 1 M. NIMMER, *supra* note 46, § 2.11[E], at 2-167 n.30 (misappropriation of news, *i.e.*, facts, not preempted because news *per se* is not a "writing" and Congress may not legislate a copyright in facts).

By contrast, the House Committee Report states that data which are not fixed in a tangible medium of expression (e.g., data on the cathode ray tube of a computer terminal) should be afforded state protection. USCCAN, *supra* note 15, at 132.

176. 412 U.S. 546 (1973).

177. *Id.* at 570. Previously the Supreme Court had held that state law prohibitions against copying interfered with the constitutional policy of free access to works left unprotected by federal law. Compco. Corp. v. Day-Brite Lighting, 376 U.S. 234 (1964); Sears, Roebuck & Co. v. Stiffel Co., 376 U.S. 225 (1964). *See generally* Note, *The "Copying- Misappropriation" Distinction: A False Step in the Development of the* Sears-Compco *Pre-emption Doctrine*, 71 COLUM. L. REV. 1444 (1971).

free flow of facts not be restrained in any manner. In other words, the area of facts has been covered by congressional action and Congress has deliberately left it unprotected.[178] As the Supreme Court stated in *Goldstein*, "a conflict would develop if a State attempted to protect that which Congress intended to free from restraint or that which Congress had protected."[179]

With respect to section 301(b), the consequence of the House Committee Report and *Goldstein* is that fact-expressions fall "within the subject matter of copyright as specified in sections 102 and 103," and thus state protection is preempted. In the words of Professor Gorman:

> [w]hen Congress declares in section 102(b) that copyright in such literary work does not "extend to any idea" described, explained or embodied therein, it is not declaring such an idea outside the subject matter of copyright so much as it is affirmatively declaring—as clearly as it can, and for the clearest reasons—that ideas are free to be copied, adapted and disseminated, and that no court is to construe the federal copyright monopoly as inhibiting that freedom. The implication for state law is equally clear: neither can the states. . . . Far from leaving facts, ideas and the like "unattended," to borrow a term from the *Goldstein* case, Congress has very much attended to them in section 102(b), and has declared them to be free as the air.[180]

Thus, facts have been deliberately excluded from copyright protection and therefore the states cannot protect them.[181]

Permitting state protection of simple factual expressions would create "vague borderline areas between State and Federal protection"

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178. The House Committee Report states:

> [s]ection 102(b) in no way enlarges or contracts the scope of copyright under the present law. Its purpose is to restate, in the context of the new single Federal system of copyright, that the basic dichotomy between expression and idea remains unchanged.

USCCAN, *supra* note 15, at 57. As Professor Abrams has said concerning this passage, "[t]here is certainly nothing in this comment that can conceivably be taken as endorsing such a drastic change as to allow the states to redefine the public domain to restrict access to fact." Abrams, *supra* note 155, at 564.

179. 412 U.S. at 559.

180. *Implications for Copyright*, *supra* note 17, at 604-05. Gorman's comments echo Brandeis' dissent in *International News Service v. Associated Press*: "the general rule of law is, that the noblest of human productions—knowledge, truths ascertained, conceptions, and ideas—become, after voluntary communication to others, free as the air to common use." 248 U.S. 215, 250 (1918) (Brandeis, J. dissenting). *See also* Shipley & Hay, *supra* note 23, at 165; Abrams, *supra* note 155, at 541-42.

181. Where historical facts, themes, and research have been deliberately exempted from the scope of copyright protection to vindicate the overriding goal of encouraging contributions to recorded knowledge, the states are pre-empted from removing such material from the public domain. Hoehling v. Universal City Studios, 618 F.2d at 980 (citing Sears, Roebuck & Co. v. Stiffel Co., 376 U.S. 225 (1964) and Compco. Corp. v. Day-Brite Lighting, 376 U.S. 234 (1964)).

contrary to the intent of section 301.[182] The creation of these "vague borderline areas" would also be contrary to the general congressional intent to provide a "single Federal system" of statutory copyright protection which "would greatly improve the operation of the copyright law and would be much more effective in carrying out the basic constitutional aims of uniformity and the promotion of writing and scholarship."[183]

Thus, it appears doubtful that states could provide a property interest protection for scientific research data, because such protection fails both prongs of the preemption test: first, the rights of importance to scientists in protecting raw data are equivalent to those provided by section 106 of the Act; second, raw scientific data fall within the subject matter considered by the Act. Therefore, there is no room for nonfederal property interest in scientific research data.

CONCLUSION

A scientist conducting an experiment and gathering data is not an author of an original work in a sense relevant to copyright. It may seem anomalous that no protection is available under the copyright laws despite the ingenuity and labor expended in creating and carrying out scientific experiments, but from the point of view of copyright law, the scientific researcher is simply gathering the work of another author: nature. The 1976 Copyright Act was not designed to protect scientific data. Furthermore, the cases and secondary authorities on fact-gathering works do not indicate that the Act should be adapted to protect such data. In addition, because scientific data fit squarely into the category of expressions Congress intended to leave unprotected by copyright, the states may not extend protection to such data under the doctrine of misappropriation.

In sum, this Comment has argued that a property interest would not be the proper vehicle for protecting intangible scientific research data. However, this does not mean scientists are necessarily without recourse in asserting rights over their research results. The House Committee Report gives "invasion of personal rights" as an example of a cause of action not equivalent to copyright.[184] Conversion, trespass,

182. USCCAN, *supra* note 15, at 130.

183. *Id.* at 129.

184. USCCAN, *supra* note 15, at 132. For a discussion of the rights of scientists in the context of German law, see Engel, *Protection of Personal Rights in Scientific Discoveries*, 15 INT'L REV. INDUS. PROP. & COPYRIGHT L. 302 (1984). Engel concludes that the German copyright law is "hardly effective" for protecting "the purely factual standard staccato of scientific writings." *Id.* at 307.

misrepresentation, and breaches of contract and of trust are other examples included in the Report.[185] Other potential actions not mentioned in the Report include unfair competition and false designation of the origin of a work under the Lanham Act.[186] A District Court has even held that an action concerning trade secrets is not preempted when the material was not copyrighted.[187] Perhaps these causes of action concerning tangible and intangible property will help secure the rights of scientists in their raw data and protect the integrity of the research process without unduly restricting the free flow of scientific information.

185. USCCAN, *supra* note 15, at 132. The House Committee Report also states: "[n]othing contained in section 301 precludes the owner of a material embodiment of a copy . . . from enforcing a claim of conversion against one who takes possession of the copy . . . without consent." *Id.* at 133. *See also* United States Trotting Ass'n v. Chicago Downs Ass'n, 665 F.2d 781 (7th Cir. 1981) (recovery for the physical taking of a particular fact-document not preempted by the 1976 Copyright Act).

186. 15 U.S.C. § 1125(a) (1982) (trademark law). This section creates a federal tort for unfair competition based on "false designation of origin or other false representation used in connection with the sale of a product." Metric & Multistandard Components Co. v. Metric's Inc., 635 F.2d 710, 713 (8th Cir. 1980).

187. BPI Sys. v. Leith, 532 F. Supp. 208, 211 (W.D. Tex. 1981).

MEDICAL EXPERT SYSTEMS: GRAPPLING WITH ISSUES OF LIABILITY

BY CHRISTOPHER J. GILL †

INTRODUCTION

The British mathematician Alan Turing once addressed the question of whether machines would ever "think."[1] Mr. Turing proposed a simple exercise which has since become known as "Turing's Test."[2] The test is a type of imitation game in which a computer, a human being, and an impartial human observer are put in separate sealed rooms. Turing opined that the machine would have achieved thought when the human observer asking questions could not identify which room contained the machine and which contained the human by the answers coming from each room.[3]

Some years after Mr. Turing proffered his perceptive observation, the rapid advance of computer technology has produced human-like "thought" in machines through the use of expert system programming. Such capabilities are not new. Twenty years ago, Dr. Joseph Weizenbaum of MIT developed a computer program called ELIZA that responds in a startlingly human manner to statements made by an observer. While operating ELIZA initially required one of the largest computers then available, it currently can be run on virtually any personal computer and costs approximately twenty dollars.[4]

Although ELIZA is little more than illusion, a great number of computer systems presently provide valuable assistance in clinical decision-

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1. Turing, *Computing Machinery and Intelligence*, in COMPUTERS AND THOUGHT 11 (E. Feigenbaum & J. Feldman eds. 1981).
2. *Id.* at 9.
3. *Id.* at 11-13.
4. I. Moskatel, *Looking at Intelligence in Law Practice*, NETWORK, Vol. 4, No. 1, p. 14 (Aug. 1986).

making, mathematics, circuit design, and oil exploration. These so-called "expert" systems can ask questions, discard irrelevant information, and produce both a reasoned conclusion and a credible explanation of how that conclusion was obtained. For example, the MIT Laboratory for Computer Science has developed a program that recommends an appropriate dose of the drug digitalis based on a patient's history and symptoms.[5]

The use of expert computer systems in medicine has increased dramatically over the past ten years and several systems now perform health care functions, such as printing results of laboratory tests.[6] Indeed, a Computer Axial Tomography ("CAT") scan provides diagnoses of neural disorders and injuries. Looming on the horizon are computer programs for in-home use that will help lay people roughly to categorize or diagnose their own illnesses as well as those of their children.[7]

Such medical expert systems will present courts with unique and difficult liability questions regarding personal injuries resulting from the use of these programs by either untrained physicians or lay users. This Comment will focus on two types of medical expert systems: those designed for in-home use and those restricted to operation by a physician.

There are significant differences in the marketing of the two types of programs; hence, liability cannot be determined according to a single, universal rule. When an expert system is intended for home use, a program user who relies on a computer generated diagnosis may seek to hold the physician who developed the program, the software manufacturer, the seller, or others in the commercial stream strictly liable for distributing a defective product. On the other hand, use of a professional expert system may expose the attending physician, as well as the manufacturer, developer, and seller to liability.

This Comment suggests that strict products liability is the more effective method of assigning liability for personal injuries connected to unrestricted use of a home expert system. However, an analysis of the liability spawned by the use of a professional system must account for the service component in the relationship between an injured patient and a physician. This Comment proposes that liability for professional

5. Gorry, Pauker & Silverman, *Computing Clinical Expertise That Considers Clinical Responses to Digitalis*, 64 AM. J. MED. 452 (1978).

6. Several expert systems programs are now commercially available for use in accounting and law. These programs include "Expert Edge," which is priced at $800, produced by Human Edge Software, and "Personal Consultant" from Texas Instruments, which is in the $900 to $3,000 price range depending upon the sophistication desired.

7. *See, e.g.*, J. Rose, Thinkalong Software: First Opinion Pediatrics (unpublished software, copyright 1985).

expert systems should be contingent upon proof of professional negligence when a claim is brought against a user-physician and proof of unreasonable danger when a defective product claim is brought against a manufacturer.

I. SYNOPSIS OF MEDICAL EXPERT SYSTEMS TECHNOLOGY AND LIMITATIONS

An expert system is a computer program intended to embody the knowledge of an expert in a particular intellectual domain. The goal of an expert system project "is to write a program that achieves a high level of performance on problems that are difficult enough to require significant expertise for their solution."[8] These programs are usually long, normally upwards of 500,000 characters. Although these systems cannot perfectly mimic human reasoning, they can match human queries to machine explanations. Thus, as an indexing and reference system, medical expert systems are unsurpassed.

An expert program performs deductive reasoning using a compiled knowledge base, an inference procedure, and specific user-supplied data. The knowledge base is a collection of carefully selected logical rules reflecting the expertise of individuals working in the field. The inference procedure acts upon the specific data and the knowledge base to analyze, form hypotheses, and arrive at solutions to problems. In theory, the knowledge base is separable from the inference procedure. The knowledge base of an expert system is the portion of the program that enables a computer to simulate the reasoning function which makes these systems so potentially valuable.[9]

In the case of a medical expert system, the developer physician (or other medical authority) would enter principles into the knowledge base. These principles will be used to deduce answers to users' questions. Each rule used in such a system must take the form of an "IF-THEN" conditional. For example, a developer might construct the following principle: IF "swollen, red throat" is entered, THEN ask if donut-shaped pustules are also present. The "IF" clause defines a set of conditions such that if each is true, the statement contained in the "THEN" clause is executed.

The user-supplied data is simply information entered into the computer by the user. The computer selects relevant principles based on the

8. Feigenbaum, *Knowledge Engineering: The Applied Side of Artificial Intelligence*, 426 ANNALS N.Y. ACAD. SCI. 91, 91-92 (1984).
9. *Id.*

input, asks questions to find out any additional pertinent facts, and generates an answer.

For example, a medical expert system for use in the home might be designed to perform a triage screening of basic health problems based on a user's specific complaints. This software would place an ailment in one of three categories: (1) life-threatening emergency situations; (2) problems requiring professional evaluation; and (3) situations likely to self-resolve. The program might then present the user with a prognosis, an explanation of the categorization and suggestions as to appropriate reactions. For example, the following prognosis might appear in a nonemergency case:

> URETHRITIS- MALE, GONORRHEA
> ROUTINE PROFESSIONAL CARE
> URETHRITIS, PENIS INFECTION, CHLAMYDIA, GONORRHEA
> Medical evaluation needed in next day or so.
> * Lab work indicated.
> * Antibiotic probably required to eradicate infection.
> Burning on urination or a discharge from the penis are suspicious signs of an infection in the urethra (the tube leading from the bladder). This is especially true in a sexually active male. These symptoms need laboratory evaluation with cultures and urinalysis. See your physician in the next day or so for appropriate studies.[10]

A more extreme situation might prompt the system to offer advice such as:

> EMERGENCY SITUATION
> POSSIBLE SHOCK OR SUSTAINED LOW BLOOD PRESSURE
> Professional help must be obtained immediately.
> * Keep victim lying down; elevate feet above head.
> * Do not give anything to eat or drink.
> * Apply pressure to any bleeding area and cover all burns.
> Shock is a decrease in blood pressure below the level necessary to pump the blood to the vital organs. It can be produced by a number of situations such as blood loss,

10. J. Rose, *supra* note 7.

heart failure, infection, or allergic reaction. True shock is NOT caused by unpleasant emotional experiences.

Contact your doctor or emergency facility immediately.[11]

An excellent example of a professional system, designed to augment a physician's own personal skill and reasoning, is MYCIN, which produces diagnoses of infectious diseases, particularly blood and meningitis infections, and advises physicians on antibiotic therapies for treating those disorders.[12] When "consulting" MYCIN, a physician is asked only for patient history and laboratory test results. The program then generates a probable diagnosis based on the existence or non-existence of specified conditions and a possible plan of treatment. MYCIN's knowledge base consists of approximately 500 rules; approximately one-half deal with blood infections and one-half with meningitis infections.

MYCIN's reasoning consists of a chain of rules that concludes the presence of an infecting organism from test data and patient history. A sample piece of knowledge embodied in MYCIN is the following:

IF:
1) the infection that requires therapy is meningitis, and
2) the type of the infection is fungal, and
3) organisms were not seen on the stain of the culture, and
4) the patient is not a compromised host, and
5) the patient has been to an area that is endemic for coccidioidomycosis, and
6) the race of the patient is one of: black asian indian, and
7) the cryptococcal antigen in the csf was not positive

THEN: there is suggestive evidence that cryptoccus is not one of the organisms that might be causing the infection.[13]

The program can answer a variety of questions during or after a consultation session, including "Why are you asking for this information?" and "How was a conclusion reached?" In MYCIN, a conclusion is ordinarily stated as a measure of uncertainty based on a continuum

11. *Id.*

12. MYCIN was originally developed as the Ph.D. thesis of E. H. Shortliffe, Computer Science Department, Stanford University. It was further perfected by the Heuristic Programming Project at Stanford University. *See generally* E. SHORTLIFFE, COMPUTER-BASED MEDICAL CONSULTATIONS: MYCIN (1976).

13. Feigenbaum, *supra* note 8, at 94.

from 0.1 to 1.0, where 1.0 is a definite certainty, 0.9 is "very strong evidence," 0.6 is "suggestive evidence," and so on.

While expert systems such as MYCIN can be useful, both home and professional systems have limitations and cannot entirely supplant physicians in the identification and treatment of health problems. For example, if a patient has tested positive for cholera bacteria, MYCIN will recommend a two-week course of tetracycline. This treatment is accurate, but not complete:[14] while the antibiotic will destroy the bacteria, it will not save the patient from the fatal ravages of untreated diarrhea and other symptoms.[15] Furthermore, a program like MYCIN cannot render a prognosis concerning the effect of a treatment, nor can it answer a question about the results of a hypothetical course of treatment. Finally, to maintain its worth, a medical expert system would have to be constantly updated to reflect changes in the state of the medical arts.[16]

In short, the efficacy of medical expert systems for prescribing a course of treatment is bounded by the individual vagaries of medical cases. An expert system can only implement those principles incorporated into the system by the program developer. If a specific disorder is not correlated to the knowledge base rules, or if an individual's combination of symptoms is unique and therefore unforeseen at the time the program is created, the expert system will not respond adequately to the user's query.

Nevertheless, a properly designed medical expert system can still play a valuable role in an individual's total health care regime. Professional systems serve to cut down upon the number of physician mistakes.[17] Furthermore, an expert system developed for in-home operation should also produce tangible benefits. These programs can successfully classify routine ailments and help eliminate unnecessary trips to the family physician, especially when a disorder is minor and self-resolving. Thus, as a supplement to a regular health care program, an in-home

14. McCarthy, *Some Expert Systems Need Common Sense*, 42 ANNALS N.Y. ACAD. SCI. 19, 131 (1984).

15. Professor Edward Feigenbaum of Stanford University hinted at these constraints when he stated that heuristic knowledge "can be extracted by a careful, painstaking analysis by . . . a knowledge engineer, operating in the context of a large number of highly specific performance problems." Thus, these systems lack the ability to function in situations which, although very similar to those envisioned by the developer, are different from the program model in subtle, often crucial ways. Feigenbaum, *supra* note 8, at 101.

16. McCarthy, *supra* note 14, at 130.

17. "When MYCIN is used in its intended manner, it scores better than medical students or interns or practicing physicians and on a par with experts in bacterial diseases. . . ." *Id.*

medical expert system can help to control skyrocketing medical costs,[18] avoid unnecessary complications by identifying afflictions at an early stage, and ease uncertainty about health problems, thereby engendering significant psychological benefits.

II. COMPUTER EXPERT SYSTEMS: A PRODUCT OR A SERVICE?

In evaluating the potential liability associated with use of a medical expert system, courts must decide whether the system is a product or a service. Classification as a product means that the developer, manufacturer, and sellers may all be subject to strict liability; by contrast, characterization as a service implies a negligence standard. Since the elements necessary to establish a claim under the two standards differ dramatically,[19] resolution of this issue will have a tremendous impact upon the potential success of a user's personal injury claim.

A. Expert Systems as Products

A judicial decision to characterize the system as a product rather than a service can stem from the corporeal nature of the article itself or from overriding policy considerations. Due to their nature, "multifaceted medical computer programs do not fall neatly into either category . . . ."[20] Two general factors may be useful in reaching a rough

18. Health insurance for the elderly is just one example of the skyrocketing cost of health care in America. Government spending for Medicare has increased from $16.6 billion in 1970 to a projected $63.8 billion in 1986. Total U.S. expenditures on health care have increased from $180.4 billion in 1970 to an estimated $400.6 billion in 1986. The trend toward increasing medical costs has greatly accelerated over the years. During the decade 1970 to 1980, total U.S. outlays on health care rose by $108.4 billion. In the six years since 1980, health care expenditures have already increased by $111.8 billion (all figures are in 1982 dollars). Brooks, *Health Insurance for the Elderly,* San Francisco Chron., Nov. 3, 1986, at 15, col. 1. Another indication of the severity of the inflationary spiral in medical costs is that over the past five years, hospital room charges have increased by 70 percent. *Hospital Costs Most Expensive in California,* San Francisco Chron., Nov. 5, 1986, at 17, col. 2.

19. W. PROSSER & P. KEETON, HANDBOOK OF THE LAW OF TORTS § 103, at 712-13 (5th ed. 1985) (distinguishing negligence from products liability where a plaintiff must show a breach of warranty or an unreasonably dangerous condition).

20. Brannigan & Dayhoff, *Liability for Personal Injuries Caused by Defective Medical Computer Programs,* 7 AM. J. L. & MED., 123, 130 (1981). Classifying a medical expert system as either a product or a service is seldom simple or straightforward. Computer software is sometimes classified as a "good." RRX Indus. v. Lab-Con Inc., 772 F.2d 543, 546 (9th Cir. 1985) (computer software a "good" within Cal. Com. Code § 2-105, a label normally reserved for tangible personal property-like products; Note, *Computer Programs as Goods Under the U.C.C.,* 77 MICH. L. REV. 1149 (1978) (stating that while it is logical to consider a computer program as a "good" under U.C.C. § 2-105(1), the sale of the program must be primarily a transaction in goods). In contrast, California specifically classifies custom computer software as a service for purposes of the state

determination about whether an article is a product or service: (1) the tangible form of a product; and (2) the ownership potential of a product.[21] Even though these factors may be useful to some extent, in the final analysis, policy considerations will dictate whether a court applies strict products liability doctrine to either type of medical expert system.[22]

1. The Tangible Form of a Product

As a general observation, most products, such as automobiles or bicycles, are visible items subject to sensory perception. In contrast, services usually have no corporeal existence apart from their visible effects upon other objects.[23] Nonetheless, many services produce a tangible end-product, as where an attorney prepares a legal brief or a writer composes a manuscript. At this level, the distinction between products and services blurs; classification must hinge upon more than simple physical characteristics.[24] A medical expert system is tangible in nature, yet it is also the end result of the developer's services; it lies in that gray area where product and service merge.

Accordingly, the importance of the tangible form of an expert system varies according to the type of system and the circumstances. Although a program developed for professional use is clearly tangible, its corporeal qualities are only apparent to the physician who uses the program and are not perceived or encountered by the patient. In other

sales and use taxes. CAL. REV. & TAX. CODE § 6010.9 (West Supp. 1987); General Business Sys. v. State Bd. of Equalization, 162 Cal. App. 3d 50, 208 Cal. Rptr. 374 (1984) (affirming refund of sales tax charged taxpayer on the transfer of custom computer programs delivered on punch cards).

21. Brannigan & Dayhoff, *supra* note 20, at 130-31.

22. *Id.* at 130, 132.

23. *Id.*

24. Furthermore, there is no legal rule or precedent which restricts the definition of products to articles of physical substance. A number of recent decisions have addressed the issue of whether a public utility should be held strictly liable for injury caused by "defective" electrical current. *E.g.* Ransome v. Wisconsin Elec. Power Co., 87 Wis. 2d 605, 620, 275 N.W.2d 641, 648 (1979) (reversed dismissal of complaint stating there can be recovery in a strict liability action for defective electricity). Because electricity is a form of energy, it possesses no concrete aspect beyond its effects. Nevertheless, when confronted with strict liability claims connected to the provision of electrical power, courts have treated electricity as a product. Even courts which have refused recovery have not questioned the status of electricity as a product. *E.g.*, Genaust v. Illinois Power Co., 62 Ill. 2d 456, 463, 343 N.E.2d 465, 469 (1976) (assumed *arguendo* that electricity was a product); Petroski v. Northern Ind. Pub. Serv. Co., 171 Ind. App. 14, 30-31, 354 N.E.2d 736, 747 (1976) (no transfer to would-be consumer); Erwin v. Guadalupe Valley Elec. Co-op, 505 S.W.2d 353, 355 (Tex. Civ. App. 1974) (placement of transmission line was not design or assembly or manufacture of product, but placement of product). Thus, while tangibility may be useful as a rough description of a product, it is not necessary for the application of a rule of strict liability.

words, the intended use of a professional system is slightly different from that of in-home programs in a way that makes the tangibility factor less pertinent. This distinction may make a court less willing to classify an expert system employed by a medical practitioner as a tangible product.

2. Ownership Potential of a Product

Ownership is a second criterion by which to distinguish a product from a service: one of the hallmarks of a product is its capacity to be possessed. The ability to purchase and own a medical expert system indicates that this software resembles a product more than a service.[25] Once such a program becomes an article of commerce, its ownership potential is indistinguishable from that of items normally conceived of as products, such as automobiles or bicycles.[26]

Like tangibility, the ownership factor is much less relevant in the case of medical expert systems which are designed for use by medical practitioners and not the general public. These medical expert systems are undoubtedly subject to ownership, but not by the injured claimant. Injuries resulting from a physician's use of an expert system will not flow from the plaintiff's own direct manipulation of the software, as in the instance of a program intended for in-home use. Thus, professional expert systems are less likely to be classified as products for purposes of strict liability.

B. Expert Systems as Providers of Professional Health Services

In light of the two factors discussed above, medical expert systems might be described as products; however, the functions performed by such programs are normally characterized as the provision of services.

1. The Practice of Medicine By a Medical Expert System

Medical expert system programs are designed and constructed to augment traditional physician services. Thus, one of the more persuasive arguments in favor of categorizing an expert system as a service is that these programs practice medicine. Although the phrase "the practice of medicine" is not explicitly defined by statute, states have enacted statutes that regulate the practice of medicine within the state. For example, the California Business & Professions Code provides an adequate definition[27] of the practice of medicine:

25. *Id.* at 132.
26. Brannigan & Dayhoff, *supra* note 20, at 132.
27. Stevenson v. State Bd. of Medical Examiners, 10 Cal. App. 3d 433, 438, 88 Cal.

> [t]he physician and surgeon's certificate authorizes the holder to use drugs or devices in or upon human beings and to sever or penetrate the tissues of human beings and to use any and all other methods in the treatment of diseases, injuries, deformities, and other physical and mental conditions.[28]

California courts have further refined this description by enumerating the constituent parts of the practice of medicine: diagnosing, prescribing, and treating ailments.[29]

A medical expert system that categorizes a user's symptoms approximates the diagnostic element of the practice of medicine under California law. "Diagnosis" is defined to "include any undertaking by any method, device or procedure whatsoever, and whether gratuitous or not, to ascertain or establish whether a person is suffering from any physical or mental disorder."[30] Diagnosis extends to the taking of a person's blood pressure and the use of any mechanical devices or machines for the purpose of representing to any person a conclusion with respect to a physical, mental, or nervous condition.[31] Thus the established legal meaning of the term "diagnosis"—the recognition of disease from symptoms—extends to the function of a detailed medical expert system.[32]

However, several considerations may place medical expert software outside the realm of practicing medicine. First, the California Business and Professions Code plainly contemplates diagnosis with the aid of mechanical devices, rather than diagnosis by the device itself.[33] Second, in-home medical expert systems do not prescribe for and treat illnesses. A home medical program merely categorizes complaints into general determinations. A program would not prescribe any specific steps to alleviate the problem, nor would it suggest any particular steps to effect a cure. Rather, prescription and treatment would clearly be left to the physician or surgeon to whom the user is directed. The category of self-resolving advice is arguably a form of treatment and prescription;

Rptr. 815, 816 (1970).

28. CAL. BUS. & PROF. CODE § 2051 (West Supp. 1986).

29. *See* People v. Cantor, 198 Cal. App. 2d Supp. 843, 848, 18 Cal. Rptr. 363, 366 (1961) (use of hypnosis to lose weight constituted practice without license where cure was promised); *see also* 66 Ops. Cal. Atty. Gen. 427, 433 (1983) (registered nurse can inject or infuse a patient with "contrast/opaque" materials used for *diagnostic* studies so long as physician is within proximity of patient so physician can respond should adverse effects occur).

30. CAL. BUS. & PROF. CODE § 2038 (West Supp. 1987).

31. *Id.*

32. *Cantor*, 198 Cal. App. 2d Supp. at 847, 18 Cal. Rptr. at 365.

33. CAL. BUS. & PROF. CODE § 2038 (West Supp. 1987) (defining "diagnose" or "diagnosis" to include the "use of mechanical devices or machines for the purpose of making a diagnosis").

however, because the program would warn a user of the system's limitations and advise seeking professional help if a problem persists, any course of treatment would ultimately be decided upon by the user.

Conversely, a program designed to be used by a physician attempts a more precise identification of a patient's condition and suggests the exact procedures or drugs that will eliminate an affliction; thus, the use of such a program is much more likely to constitute the practice of medicine under appropriate statutes. Indeed, a system like MYCIN is designed to aid a physician in the identification and possible treatment of disease. While the program itself does not physically examine and treat a patient, it is intended to be an integral part of the using physician's examination of the patient. In the hands of a physician, the expert system is but another tool of the physician's practice; the system itself does not practice medicine.

On the other hand, an in-home medical expert system that attempts to achieve the sophistication of MYCIN may be incorrectly viewed by a non-physician as a replacement for traditional medical services. As a matter of policy, a court may well wish to discourage the proliferation of these technical systems for use in the homes of untrained, unsophisticated purchasers. By holding the developers of this latter type of system liable under a medical malpractice theory, the evolution of such expert systems for private applications could be discouraged. Thus, courts may be more willing to classify technically sophisticated in-home systems which attempt specific diagnosis and prescription as services.

2. *Computer Programs as "Processes" Instead of Products*

Another argument that a computer program should be classified as a service, and hence governed by a negligence standard, is founded upon the nature of computer programming. Although software can be produced on a mass scale, the fabrication of individualized programs is also perfectly feasible. The capacity to program each computer system individually, when added to the intangible quality of internal program impulses, prompted one noted author to conclude that a computer program should not be considered a product.[34] According to this theory, computer software constitutes a process that is no more a product than is an industrial manufacturing process.[35]

This reasoning has little relevance in the case of computer software which is sold on a mass scale and which is not individually tailored for the particular needs and equipment of each user. The electrical nature

34. Freed, *Products Liability in the Computer Age*, 12 FORUM 461, 478 (1977).
35. *Id.* at 473-76.

of internal computer operation is not a sufficient reason to classify the program itself as a service or process. Software directs a computer hardware system to respond in a particular manner— the internal electrical impulses are the language by which this guidance is accomplished. Many other products have value largely as a result of an intangible effect that they produce. Medical expert systems cannot be classified neatly as either products or services. Rather, an analysis of these systems requires looking at how they combine features of both classifications.

C. "Hybrid" Cases: Transactions Involving Both a Product and a Service

In a number of instances, particularly in the medical field, a transaction encompasses more than the mere provision of a service or the transmittal of a product. Many situations involve the rendering of a service which in some manner includes the use or transfer of a product— a hybrid transaction. These situations can produce one of two injury-causing events: the use of a defective product during the provision of a service; or the improper use of an otherwise safe article. Medical expert systems involve hybrid transactions.[36]

The distinction between the service element and the product element of a hybrid transaction is often troublesome.[37] A medical expert system that is intended for general use in the home does not suffer from this complexity. Professional services are clearly rendered at an early stage in the compilation and programming of the system knowledge base; however, once the program is reproduced for mass distribution, the service element of the production process is no longer an integral part of a purchaser's manipulation of the software. The manufacturing of this type of product is identical to the production of a variety of products wherein a service generates the final commercial article, such as the designing of an automobile or the writing of a book. Although much work goes into manufacturing a given material good, once a good is complete it becomes a "product" in the legal sense.

By contrast, when a physician uses a medical expert system the product is inseparable from the service transaction. Because the

36. Not surprisingly, many courts have applied strict liability in tort to hybrid situations. *See, e.g.*, O'Laughlin v. Minnesota Natural Gas Co., 253 N.W.2d 826 (Minn. 1977) (strict liability adopted for installation defects). *But see*, Hoover v. Montgomery Ward & Co., 270 Or. 498, 528 P.2d 76 (1974) (refused to apply strict liability to installation situation).

37. *See* W. PROSSER & P. KEETON, *supra* note 19, §104 at 720. The contrary positions adopted by Minnesota and Oregon with respect to strict liability for installation services illustrates these difficulties. *See supra* note 36.

physician is using a product to provide a service, the hybrid situation cannot be analyzed readily under either strict liability or negligence principles. Some courts have applied strict liability standards, while others have applied negligence standards. Thus, categorizing a transaction as a hybrid, rather than as a simple product or service, leaves the standard of liability undetermined.

Courts have generally examined three elements in determining whether to hold an individual who uses a defective product in the provision of a service strictly liable. These considerations are: (1) the nature of the activity; (2) whether the defective product was actually conveyed or merely used in providing a service; and (3) whether the service or the product was the primary focus of the bargain.[38] Judicial interpretations of these factors, combined with certain policy aims, outline a workable framework in which to apportion liability for the professional use of a medical expert system.

A physician's use of a medical expert system can give rise to two possible sources of injury and two potential theories of recovery. A patient injured by a medical expert system can claim that the physician used a defective computer program during the course of treatment. The crux of this claim is that the product was flawed. However, this type of claim is less likely to result in the imposition of strict liability. For example, in *Magrine v. Krasnica*,[39] a court refused to apply strict liability where injuries were caused by a dentist's use of a defective hypodermic needle which broke during treatment. In that case, both parties conceded that the breakage was due to a latent defect in the needle itself, and not to the dentist's negligence.[40]

The court stressed that the dentist was in no better position than the plaintiff to control, inspect, and discover the hidden defect in the hypodermic needle that was purchased from a manufacturer,[41] and that the transaction was essentially one for professional services predicated on the relationship between the dentist and his patient.[42] The dentist's job was not to sell the needle, but to treat patients.

An alternative cause of action for a patient injured by a physician's use of a professional expert system would be that, even though the

38. *Id.*

39. 94 N.J. Super. 228, 227 A.2d 539 (1967), *aff'd sub nom.*, Magrine v. Spector, 100 N.J. Super. 223, 241 A.2d 637 (1968), *aff'd* 53 N.J. 259, 250 A.2d 129 (1969).

40. *Magrine*, 94 N.J. Super. at 230, 227 A.2d at 540.

41. 94 N.J. Super. at 234, 227 A.2d at 543. The court did not rule on the strict liability of the needle manufacturer because plaintiff had not pursued such a claim. 94 N.J. Super. at 240, 227 A.2d at 546.

42. *Id.* at 235-38, 227 A.2d at 543-45; *see also*, Carmichael v. Reitz, 17 Cal. App. 3d 958, 978-79, 95 Cal. Rptr. 381, 392-93 (1971).

program itself was not defective, the physician used it improperly or negligently. The focus of this second cause of action would be that the professional service itself, and not the product used, was somehow inadequate. For example, in *Barbee v. Rogers*,[43] the petitioner sought damages for eye injuries caused by the improper fitting of contact lenses. The defendants were two optometrists who operated eighty-four offices throughout the state of Texas.[44] The court recognized that the defendants' activities fell between those ordinarily associated with the practice of a profession and those characteristic of a merchandising concern.[45] In spite of the retail facet present in defendants' enterprise, the court held the rule of strict liability inappropriate because the injury was not attributable to the product itself, but instead was connected to the improper fitting of the lenses —a professional service.[46]

The focal point of the court's decision in *Barbee* was that the plaintiff did not prove that the contact lenses themselves were somehow flawed.[47] Rather, the thrust of the plaintiff's complaint was that the contact lenses he purchased from the defendants were incorrectly fitted to his eyes.[48] Consequently, the plaintiff did not demonstrate that the defendants had manufactured or sold a defective product.[49] Thus, courts faced with the problem of assigning liability for negligence in the provision of professional services have applied ordinary malpractice standards and not the standard of strict liability. A claim that an expert medical system was improperly used or relied upon by a physician in diagnosing a patient should also be governed by negligence standards.

One could argue that strict liability is appropriate in expert system cases because a physician who uses an expert system will probably be in a better position than his or her patient to detect and compensate for any flaws in the program.[50] These defects may be latent in the sense that they are not discoverable until the physician guides the computer into the specific area in which the "bug" is located; however, once the doctor inputs the information necessary to enter the flawed part of the program, the physician should be able to discern a program response that does not coincide with the physician's own medical knowledge and

43. 425 S.W.2d 342 (Tex. 1968).

44. *Id.* at 344-45.

45. *Id.* at 345-46.

46. *Id.* at 346.

47. "The miscarriage, as such there was, rests in the professional acts of respondents and not in the commodity they prescribed, fitted and sold." *Id.*

48. *Id.* at 343-44.

49. Plaintiff incorrectly assumed that the defendants were also the manufacturers of the lenses. *Id.* at 344.

50. *But cf., Magrine*, 94 N.J. Super. 228, 227 A.2d 539 (court determined that dentist was not in a better position). *See supra* note 39.

expertise. This distinction seems to support the imposition of strict liability upon a physician who uses an expert system because a defect may be detected before an injury occurs.

Nevertheless, the best standard of liability for a physician's use of a defective expert system is professional negligence. A defect in a medical expert system will not immediately produce an injury. The harm in such a case will result only when the physician fails to realize that the program's diagnosis or suggested treatment is inaccurate and proceeds to implement the system's plan of action. Such behavior can be deemed negligent since a physician who reaches an incorrect diagnosis or prescribes an improper course of treatment is normally liable for medical malpractice if such conduct falls below the customary standard of care in the profession.[51] The bare fact that the physician relies upon a medical expert system in arriving at the wrong conclusions—rather than making an error based on personal knowledge—should not convert what would be liability for negligence into strict liability.

Other policy considerations indicate that holding a physician strictly liable for the use of a medical expert system may not be warranted. A physician who uses a medical expert system does not inject the program into the commercial marketplace.[52] Furthermore, the essence of the bargain for which a medical patient contracts is the physician's professional services, and not the use of an expert system. A physician who employs expert system software will not normally possess sufficient assets, nor will he or she be able to spread the costs of a risk over a large enough group, to support a policy of risk distribution.[53] Finally, forcing a physician to internalize higher costs under a strict liability standard will contribute to an increase in medical expenses that may be unwarranted, especially in light of the existing incentives to discover and correct defects provided by a negligence standard.

Several courts have summarized the reasons why strict liability should not be extended to cover the rendering of defective health care services. In *Carmichael v. Reitz*,[54] a patient initiated a strict liability action for injuries sustained as the result of ingesting a drug prescribed by the defendant physician. As in *Barbee*, the claimant did not argue that the drug was flawed, but contended that the doctor had prescribed an inappropriate medication under the circumstances. In rejecting the

51. *See generally* D. LOUISELL & H. WILLIAMS, MEDICAL MALPRACTICE § 4.02 (poor results in practice), § 8.04 (requirement of reasonable skill and care) (1986).

52. *Magrine*, 94 N.J. Super. at 235-38, 227 A.2d at 543-45. *See also, supra* note 42 and accompanying text.

53. *See, e.g.*, Greenberg v. Michael Reese Hosp., 83 Ill.2d 282, 415 N.E.2d 390 (1980) (discusses economics of risk distribution in context of physician's use of X-rays).

54. 17 Cal. App. 3d 958, 95 Cal. Rptr. 381 (1971).

plaintiffs' claim of strict liability, the court relied on the continuing validity of a distinction between a transaction in which the primary objective is the provision of a service, and one in which the principal purpose is to acquire ownership of a product.[55]

Moreover, the *Carmichael* court emphasized that the provision of a defective medical service did not comply with the requirements of strict liability as enunciated in section 402A of the Second Restatement.[56] The court noted that the Restatement formulation only applies to a seller of an injury-causing product who is regularly engaged in the business of selling that item.[57] The court concluded that a physician treating or diagnosing a patient is selling his or her services as a healer of illness, and uses a product such as a drug only as an aid in achieving a cure.[58] Thus, liability was contingent upon proof of professional negligence.

Likewise, the Wisconsin Supreme Court ruled, in *Hoven v. Kelble*,[59] that the doctrine of strict liability does not apply to the rendition of professional health care services. There, a husband and wife sought damages for injuries incurred while the husband underwent a lung biopsy. One of the theories upon which the plaintiffs sought to hold the hospital, surgeon, and anesthesiologist liable was strict liability for the provision of defective medical services. The court rejected plaintiffs' contention that recovery should be allowed if a hypothetical and perfectly informed physician working in a perfect environment could have avoided the injurious result.[60]

The court observed that adoption of strict liability with respect to professional medical services would establish a standard of performance at the zenith of the profession's achievement, a level virtually impossible to sustain.[61] Moreover, a variety of policy concerns created substantial differences between the sale of a good and the rendition of health care services. These circumstances include the concern that medical services

55. *Id.* at 978, 95 Cal. Rptr. at 392.

56.

> (1) One who sells any product in a defective condition unreasonably dangerous to the user or consumer or to his property is subject to liability for physical harm thereby caused to the ultimate user or consumer, or to his property, if (a) the seller is engaged in the business of selling such a product, and (b) it is expected to and does reach the user or consumer without substantial change in the condition in which it is sold. (2) The rule stated in Subsection (1) applies although (a) the seller has exercised all possible care in the preparation and sale of his product, and (b) the user or consumer has not bought the product from or entered into any contractual relationship with the seller.

RESTATEMENT (SECOND) OF TORTS § 402A (1965).

57. 17 Cal. App. 3d at 979, 95 Cal. Rptr. at 393.

58. *Id.*

59. 79 Wis. 2d 444, 256 N.W.2d 379 (1977).

60. *Id.* at 460, 472, 256 N.W.2d at 387, 393.

61. *Id.* at 460, 256 N.W.2d at 387.

are often experimental and uncertain, the fact that medical services are absolutely indispensable to society, the potential that medical costs would dramatically increase with the imposition of strict liability, and the fear that strict liability would hamper the development of new medicines and medical techniques.[62]

The foregoing decisions indicate that a physician should not be held strictly liable either for the proper use of a defective program or the improper use of a program. When a patient visits a physician the basis of the relationship is the skill of the doctor in treating afflictions; the crux of the transaction is the performance of a service. A physician who uses a medical device is not a merchant engaged primarily in the sale of that item. This undermines the requirement that the seller be engaged in the business of marketing these products for strict liability to apply.

Even though a physician who uses a medical expert system should not be held strictly liable at any stage, a health care practitioner is still subject to liability for negligence. Furthermore, the rejection of strict liability with respect to a physician who uses a medical expert system does not necessarily mean that strict liability is wholly inappropriate in the professional use of such a program. If a claimant asserts that a program is defective, the manufacturer and others in the chain of distribution can still be held strictly liable for the sale of an unreasonably dangerous product.

III. STRICT PRODUCTS LIABILITY FOR MEDICAL EXPERT SYSTEMS

Based on the analysis of whether medical expert systems are products or services, this Comment has argued that the manufacturer of either an in-home or a professional medical expert system should be subject to strict product liability for personal injuries caused by a defective program. However, it is inappropriate to hold a professional health care provider strictly liable for the use of a defective medical expert system. The proper vehicle for assigning physician liability for the improper or negligent use of a medical implement is ordinary professional negligence doctrine.[63]

In a strict liability action, the injured plaintiff does not directly attack a manufacturer's conduct, but instead impugns the quality of the product itself.[64] According to the Restatement, a manufacturer or seller is strictly liable for any injuries caused by a product that is flawed in a

62. *Id.* at 469-70, 256 N.W.2d at 391.
63. *See infra,* notes 132-41 and accompanying text.
64. W. PROSSER & P. KEETON, *supra* note 19, § 99 at 695.

manner that makes it unreasonably dangerous.[65] Thus, the crux of a strict product liability claim is whether a particular characteristic or feature of a product creates undue consumer peril. In the next section, this Comment will examine the proper application of these standards.

While the Restatement formulation remains the authoritative definition of strict liability, jurisdictions disagree about the burden of proof that it imposes upon a plaintiff. For example, in *Dippel v. Sciano*[66] the Wisconsin Supreme Court required the plaintiff to prove the existence of both a product defect and unreasonable danger: "[f]rom a reading of the plain language of the rule, the plaintiff must prove 1) that the product was in defective condition when it left the possession or control of the seller,[and] 2) that it was unreasonably dangerous to the user or consumer . . . ."[67] Not surprisingly, those jurisdictions that require proof of both a defect and unreasonable danger have done so to limit the liability of manufacturers and others in the chain of distribution.[68]

By contrast, in *Cronin v. J.B.E. Olsen Corp.*,[69] the California Supreme Court rejected a literal reading of the Restatement because it would "require the finder of fact to conclude that the product is, first, defective, and, second, unreasonably dangerous."[70] The court believed that such a reading was contrary to the aim of compensating injured consumers because it placed a heavy burden upon plaintiffs and was therefore inimical to the spirit of strict liability doctrine.[71] As a result, the court required proof of a product defect only.

Product defects fall into three major categories: (1) a flaw in the product that was present at the time of sale (i.e., manufacturing defect); (2) an error in product conceptualization or design; and (3) a failure by the producer or assembler of a product to adequately warn of a hazard related to a product's design.[72]

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65. RESTATEMENT (SECOND) OF TORTS § 402A comment i (1965).

66. 37 Wis.2d 443, 155 N.W.2d 55 (1967).

67. *Id.* at 460, 155 N.W.2d at 63.

68. *See, Dippel*, 37 Wis. 2d at 460, 155 N.W.2d at 63-64; Byrns v. Riddell, Inc., 113 Ariz. 264, 267, 550 P.2d 1065, 1068 (1976).

69. 8 Cal.3d 121, 501 P.2d 1153, 104 Cal. Rptr. 433 (1972).

70. *Id.* at 133, 501 P.2d at 1162, 104 Cal. Rptr. at 442.

71. *Id. See also* CAL. JURY INSTRUCTIONS: CIVIL § 9.00, at 288-89 (1977 Revision). Numerous other jurisdictions that have faced the question of both defective condition and unreasonable danger have followed the California lead and have opted for a single element approach. *See* Butaud v. Suburban Marine & Sporting Goods, Inc., 543 P.2d 209 (Alaska 1975); Seattle-First Nat'l Bank v. Tabert, 86 Wash. 2d 145, 542 P.2d 774 (1975); Suter v. San Angelo Foundry & Mach. Co., 81 N.J. 150, 406 A.2d 140 (1979); Morningstar v. Black & Decker Mfg. Co., 162 W. Va. 857, 253 S.E.2d 666 (1979); N.Y. PATTERN JURY INSTRUCTIONS SUPP. 2:141, at 109 (1979).

72. W. PROSSER & P. KEETON, *supra* note 19, § 99 at 695.

A. Stages of Development: Manufacturing versus Design Defects

Classification of a product flaw as either a manufacturing or a design defect may have a significant impact upon the quantum of proof demanded of a plaintiff. If a defect is introduced during the purely mechanical task of reproducing the finished product for commercial distribution, the defect is one of manufacture and an injured user need only prove that the defect exists.[73] On the other hand, if a manufacturer committed an error in conceptualizing or designing the article, a plaintiff will have to prove both the existence of the alleged defect *and* that the manufacturer had a viable alternative to the chosen design.[74] This additional burden is often factually complicated and can determine a plaintiff's chances for success.

Thus, the initial problem is distinguishing design defects from manufacturing defects. The creation of a computer program design or concept is theoretically distinguishable from the coding of the program in an appropriate programming language and the implementation of the program in an appropriate medium. As a practical matter, however, the processes involved in most software development are not so neatly distinguishable.

Software development involves a lengthy period of "debugging," which is the location and elimination of operational flaws. The removal of all syntax errors from a computer program is a difficult, if not impossible, endeavor. Original program mistakes may become apparent only under a unique set of circumstances. Adjustments may introduce new flaws or reveal previously existing errors, especially if these modifications are not performed by the developer.[75] In other words, the debugging process may alter the ultimate program design, and is therefore not solely a manufacturing process.

This blending of activities "create[s] a continuum that begins with the abstract conceptualization of a program and moves to the mechanical task of reproducing the program for distribution."[76] The mechanical stage of coding and reproducing a medical expert program is clearly manufacturing and therefore warrants application of a stricter standard of liability; the abstract conceptualization phase is design work and

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73. *See infra* notes 103-14 and accompanying text.

74. *See infra* notes 86-102 and accompanying text; *see also* Volkswagen of Am., Inc. v. Young, 2722 Md. 201, 321 A.2d 737 (1974).

75. *See generally* R. NIMMER, THE LAW OF COMPUTER TECHNOLOGY § 7.05[2] at 7-20 (1985).

76. *Id.* § 7.06(2)(b) at 7-28 (1985).

requires a weighing of alternative designs. The status of the intermediate stages, particularly the debugging process, is much less certain.

For policy reasons, debugging should be considered a part of the design phase of software development. Debugging is closely analogous to the safety and efficiency testing performed by automobile manufacturers before their products reach the market. As in the case of automobile testing, the ultimate design of a computer program is not determined until the software has been tested under a variety of conditions and environments. Consequently, the design of a computer program is subject to alteration through the debugging process up until the time of actual sale to a consumer. Thus, liability for manufacturing defects should be limited to the final, packaged product sold to users.[77]

B. Product Liability for Design Defects

Liability for design defects mandates some inquiry into the choices made by the manufacturer developing the product. Consequently, in the instance of a defective design, the determination often becomes extremely complex. The courts have generally taken two approaches in defining design flaws: a consumer-expectation test and a risk-utility model.[78] Most jurisdictions that retain the consumer-expectation test use it in conjunction with the risk-utility model.[79]

1. *The Consumer Expectation Test*

Under the consumer-expectation test, a product is flawed in design if it fails to live up to reasonable consumer expectations with respect to safety, based on the knowledge common to the community as to the product's features.[80] For a host of reasons this test alone is inadequate for evaluating the dangerousness of a particular design.[81] An injured

77. Brannigan & Dayhoff, *supra* note 20 at 137 (1981); R. NIMMER, *supra* note 75, at § 7.06(2)(b).

78. W. PROSSER & P. KEETON, *supra* note 19, § 99 at 698-99.

79. *See, e.g.*, Barker v. Lull Eng'g Co., 20 Cal. 3d 413, 432, 573 P.2d 443, 455-56, 143 Cal. Rptr. 225, 237-38 (1978); Suter v. San Angelo Foundry & Mach. Co., 81 N.J. 150, 170-72, 406 A.2d 140, 150-51 (1979); Cremeans v. International Harvester Co., 6 Ohio St. 3d 232, 234, 452 N.E.2d 1281, 1284 (1983).

80. RESTATEMENT (SECOND) OF TORTS § 402A comment i; *see, e.g.*, Greenman v. Yuba Power Prods., 59 Cal. 2d 57, 64, 377 P.2d 897, 901, 27 Cal. Rptr. 697, 701 (1963) (Traynor, J.).

81. The consumer expectation test has been roundly criticized as too uncertain to regulate manufacturer conduct because, among other things, a manufacturer can manipulate consumer attitudes about safety through a media campaign that describes, limits, or modifies a product's purposes or capabilities. The California Supreme Court expressed this concern in *Barker v. Lull Eng. Co.*, 20 Cal. 3d 413, 430, 573 P.2d 443, 454, 143 Cal. Rptr. 225, 236 (1978); *see also* Keeton, *Product Liability and the Meaning of Defect*, 5 ST. MARY'S L.J. 30, 37-38 (1973).

user can never recover for harm inflicted by an open or obvious hazard or risk of which the user was, or should have been, fully aware.

In addition, and more importantly for technological advances such as medical expert systems, the consumer expectation test can compel classification of a product as unreasonably dangerous even though it may not be so in actual fact.[82] For example, the development of a new drug that would be a "great boon to humanity" may be crushed under a landslide of liability due to a side effect or adverse reaction which amounts to an unforeseeable risk.[83] It is probable that the consumer-expectation test will produce just such an effect upon medical expert systems since the technology is new and has not been tested by the marketplace. Consumer hopes in regard to a new computer technology cannot be grounded upon concrete experience and therefore should not be incorporated into the legal standard for strict liability.

Another shortcoming of the consumer-expectation test is the difficulty of developing a more specific definition of reasonable consumer expectations.[84] "In a sense the ordinary purchaser cannot reasonably expect anything more than that reasonable care in the exercise of the skill and knowledge available to design engineers has been exercised."[85] In other words, consumer expectations are not sufficiently refined to identify specific product strengths and weaknesses. This problem is exacerbated in the technologically innovative computer industry because the average consumer has little familiarity with computer programming and therefore cannot identify precisely which step caused an injury. Thus, in demonstrating that a particular product feature or characteristic produced an injury, the consumer-expectation test may often be of little practical import.

2. *The Risk-Utility Model*

The pitfalls of indiscriminate use of the consumer expectation test prompted numerous courts to supplement that test with the risk-utility model.[86] According to the risk-utility model, a product is defective as

82. *See* General Motors Corp. v. Simmons, 545 S.W.2d 502 (Tex. Civ. App.), *rev'd on other grounds*, 558 S.W.2d 855 (Tex. 1977).

83. W. PROSSER & P. KEETON, *supra* note 19, § 99.

84. *See* Hubbard, *Reasonable Human Expectations: A Normative Model for Imposing Strict Liability for Defective Products*, 29 MERCER L. REV. 465, 478 (1978); Montgomery & Owen, *Reflections on the Theory and Administration of Strict Tort Liability for Defective Products*, 27 S.C. L. REV. 803, 823 (1976).

85. W. PROSSER & P. KEETON, *supra* note 19, § 99 at 699.

86. *See, e.g.*, Barker Eng'g Co. v. Lull, 20 Cal. 3d 413, 432, 573 P.2d 443, 456, 143 Cal. Rptr. 225, 238 (1978). In the wake of this California Supreme Court decision, the jury instruction committee in California composed a definition of defective design that encompasses both a consumer expectation and risk-utility analysis. The definition provides that a product is defective in design "unless the benefits of the design of the pro-

designed if the magnitude of this risk of danger outweighs the utility of the product.[87] Therefore, in its widely accepted form, the risk-utility model asks whether "on balance, the benefits of the challenged design outweigh the risk of danger inherent in such design."[88] Despite the apparent simplicity of the model, the process of balancing a product's risks against its utility can become very complicated.[89]

Application of this standard requires a consideration of the current state of the pertinent technology, the comparative costs and feasibility of alternative designs,[90] and the extent to which the questioned design choice pertains to the characteristics that made the product a commercial success.[91] Some additional common elements in the risk-utility balancing include the usefulness of the product, the availability of substitutes, and the consumer's ability to guard against a product's hazards.[92]

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duct as a whole outweigh the risk of danger inherent in the design" or "if the product failed to perform as safely as an ordinary consumer of the product would expect when used in a manner reasonably foreseeable by the defendant(s)." In determining whether the benefits outweigh the risks under the definition, one may consider, among other things, "the gravity of the danger posed by the design and the likelihood that such danger would cause damage, the mechanical feasibility of a safer alternate design at the time of manufacture, the financial cost of an improved design, and the adverse consequences to the product and the consumer that would result from an alternate design." CAL. JURY INSTRUCTIONS: CIVIL § 9.00.5 (West Supp. 1981).

87. Raney v. Honeywell, Inc., 540 F.2d 932, 935 (8th Cir. 1976); Turner v. General Motors Corp., 584 S.W.2d 844, 847 (Tex. 1979).

88. *Barker*, at 432, 573 P.2d at 456, 143 Cal. Rptr. at 238.

89. The risk-utility calculation encompasses a number of additional elements that are summarized in the Model Uniform Product Liability Act. "In order to determine that the product was unreasonably unsafe in design, the trier of fact must find that . . . the likelihood that the product would cause the claimant's harm . . . and the seriousness of those harms outweighed the burden on the manufacturer to design a product that would have prevented those harms [as well as] the adverse effect that alternative design would have on the usefulness of the product." UNIF. PRODUCT LIABILITY ACT § 104(b)(1), 44 Fed. Reg. 62,714, 62,721 (1979). *See also* Caterpillar Tractor Co. v. Beck, 624 P.2d 790, 791 (Alaska 1981).

90. The New Jersey Supreme Court, in the case of *O'Brien v. Muskin Corp.*, 94 N.J. 169, 184-85, 463, A.2d 298, 306 (1983), has apparently abandoned the requirement that the availability of alternative designs must be considered when weighing the risks and utility of a given product. The claim in *O'Brien* was that a swimming pool lining was too slippery for safe use. This extension of the goal of compensating injured victims has been persuasively criticized. *See* Note, *Strict Products Liability and the Risk-Utility Test for Design Defect: An Economic Analysis*, 84 COLUM. L. REV. 2045 (1984). Indeed most jurisdictions still require a plaintiff to prove the viability of alternative designs. *See* Wilson v. Piper Aircraft Corp., 282 Or. 61, 66-71, 577 P.2d 1322, 1326-27 (1978); Kerns v. Engelke, 76 Ill. 2d 154, 161-64, 390 N.E.2d 859, 863-64 (1979).

91. *See* Dreisonstok v. Volkswagenwerk, A.G., 489 F.2d 1066 (4th Cir. 1974).

92. A number of factors employed in risk-utility analysis were identified by Dean Wade. Wade, *On the Nature of Strict Tort Liability for Products*, 44 MISS. L.J. 825, 837-38 (1973).

The case of *Wilson v. Piper Aircraft Corp.*[93] illuminates two principal considerations which influence the risk-utility calculation. In *Piper*, a light-aircraft manufacturer's decision to use a carburetor instead of a fuel injector was challenged by the plaintiffs, who contended that a fuel injector would decrease the possibility of fuel system freezing.[94] The court held the evidence insufficient to establish a design defect[95] and observed that use of a fuel injector could significantly compromise the safety of the airplane by reducing the aircraft's reponsiveness and performance. Thus, while a fuel injector system might decrease risk in one area it would also reduce overall utility and contribute to an increase in the airplane's price.[96] *Piper* thus reveals two vital considerations: whether a manufacturer can technologically improve its product's safety design without increasing the item's cost to the point that a consumer would no longer purchase it;[97] and whether the suggested alternative, while solving a particular problem, would create new or additional risks that outweigh the benefits of a different design.[98]

At least in theory, a carefully constructed medical expert system would embody the most widely accepted and effective methods of diagnosing an illness. If a system designer failed to include some well-established medical principles in the knowledge base, or inputted erroneous information, proof of a design defect would be relatively simple; a properly designed program would avoid the risk of injury at little or no additional cost. Because a safe and useful program would not attempt to treat illnesses as a physician does, potential differences in courses of treatment would be of little significance. Thus, a viable medical expert system could be technologically impervious to alteration until advances are made in the healing arts, at which point the knowledge base could be updated.

Furthermore, even if some disagreement did exist in the medical community over what signals indicate a particular ailment, choosing one set of rules over another would likely produce a mere trade-off in

93. 282 Or. 61, 577 P.2d 1322, *reh'g denied*, 282 Or. 411, 579 P.2d 1287 (1978). For the history of products liability in Oregon see generally, Vetri, *Legislative Codification of Strict Products Liability Law in Oregon*, 59 OR. L. REV. 363 (1981).

94. *Piper*, 282 Or. at 69-71, 577 P.2d at 1327.

95. The court held that a party challenging a product design must present "evidence from which the jury could find the suggested alternatives [were] not only technically feasible but also practicable in terms of cost and the over-all design and operation of the product." *Id.* at 69, 577 P.2d at 1327.

96. *See id.* at 70, 577 P.2d at 1327.

97. This aspect of the risk-utility model has been described as "the manufacturer's ability to eliminate the unsafe character of the product without impairing its usefulness or making it too expensive to maintain its utility." Wade, *supra* note 92, at 837.

98. *Piper*, 282 Or. 61, 69, 577 P.2d 1322, 1327.

cumulative risks and benefits. In other words, although alternative principles might be inserted in the knowledge base to solve one problem, such a modified knowledge base could create different, perhaps even more costly risks in other areas. Hence, where a medical expert system is carefully constructed, it is unlikely that mere differences of opinion in the medical community would lead to a conclusion that a design defect exists under the risk-utility model.[99]

The availability of more advanced or sophisticated technology may also be relevant to risk-utility analysis. For example, *Swiss Air Transport Co. v. Benn*,[100] though not a strict liability case, assigned liability based on the availability of more advanced computer programming techniques. In that case the defendant had purchased illegitimately altered airline tickets. The airline sued to recover the price of the tickets and explained its own failure to detect the alterations prior to the use of the tickets by claiming it was unable to connect the computer database for reservations with the database for sales. The court shielded the innocent buyer from liability based on principles of estoppel, stating:

> [p]laintiff could have prevented the passengers from using altered tickets by maintaining a system capable of confirming which passengers are scheduled for a particular flight. In light of the advanced computer technology available today, this is not an unreasonable burden to place on the plaintiff.
>
> . . . I do not recognize Swiss Air's reliance on its computer system as a legally cognizable defense. Had [it] been properly equipped with a more sophisticated computer system, it could have promptly discovered [the alteration].[101]

Even though the *Swiss Air Transport* holding was not founded upon products liability theory, it does suggest that the choice of a particular computer program design, and the data or capabilities that it does and does not utilize, are subject to judicial review. By analogy, a conclusion that the knowledge base or processes of a medical expert system generate liability might rest upon an assessment of the availability of alternative systems.[102]

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99. This final drawback could be entirely circumvented by a developer if he opted for the safest possible route and instructed the expert system to exhort a user to visit a physician whenever there was the slightest doubt as to the severity or nature of the user's complaint. Such a system might be less useful to consumers, though, because it would not always be able to differentiate between situations that require professional assistance and those that do not.

100. 467 N.Y.S.2d 341 (N.Y. Civ. Ct. 1983).

101. *Id.* at 344.

102. *See* Exceptional Children's Home & Nursery, Inc. v. Fortuna, 414 So.2d 1130 (Fla. Dist. Ct. App. 1982).

However, in the medical expert system market, weighing the attractiveness of alternative designs could insulate manufacturers from product liability. The revolutionary nature of in-home medical expert systems makes the existence in the marketplace of similar alternative designs highly unlikely. Proof of alternative design options would have to concentrate upon the body of medical knowledge that comprises the system's operational rules. And, as stated above, substituting one set of health care principles for another will probably only serve to replace one group of risks with another. Thus, strict liability would probably not be imposed solely on the basis of more attractive available designs.

C. Product Liability for Manufacturing Flaws

In addition to liability for a defective design, a manufacturer can incur liability for products that are dangerous because they have not been produced as designed.[103] When such manufacturing defects cause products to deviate from the producer's own safety specifications they render the product unreasonably dangerous as a matter of law, because the product as marketed is more dangerous than originally planned.[104]

The celebrated case of *Henningsen v. Bloomfield Motors*[105] demonstrates the relatively light burden of proof that a plaintiff must bear under this branch of product liability law. In that case the only evidence submitted to show that the plaintiff's automobile was unreasonably dangerous was testimony that "she heard a loud noise" from underneath the hood, felt "something crack," and lost control of the vehicle when the steering wheel "spun in her hands."[106] The court did not require any showing of negligence,[107] and permitted recovery against the manufacturer because the account supported an inference that a defect attributable to a malfunction in the production process had caused the mishap.[108]

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103. W. PROSSER & P. KEETON, *supra* note 19, § 99 at 695. *See also* MacPherson v. Buick Motors, 217 N.Y. 382, 111 N.E. 1050 (1916); Chandler v. Anchor Serum Co., 198 Kan. 571, 426 P.2d 82 (1967).

104. W. KIMBLE & R. LESHER, PRODUCTS LIABILITY §155, at 178-80 (1979); Keeton, *supra* note 81, at 38-37; *see also* UNIF. PRODUCT LIABILITY ACT § 104(a), Fed. Reg. 62,714, 62,721 (Oct. 31, 1979) (the determination of whether a product was unsuitably altered during fabrication hinges upon a comparison between the actual condition of a particular item and the design specifications of the manufacturer).

105. 32 N.J. 358, 161 A.2d 69 (1960).

106. *Id.* at 369, 161 A.2d at 75.

107. *Id.* at 417, 161 A.2d at 102.

108. *Id.* at 409, 161 A.2d at 97. This strict standard was intended to counterbalance the difficulty of uncovering circumstances indicating negligence in manufacturing. W. PROSSER & P. KEETON, *supra* note 19, § 99 at 695.

In general, a *prima facie* case for strict liability for manufacturing defects can be based on any one of three types of evidence: (1) expert testimony pinpointing the flaw which caused the injury;[109] (2) proof of the destruction or disappearance of the offending product;[110] or (3) proof of circumstances of the accident that point to a manufacturing defect.[111]

A strict judicial reading of the manufacturing flaw test will effectively curtail production of defective medical expert systems while keeping liability within reasonable bounds. Classifying the debugging and related intermediate stages of development as an element of product design will limit strict manufacturing liability to inconsistencies in the final, packaged program. These defects can be regulated by the adoption of stringent quality and production controls. The desire to limit product liability should prompt software manufacturers to implement safe, efficient production strategies.

In those instances where improper production techniques create a dangerous expert system, the flexibility of the manufacturing flaw quantum of proof will lead to compensation of the injured user. The goals of accident prevention and loss spreading will be furthered without ending the development of properly conceived medical expert systems.[112]

D. Product Liability for a Failure to Warn

A manufacturer or seller has a duty to warn and is subject to liability for a failure to provide adequate admonitions about a risk inherent in a product's intended or reasonably foreseeable functions.[113] A warning that lacks the information necessary to make a product safe, or to fully inform a consumer of the risks attendant upon a product's use, can thus result in liability.[114] However, according to the generally accepted view, liability for a failure to warn is similar to negligence in that a plaintiff must prove that the manufacturer knew or should have known of the risks generated by the product.[115]

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109. Holloway v. General Motors Corp., 403 Mich. 614, 271 N.W.2d 777 (1978) (expert testimony explaining a break in a ball joint assembly).

110. *Henningsen*, 32 N.J. at 410-12, 161 A.2d at 98-99 (accident destroyed both the vehicle and allegedly flawed steering mechanism).

111. Lindsay v. McDonnell Douglas Aircraft Co., 460 F.2d 631 (8th Cir. 1972), *on remand* 352 F. Supp. 633, *aff'd on rehearing* 485 F.2d 1288 (new Navy jet caught fire for no apparent reason and crashed into the sea).

112. *See infra* notes 144-50 & 161-66 and accompanying text.

113. Wright v. Carter Prods., Inc., 244 F.2d 53, 57 (2d Cir. 1957); Moran v. Faberge, Inc., 273 Md. 538, 543, 332 A.2d 11, 15 (1975).

114. Borel v. Fibreboard Paper Prods. Corp., 493 F.2d 1076, 1088-89 (5th Cir. 1973), *cert. denied*, 419 U.S. 869 (1974); Midgley v. S.S. Kresge Co., 55 Cal. App. 3d 67, 127 Cal. Rptr. 217 (1976).

115. W. PROSSER & P. KEETON, *supra* note 19, § 99; *see, e.g., Borel*, 493 F.2d 1076;

The extent of the duty to warn will depend upon the obviousness of the danger and the character of the intended or foreseeable use of the product.[116] Where a hazard is blatantly obvious there is simply no duty to warn.[117] If the danger is not obvious or discoverable by an unenlightened consumer, liability may be obviated by an adequate warning, provided that in the ordinary course of events it will reach and be understood by the consumer.[118] However, a warning need not be directed towards an individual who possesses enough knowledge to apprehend a product's perils without warning.[119]

For a warning to be adequate, it must notify a user, exercising reasonable care for his or her own safety, of the possible consequences of use or misuse of the product.[120] The gravity of potential dangers in light of the foreseeable uses of a product may also affect the definition of adequacy.[121] Additionally, a warning must be specific and comprehensive: directions which merely tell how to use the product, but say nothing about the inherent and specific dangers if the directions are not followed are not sufficient.[122] Adequate instructions must therefore educate a consumer about both the efficient and safe use of a product and any dangers likely to emanate from any foreseeable use of the item.[123]

Marketing a well-thought-out medical system for the general public should not create any substantial liability for failure to warn. As previously discussed, a safe medical expert system will continually urge a user to seek expert medical help in any ambiguous situation.[124] However, an in-home expert system that does not warn a user of the dangers in relying exclusively on computer information will generate tremendous liability. It is clear that a user of such an expert system purchases the software as a means to supplement, or even replace, traditional health-care services. Hence, it is readily foreseeable that a user will be injured if he relies on erroneous or incomplete computer information and is not cautioned to see a physician if a condition persists or worsens.

Moran, 273 Md. 538, 332 A.2d 11.

116. W. PROSSER & P. KEETON, *supra* note 19, § 96; *see, e.g.*, Murphy v. Cory Pump & Supply Co., 47 Ill. App. 2d 38, 197 N.E.2d 849 (1964).

117. McCabe Powers Body Co. v. Sharp, 594 S.W.2d 592, 595 (Ky. 1980).

118. Ulrich v. Kasco Abrasives Co., 532 S.W.2d 197 (Ky. 1976).

119. *See* Ford Motor Co. v. McCamish, 559 S.W.2d 507, 512 (Ky. App. 1977) (manufacturer did not need to disclose torque pressures to automobile mechanics since pressures not unusual).

120. Post v. American Cleaning Equip. Corp., 437 S.W.2d 516, 520 (Ky. App. 1968).

121. *Id.*

122. Hiigel v. General Motors Corp., 190 Colo. 57, 63, 544 P.2d 983, 988 (1975).

123. Bituminous Casualty Corp. v. Black & Decker Mfg. Co., 518 S.W.2d 868, 873 (Tex. Civ. App. 1974).

124. *See supra* note 99 and accompanying text.

Similarly, professional systems could lead to liability if marketed without adequate warnings. Professional medical expert systems are normally designed to complement a physician's own personal skill and analytical prowess;[125] therefore, a nonphysician who obtains a professional system, and who relies on information provided by the software, could be severely harmed. Since it is foreseeable that a nonphysician may secure this type of program, adequate warnings would at the very least instruct lay persons about the perils attendant upon nonphysician use.[126]

E. User Risk: Comparative Negligence and Strict Products Liability

There is no consensus among the various American jurisdictions as to whether a plaintiff's own negligent conduct will reduce a manufacturer's strict products liability.[127] A few courts have held comparative negligence concepts inapplicable to strict products liability actions because reducing a manufacturer's liability to account for consumer negligence would undermine the goal of encouraging manufacturers to anticipate consumer misconduct.[128] Most courts apply unrestricted comparative negligence apportionment principles to strict products liability actions.[129] Those courts which have accepted comparative negligence concepts in strict liability analysis have done so because "fairness and equity are more important than conceptual and semantic consistency."[130]

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125. *See supra* notes 12-17 and accompanying text.

126. If the expert system is one designed for use by a specialist, as is arguably the case with MYCIN, adequate warnings would probably also have to inform a nonspecialist physician of the risks connected with unassisted solo operation.

127. *See* Twerski, *The Use and Abuse of Comparative Negligence in Products Liability*, 10 IND. L. REV. 797, 797-98 (1977).

128. A Fifth Circuit panel first found comparative negligence inapplicable to a strict products liability action in admiralty. However, the entire circuit disagreed and recognized a comparative fault defense. Even so, the panel ultimately held as a matter of fact and law that the plaintiff was guilty of no proximate act of negligence and did not reduce the plaintiff's award. Lewis v. Timco, 697 F.2d 1252, 1255-56 (5th Cir.), *rev'd en banc*, 716 F.2d 1425, 1433 (1983), *modified*, 736 F.2d 163, 167 (1984); *cf.* Kinard v. Coats Co., 37 Colo. App. 555, 557, 553 P.2d 835, 837 (1976).

129. *See, e.g.*, Caterpillar Tractor Co. v. Beck, 593 P.2d 871 (Alaska 1979); Daly v. General Motors Corp., 20 Cal. 3d 725, 144 Cal. Rptr. 380, 575 P.2d 1162 (1978). The defense of assumption of risk is still a complete bar to recovery in a few jurisdictions. In these states, a manufacturer may still completely avoid liability if a user knowingly and voluntarily abuses the system in a way that supplants the manufacturer's fault. However, most jurisdictions have modified the defense of assumption of risk and contributory negligence to one of comparative fault so that plaintiff misconduct is no longer a complete bar. W. PROSSER & P. KEETON, *supra* note 19, §§ 65, 67.

130. Keneko v. Hilo Coast Processing, 654 P.2d 343, 352 (Haw. 1982); *see also* Suter v. San Angelo Foundry & Mach. Co., 81 N.J. 150, 406 A.2d 140 (1979).

In the context of medical expert systems, comparative negligence precepts will have little validity in regard to a physician's use of a medical expert system. Because an injured victim of this type of program would not have operated the system, the plaintiff's conduct would not be at issue.[131] As a consequence, comparative negligence will have its greatest impact upon claims generated by the use of an in-home medical expert system.

However, a manufacturer might encounter difficulties in asserting a comparative negligence defense against an in-home expert system user. Viable proof of user misconduct may often be unobtainable. Where a user simply inputs the wrong information into a computer, it may be impossible to reproduce in court exactly what responses were fed into the expert system. Similarly, a user may incorrectly answer an expert system query because of the user's failure to recognize a particular symptom. Again, actual proof of such a mistake may be impossible to discover.

Even so, comparative fault principles will be relevant in a number of situations involving in-home medical expert systems. One of the more serious forms of misuse of a medical expert system would be unwavering user reliance upon a computer opinion in the face of a clearly worsening physical condition. A manufacturer can combat this hazard by equipping each expert program with a plethora of clear and comprehensible warnings that inform each user of the severe risks associated with naive, unquestioning belief in computer information. A failure to heed such warnings may aggravate or precipitate an injury and can properly be accounted for by reducing the total amount of a plaintiff's damages.[132]

IV. EXPERT SYSTEMS AS A SERVICE: PROFESSIONAL LIABILITY FOR MEDICAL MALPRACTICE

In addition to strict liability, a theory of professional liability may apply to program developers and physicians who use medical expert

131. Questions of the physician's proper or improper use of the software will not intrude upon the relationship between the injured patient and the manufacturer. Although this issue may have some bearing upon the physician's relationship to the program manufacturer, claims of physician negligence would normally be resolved in a separate indemnity or contribution action. Tromza v. Tecumseh Prods. Co., 378 F.2d 601 (3d Cir. 1967); Frank R. Jelleff, Inc. v. Pollak Bros., 171 F. Supp. 467 (N.D. Ind. 1959). However, because this Comment focuses on the claims of a user or patient, these related problems are beyond the scope of this discussion.

132. *See* RESTATEMENT (SECOND) OF TORTS §402A comment k (1965) (discusses unavoidably unsafe products). *Cf.* Kaempfe v. Lehn & Fink Prods. Corp., 21 A.D.2d 197, 202-03, 249 N.Y.S.2d 840, 847 (1964) (court found that it was not necessary to give a warning to hypersensitive users of deodorant); Merrill v. Beaute Vues Corp., 235 F.2d 893, 897 (10th Cir. 1956).

systems. According to this standard, practitioners of the healing arts are required not only to exercise ordinary reasonable care in what they do but are also required to possess a minimum level of medical skill and knowledge.[133] In the absence of an express contract to cure a patient, however, a doctor neither warrants nor guarantees a correct diagnosis or a successful treatment.[134] By undertaking to render medical services, a physician merely holds himself out as having a minimum level of professional ability and knowledge. This threshold level is usually defined as the skill and care ordinarily exercised by members of the medical profession in good standing; thus, a physician who does not possess or use these basic qualifications will be liable for injuries to patients caused by the lack thereof.[135]

The greatest difficulty in applying professional negligence principles to medical expert systems arises in connection with the patient-physician relationship—the cornerstone of a malpractice claim. In order to pursue a medical malpractice claim against a physician, a plaintiff must normally be in a consensual relationship with the physician.[136] This relationship demands actual or implied consent to diagnose or be diagnosed, to treat or be treated.[137] If such a direct relationship between a health care provider and a patient is lacking, a plaintiff will not normally be allowed recovery for professional negligence.

In *Smith v. Linn*,[138] for example, a Pennsylvania court examined the importance of the patient-physician relationship in circumstances strikingly similar to the commercial distribution of a medical expert system. The defendant, Dr. Robert Linn, was the author of a very specialized protein diet book called *The Last Chance Diet*. Plaintiff alleged that his wife's death was caused by her adherence to the wantonly dangerous weight-loss program espoused in Dr. Linn's book. Consequently, the plaintiff initiated a lawsuit under a variety of theories, including a claim

133. *See, e.g.*, 1 LOUISELL & WILLIAMS, *supra* note 51, § 8.03; McCoid, *The Care Requirement of Medical Practitioners*, 12 VAND. L. REV. 549, 558-59 (1959).

134. *See* Salis v. United States, 522 F. Supp. 989 (M.D. Pa. 1981); Greenberg v. Michael Reese Hosp., 83 Ill. 2d 282, 415 N.E.2d 390 (1980); *but cf.* Hawkins v. McGee, 84 N.H. 114, 146 A. 641 (1929) (recovery for breach of contract to cure but no malpractice liability).

135. *See* Sullivan v. Henry, 160 Ga. App. 791, 800, 287 S.E.2d 652, 659 (1982); McPherson v. Ellis, 305 N.C. 266, 270, 287 S.E.2d 892, 895 (1982). Generally, the minimum skill and knowledge possessed by the medical community as a whole is looked to when determining if a physician breached his professional duty to a patient. However, where the practitioner is a specialist, the standard is higher. *See Salis*, 522 F. Supp. at 994; Coyne v. Cirilli, 45 Or. App. 177, 182, 607 P.2d 1383, 1386 (1980).

136. *See* 1 LOUISELL & WILLIAMS, *supra* note 51, §8.02; *see also* Brown v. Moore, 247 F.2d 711.

137. *See, e.g.*, Brown v. Moore, 247 F.2d 711.

138. 414 A.2d 1106 (Pa. Commw. Ct. 1980).

of professional negligence against Dr. Linn for advocating a perilous medical course of treatment.[139]

The court initially observed that medical malpractice actions arise "out of the relationship between the health care provider and the patient," and that "[s]uch a relationship customarily requires an immediate connection between the health care provider and the patient and involves an actual or implied consent to diagnose and to be diagnosed or to treat and to be treated."[140] The court concluded that this relationship did not exist in the sale of a diet book because there was no two-way, mutual communication between the physician author and the patient. "The relationship was therefore that of an anonymous reader to an author."[141]

Similarly, the relationship between the user of an in-home expert system and its designer does not meet the requirements of a professional patient-physician relationship.[142] The large-scale introduction of medical expert system software into the marketplace will not create direct patient-physician interaction. Consequently, as was the case in *Smith v. Linn*, the relationship between a medical expert system developer and a software buyer is that of an author to an anonymous reader.

V. POLICY IMPLICATIONS OF STRICT PRODUCTS LIABILITY

The ultimate decision to subject a manufacturer or others in the chain of distribution to strict liability is a matter of public policy.[143] Indeed, few courts have based strict liability decisions wholly on a technical distinction between products and services[144] but have instead predicated liability upon the furtherance of recognized public policy goals. Among the most important of these goals are loss-spreading, compensation, judicial economy, equitable allocation of the burden of proof, the encouragement of valuable new technologies, and the prevention of accidents. This Section analyzes these policy concerns and

139. *Id.* at 1109.

140. *Id.* at 1107-08 (quoting 1 LOUISELL & WILLIAMS, *supra* note 51, § 8.02).

141. Smith v. Linn, 414 A.2d at 1109.

142. In respect to a physician who uses an expert system, the quality of the interaction involved satisfies the relationship requirement of a professional liability theory of recovery. A patient does not see a physician with the belief that the visit is for the purpose of putting a medical expert system into operation. Thus, the physician's decision to use an expert system does not affect the consensual relationship that already exists.

143. Greenberg v. Michael Reese Hosp., 83 Ill. 2d 282, 290-91, 415 N.E.2d 390, 394 (1980) (imposition of strict liability is a question of policy); *see also* Johnson v. Sears, Roebuck & Co., 355 F. Supp. 1065, 1067 (E.D. Wis. 1973) (public policy argument that forcing charitable institutions to bear loss threatens their survival).

144. *See supra* notes 19-62 and accompanying text.

concludes that strict liability for defects should apply to manufacturers of expert medical systems but not to the physicians who design or use such programs.

A. Loss-Spreading and Compensation

One of the well-recognized and long-accepted goals of strict products liability doctrine is "to minimize the costs of accidents and to consider who should bear those costs."[145] As a result, the twin concepts of spreading the costs resulting from a business activity over a large group and compensating injured victims have emerged as the basis of the doctrine.[146] In particular, courts have long believed that an entrepreneur who makes and sells an article can best prepare for and shoulder the costs of a damaging event.[147]

In the realm of medical expert systems, the manufacturer is usually in a better position to spread the costs of a risk over a large group than is a consumer or an individual program designer or developer. A software manufacturer can ordinarily obtain insurance to cover the costs of marketing a program and can pass the cost of user injury through to consumers by charging higher prices.[148] Thus, the policy aim of allocating costs to the party best able to bear and spread the risk supports subjecting manufacturers to strict liability for medical expert systems.

However, holding the physician developer strictly liable may not result in such a favorable allocation of loss. To begin with, a physician who develops an expert system cannot pass the costs of the risk on to consumers since it is the program manufacturer who establishes the price of the final product. Furthermore, a physician who develops an expert system will only be able to shoulder the costs of user injury through malpractice insurance. This solution is problematic for several

145. Suter v. San Angelo Foundry & Mach. Co., 81 N.J. 150, 173, 406 A.2d 140, 151 (1979).

146. *See, e.g.*, Escola v. Coca-Cola Bottling Co., 24 Cal. 2d 453, 462, 150 P.2d 436, 441 (1944) (Traynor, J., concurring); Goldberg v. Kollsman Instrument Corp., 12 N.Y.2d 432, 240 N.Y.S.2d 592, 191 N.E.2d 81 (1963); Helene Curtis Indus., Inc. v. Pruitt, 385 F.2d 841 (5th Cir.), *cert. denied.*, 391 U.S. 913 (1967).

147. *See, e.g.*, Escola v. Coca-Cola Bottling Co., 24 Cal. 2d 453, 150 P.2d 436 (1944) (Traynor, J., concurring); Magrine v. Krasnica, 94 N.J. Super. 228, 227 A.2d 539 (1967), *aff'd sub nom.* Magrine v. Spector, 100 N.J. Super. 223, 241 A.2d 637 (1968), *aff'd*, 53 N.J. 259, 250 A.2d 129 (1969) (as compared to an innocent victim, a manufacturer is in a better position to bear the costs of injuries).

148. *See* Freed, *supra* note 34, at 477. Furthermore, the number of consumers should be large enough to increase only minimally the price of an individual unit. *Cf.* La Rossa v. Scientific Design Co., 402 F.2d 937, 941-42 (3d Cir. 1968) (company not liable for product because no impact on public at large, and victim's employer was better insurer than manufacturer).

reasons. First, insurance carriers may be unwilling to extend malpractice insurance to cover the sale of computer software for home use because the pool of potential claimants would extend to all program purchasers and users.[149] Second, even if a physician is able to obtain malpractice insurance to cover expert systems, policy premiums may be prohibitively expensive.[150] Finally, the insurance carrier may well cancel the policy after a few successful claims.[151] Thus, the developer of an expert system is not the appropriate party to assume liability for consumer injuries because, relative to the manufacturer, the developer is not in a good position to bear the risk of user injury through insurance.

In the professional context, though, a physician who simply *employs* a medical expert system may be in a good position to shoulder at least some of the burden of consumer injuries. A physician who uses an expert system to facilitate treatment of patients will probably have malpractice insurance covering the group of potential victims. The mere use of a medical expert system will not increase the number of a physician's patients, nor the magnitude of their potential injuries. As a result, by spreading the cost through insurance, an attending physician using an expert system can easily bear the liability for the portion of patient injuries resulting from the physician's negligence. Thus, the goal of placing burdens on those best able to bear and spread the costs favors the imposition of professional malpractice liability on attending physicians.

B. Judicial Economy and Burdens of Proof

In general, imposition of strict liability as opposed to negligence has a severe impact upon the amount and sufficiency of the proof demanded of an injured plaintiff.[152] The requirements of proof under a negligence standard are much more stringent.

One reason that a negligence trial may be more costly in the case of medical expert systems is that fault will often be extremely difficult to prove.[153] Execution of computer software involves a series of both

149. *See* American Medical Association, Special Task Force on Professional Liability and Insurance: Professional Liability in the 80's, Report 3 (1985).

150. Liability insurance premiums for all physicians have increased 236% over the last decade. American Medical Association, Special Task Force on Professional Liability and Insurance: Response of the American Medical Association of Trial Lawyers of America Statements Regarding the Professional Liability Crisis, at 3 (1985).

151. *See* American Medical Association, Special Task Force on Professional Liability and Insurance, *supra* note 149.

152. Courts favor a standard that tends to reduce the overall cost and complexity of litigation. *See, e.g.*, Phipps v. General Motors Corp., 278 Md. 337, 363 A.2d 955 (1976).

153. *See supra* notes 73-79 and accompanying text.

hardware and software components, any one of which may fail to perform properly.[154] In deciding whether injuries caused by an in-home expert system were a result of the developer's negligence, a judicial inquiry might focus upon the caliber of the medical art represented by the program's knowledge base. A trier of fact would then be faced with the unenviable task of deciding whether the medical expertise programmed into a system conforms with the prevailing standards in the medical community. Because doctors are often loathe to provide evidence that may compromise a colleague,[155] it may be difficult for a plaintiff to secure expert physician testimony to support a claim. These difficulties are largely alleviated by a strict liability standard. Under this measure, the user of an in-home medical expert system would not have to prove a failure to exercise the care that a reasonable practitioner would have under the circumstances.[156]

Proving negligence in the instance of a professional system designed for physician use may not be as difficult because a claimant can allege that the physician used the software improperly or that the physician negligently relied upon the computer information. A plaintiff would not have to prove that the program itself was negligently fabricated, but would instead merely have to demonstrate that the physician utilized the program incorrectly. As is the case in an ordinary malpractice action, an injured claimant would focus upon the conduct of the physician who used the system and would not be compelled to undertake a tedious and perhaps futile analysis of the program.

C. Encouraging Advances in Medical Science

One problem with the application of strict liability doctrine to all parties connected to the expert system enterprise is that the resulting liability may discourage advances in medical technology.[157] Justice Traynor realized that the careless expansion of a physician's liability could produce an "undesirable limitation on the use of procedures involving inherent risks of injury even when due care is used."[158] Thus, courts which have confronted the task of apportioning liability for the use of

154. *See* Gemignani, *Product Liability and Software*, 8 RUTGERS J. COMPUTER TECH. & L. 173, 181-87 (1981). Many experts believe that errors can arise as the result of inexplicable external influences. *See* Raloff, *Sick Chips*, SCI. NEWS, Nov. 23, 1985 at 332.

155. W. PROSSER & P. KEETON, *supra* note 19, § 32 at 188 n.50 and cases cited therein.

156. *See supra* notes 64-68 and accompanying text.

157. "One objective of contemporary law should be to encourage innovation and development within the computer and other technical industries." R. NIMMER, *supra* note 75, § 7.05(2) at 7-21.

158. Clark v. Gibbons, 66 Cal. 2d 399, 424, 426 P.2d 525, 542, 58 Cal. Rptr. 125, 142 (1967) (Traynor, J., concurring).

medicines and medical implements have stressed that public policy unequivocally favors a theory of liability that fosters improvements in the healing arts.[159]

In *Greenberg v. Michael Reese Hospital*,[160] the Illinois Supreme Court addressed the issue of whether the doctrine of strict liability should be applied to physicians when injuries are caused by exposure to X-ray radiation during the course of medical treatment. The court concluded that public policy dictated that physicians should not be subject to strict liability because such liability would discourage the use of new medical technologies and procedures.[161]

Similarly, the policy goal of encouraging technological advancement indicates that physicians who design medical expert systems should not be held strictly liable. The concerns indicated in *Greenberg* are equally valid in the realm of expert systems; the physician who designs a medical expert system might be discouraged from pursuing his discoveries by the prospect of strict liability for user injury.

The argument that strict liability will inhibit the development of medical expert systems is also valid when applied to physician users. The use of a medical expert system to generate or check a diagnosis is similar to a physician's use of X-rays to plan treatment—the situation in *Greenberg*. Thus, as in *Greenberg*, strict liability for physician users would conflict with the goal of encouraging medical advances.

D. Preventing Accidents

Several courts have indicated that the imposition of strict liability for defective products can further accident prevention by eliminating the necessity of proving negligence.[162] These courts reason that if a manufacturer is held strictly accountable for the safety of its products, the manufacturer will be motivated to test its products more thoroughly prior to marketing and impose more stringent quality controls in the production process.[163]

Commentators have countered that strict liability may not be an effective deterrent to unsafe product design in many instances.[164] These

159. *See* RESTATEMENT (SECOND) OF TORTS §402A comment k (1965).

160. 83 Ill. 2d 282, 415 N.E.2d 390 (1980).

161. *Id.* at 290-91, 415 N.E.2d at 394.

162. *See, e.g.*, Phillips v. Kimwood Mach. Co., 269 Or. 485, 525 P.2d 1033 (1974); First Nat'l Bank of Albuquerque v. Nor-Am Agricultural Prods., 88 N.M. 774, 537 P.2d 682, *cert. denied*, 88 N.M. 29, 536 P.2d 1085 (1975).

163. *Phillips*, 29 Or. at 502-03, 525 P.2d at 1041-42.

164. *See, e.g.*, Raleigh, *The State of the Art in Product Liability: A New Look at an Old Defense*, 4 OHIO N.L. REV. 249 (1977); Plant, *Strict Liability of Manufacturers for Injuries Caused by Defective Products: An Opposing View*, 24 TENN. L. REV. 938 (1957).

writers point out that the accident prevention rationale is valid only if a manufacturer can make an informed choice based on the safety of alternative designs.[165] If a particular risk is unforeseeable due to the state of the art or undiscoverable until the product is used in a unique manner, the imposition of strict liability will have little impact upon safety decisions.[166] Moreover, many design choices merely produce a trade-off in safety features; hence, it may be impossible to predict which of two options will be less costly in terms of injury until after the product is marketed.[167]

These criticisms of the accident prevention justification for strict products liability have particular relevance in regard to medical expert systems. A "bug" in a computer program may be detectable only under a very specific, rather unusual set of circumstances. Additionally, any choice between alternative rules or facts in the knowledge base will be merely an exchange of risks and benefits; each heuristic rule will be valid in some situations and not in others. It is unlikely that a program manufacturer will be able to foresee and predict all the unique situations that each user will encounter. Thus, accident prevention may not be furthered by a policy of strict liability.

In the case of a medical expert system designed for physician use, imposition of strict liability upon the practitioner user may actually undermine accident prevention because strict liability will discourage physicians from using expert systems as a means of double-checking and verifying diagnoses and planned treatments. A physician is unlikely to use a medical implement which generates liability independently of the degree of professional care and skill exercised.

By contrast, holding a physician responsible only for the negligent misuse of software will allow professional use of programs while simultaneously promoting caution and an awareness of system limitations. Thus, strict liability would not improve the level of accident prevention beyond that achieved by an ordinary negligence standard.

However, if plaintiffs claim that their injuries were caused by a *defect* in either an in-home or a professional program, rather than by the physician's operation of the system, the manufacturer, sellers, and other nonprofessional links in the distribution chain should still be held strictly liable. Holding a manufacturer strictly liable for defective professional software may help prevent the distribution of dangerous programs. Thus, the policy of reducing the risk of harm suggests a flexible

165. Owen, *Rethinking the Policies of Strict Products Liability*, 33 VAND. L. REV. 681, 714 (1980).

166. *Id.*

167. *See supra* notes 93-96 and accompanying text.

approach to professional medical expert systems, whereby physicians are liable only for negligent use of expert programs yet manufacturers are strictly liable for injuries caused by defective product safety and design.

CONCLUSION

The commercial promotion of medical expert systems designed for use either by an average consumer or by trained health care providers will present the courts with novel, thorny questions about the nature and extent of liability for personal injuries sustained using such software. In particular, thorough scrutiny of liability for expert systems highlights the blurred legal distinctions between product and service; strict liability and negligence; and impersonal market transactions and professional relationships.

A nationally distributed program for in-home use is akin to a product in many important respects: the ultimate software sold to a user is of tangible form, is subject to ownership, and can be periodically adjusted through the debugging process. Classifying professional systems, however, is not as straightforward because this type of program involves a combined product-service transaction. The essence of a bargain between a patient and her physician is health maintenance services, not the transmittal of a good. Yet, neither the developer of a medical expert system nor the system itself can be said to practice medicine in any traditional sense.

In addition, the variety of technologies and expertise which go into the fabrication of a medical expert system blurs the distinction between strict liability and professional negligence. After assessing various policy factors, this Comment concluded that strict products liability doctrine is appropriately suited to assessing the responsibility of the manufacturers, retailers, and sellers of all types of expert programs. Careful analysis of the components of strict liability doctrine, including the distinction between design and manufacturing flaws, will facilitate the fair and equitable apportionment of liability associated with medical expert systems.

At the same time, traditional professional negligence doctrine is well-suited to claims involving a physician's use of an expert system. Proof of physician negligence in such circumstances would be little different from that required in an ordinary malpractice action, provided a patient-physician relationship has been established. In the instance of a physician who uses an expert system as an aid in treating patients, the professional relationship clearly exists. A patient visits the doctor in order to receive care; the mere fact that the attending physician uses a computer program in rendering these services does not undermine the original purpose of the transaction.

By contrast, there is no direct interaction between consumers and physicians who develop expert systems. A professional relationship customarily requires an immediate connection between the health care provider and the patient as well as actual or implied consent to diagnose and treat. As any communications between a medical expert system developer and a patient or a user will flow wholly in one direction via the mass electronic communications market, mutual consent to form a professional medical relationship is absent. Therefore, this Comment argued that physicians who help develop medical expert systems should not be liable under professional medical malpractice standards to users of the software.

Despite the ambiguous nature of these legal distinctions, certain clear policy goals have emerged. This Comment considered the policy goals of allocating the costs of a risk, minimizing the demands and burdens placed upon judicial resources, encouraging the development of medical technology, as well as the ambivalent desire to reduce accidents. The basic framework established in this Comment for assessing liability addresses five analytically distinct categories of defendants: the designers of in-home systems; the designers of professional systems; the manufacturers of in-home systems; the manufacturers of professional systems; and, finally, the physicians who use professional systems.

Under this framework, the designing physicians would be subject only to negligence standards because of their limited control over marketing and production. Attending physicians who utilize expert systems would only be subject to liability for professional malpractice because even with the aid of a sophisticated tool such as an expert system, they are essentially still providing services rather than goods.

Finally, the framework suggests that courts should adopt a products liability approach towards the manufacturers of expert systems, whether for in-home or professional use. Because a manufacturer can spread the risk of loss through pricing or insurance, they are in a much better economic position to bear these costs than is the program user or the physician who developed the system. Furthermore, applying products liability principles to manufacturers of medical expert systems will discourage the manufacture of dangerous, all-encompassing programs sold as a replacement for physician services while simultaneously encouraging development of medical software intended as a supplement to traditional health care.

BOOK REVIEWS

SOFTWARE PROTECTION
By G. Gervaise Davis III
Published by Van Nostrand Reinhold Company, New York, 1985
Pp. xvii, 372; $44.95; *and*

LEGAL PROTECTION OF COMPUTER PROGRAMS AND DATA
By Christopher J. Millard
Published by The Carswell Company, Toronto, 1985
Pp. xxvi, 239; $45.00.

Reviewed By LOIS W. ABRAHAM †

It is hard to advise the practitioner to "buy American" after comparing *Software Protection* by G. Gervaise Davis III, a California based attorney and frequent contributor to computer law publications, with *Legal Protection of Computer Programs and Data* by Christopher J. Millard, a British solicitor practicing and lecturing in the areas of software and data protection.

Davis is not modest in his ambitions for *Software Protection*. Its purpose, he says, is to give "both practical and legal assistance to those persons in the industry concerned with software protection — whether they are software developers, software publishers, industry executives, or lawyers working in the software industry."[1] Judged by his own expansive goal, Davis falls short. Perhaps as a result of his empathy with the software professional and his sensitivity to that portion of his intended audience, Davis sounds warnings — the right warnings — but does not expand his ideas for the legal reader. Lawyers working in the software industry can more efficiently understand the law from other sources.

Millard, on the other hand, writes unambiguously for the lawyer. His book is a tightly organized and well-documented analysis of the success with which common law jurisdictions have "balance[ed] the competing interests of creators, compilers, controllers, and consumers of software and data."[2] Recognizing its audience, the book contains an extensive table of cases and statutes, abundant footnotes and a detailed index.[3]

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1. G. DAVIS, SOFTWARE PROTECTION vi (1985).
2. C. MILLARD, LEGAL PROTECTION OF COMPUTER PROGRAMS AND DATA iii (1985).

Addressing their different audiences, both Millard and Davis evaluate the systems in place for the protection of software (or at least those in place in 1985). The common subject matter of the books is extensive: each discusses copyright, patent, and trade secret protections for computer programs. Davis also includes sections on trademark coverage, tax issues, and export controls as well as "how-to" chapters dealing with the nuts and bolts of applying for registrations, drafting limited warranties, and selecting a competent software attorney. Conversely, Millard includes several sections on computer crime, the regulation of transborder data flows, and data protection and the right to privacy. Millard's text contains extensive analysis of British and Canadian law, as well as that of the United States. Despite their common subject matter, Davis and Millard employ very different approaches in their books, as is illustrated by their respective treatment of video game copyright protection.

The early video game cases can provide considerable insight to the development of copyright protection for computer programs. However, Davis substantially ignores their legal substance, only briefly discussing a few of the important cases. Instead, he feels constrained to describe video games in excruciating and extraneous detail.[4] The remaining bulk of Davis' video game chapter deals with the practical problems associated with registering a video game (and includes sample registration forms). Davis' summary of the video game chapter reaffirms that it is entirely directed to owners and creators of video games and that he has, at least temporarily, forgotten the portion of his proposed audience that practices law.[5]

Millard mercifully foregoes any explanation of basic video game strategy. Instead, he provides a concise but thoughtful discussion of the leading cases, extracting the elements which became the precedents for many of the decisions in later computer program cases. For example,

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3. Davis' index is useful, but he employs a bibliography rather than a table of cases and statutes so that, while browsing is encouraged, direct research on a particular issue is not.

4. The following quotation is an apt example:

> Depending on the game and its rules, the player guides an airplane, rocket, or spaceship through various battlegrounds or hostile territory. The objective is to rack up the highest possible number of points in a given time, in a game that usually gets harder and harder as the time passes and as the points add up. During the play, strange sounds, flashes, and color changes occur with increasing frequency. The famous PAC-MAN® game involves maneuvering odd little colored characters through a maze—gobbling up "power pills," and avoiding hazards in the form of monsters, rocks, and other items—with the objective of getting the most points by avoiding errors and by the cleverest manipulation of the characters. The scores are displayed in flashing lights on the screen.

G. DAVIS, *supra* note 1, at 105.

5. Nevertheless, Davis' book is a good source of information for the industry professional. His experience gives him excellent credentials to warn where the traps are, and he is generous in sharing his practical knowledge.

Millard's in-depth analysis of *Midway Mfg. Co. v. Dirkshneider,*[6] *Atari, Inc. v. Amusement World, Inc.,*[7] *Stern Elec., Inc. v. Kaufman,*[8] *Williams Elec., Inc. v. Artic Int'l, Inc.,*[9] *Midway Mfg. Co. v. Artic Int'l, Inc.,*[10] and *Midway Mfg. Co. v. Strohon*[11] led him to conclude that both the object and source codes of a software program are protected under copyright law.[12] Davis' computer entrepreneur would likely have little patience with Millard's analysis, but the litigator seeking familiarity with this area of the law, short of collecting and reading all the cases, will benefit from Millard's approach.

The evaluations of Davis and Millard are also surprisingly different on a more philosophical level. Davis' fundamental assumption is that present legal theories are not adequate to protect software. We must "somehow blunder through the next years of uncertainty"[13] and see where they will take us. Thus, Davis seems somewhat tentative about issues which were substantially resolved in 1984, such as what forms of computer programs are protected, and is rather pessimistic about the outcome of issues yet to be decided.[14]

Millard proceeds from the base that, while the mechanisms for protection are not perfect, they are working better than we had any reason to expect. While both authors acknowledge that a guiding principle in the application of copyright law to computer programs is that "regardless of how 'hard' a form they are fixed in, all programs can reasonably be viewed as 'writings,'"[15] Millard uses this principle to demystify the line between those elements of the computer system which can be protected by copyright law and those which cannot. For instance, although Millard characterizes the computer software cases arising under the 1909 Copyright Act as a "[l]egacy of [c]onfusion,"[16] he describes a path out of that confusion through pithy discussions of the cases and statutes that followed.[17]

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6. 543 F. Supp. 466 (D. Neb. 1981).
7. 547 F. Supp. 222 (D. Md. 1981).
8. 523 F. Supp. 635 (E.D.N.Y. 1981), *aff'd,* 669 F.2d 852 (2d Cir. 1982).
9. 685 F.2d 870 (3d Cir. 1982).
10. 547 F. Supp. 999 (N.D. Ill. 1982), *aff'd,* 704 F.2d 1009 (7th Cir. 1983), *cert. denied,* 464 U.S. 823 (1983).
11. 564 F. Supp. 741 (N.D. Ill. 1983).
12. C. MILLARD, *supra* note 2, at 46-47.
13. G. DAVIS , *supra* note 1, at 141.
14. *Id.*
15. C. MILLARD, *supra* note 2, at 53. *See also* G. DAVIS , *supra* note 1, at 59.
16. C. MILLARD, *supra* note 2, at 36 (discussion of Synercom Technology, Inc. v. Univ. Computing Co., 462 F. Supp. 1003 (N.D. Tex. 1978) and Data Cash Systems, Inc. v. JS & A Group, Inc., 480 F. Supp. 1063 (N.D. Ill. 1979), *aff'd on other grounds,* 628 F.2d 1038 (7th Cir. 1980)).
17. *Id.* at 39-59.

Both books (as well as this review) share a near-fatal and unavoidable flaw. In this fast moving legal area, what was *au courant* at the end of 1984 is old hat by 1986. Easy questions about the applicability of the 1976 Act were answered by 1984. The broad scope of copyright protection for computer programs inherent in the statutory language was confirmed by the cases.[18] It is the second generation questions that now concern entrepreneurs and attorneys alike: how will the courts apply traditional copyright doctrines such as "substantial similarity" and "the idea/expression dichotomy" to computer software?

We are learning fast. No understanding of the areas preliminarily explored by Davis and Millard can be complete without consideration of (at least) *SAS Institute, Inc. v. S & H Computer Systems, Inc.*,[19] *Whelan Associates, Inc. v. Jaslow Dental Laboratory, Inc.*,[20] *E.F. Johnson Co. v. Uniden Corp. of America*,[21] *Q-Co Ind., Inc. v. Hoffman*,[22] and *Kramer Mfg. Co. v. Andrews*.[23] While virtually all of the pre-1985 cases involved literal copies of computer programs, only one of these more recent cases, *Kramer*, dealt with slavish copying. In each of the other cases, the courts attacked head-on the kind of less-than-literal copying more frequently encountered in literary works.

One of the most interesting and important developments in the recent cases has been the attempt by most defendants to pigeonhole computer programs as "factual works" so that "similarity of expression may have to amount to verbatim reproduction or very close paraphrasing before a factual work will be deemed infringed."[24] The practical consequence of classifying computer programs as factual works à la *Landsberg* is the application of a *de facto* presumption that idea and expression have all but merged, leaving very little room for copyright protection. The test, then, for determining infringement announced by the Third Circuit in *Apple v. Franklin*[25] would likely be superfluous, if not

18. Tandy Corp. v. Personal Micro Computers, Inc., 524 F. Supp. 171 (N.D. Cal. 1981); GCA Corp. v. Chance, 217 U.S.P.Q. 718 (N.D. Cal. 1982); Williams Elec., Inc. v. Artic Int'l Inc., 685 F.2d 870 (3d Cir. 1982); Apple Computer, Inc. v. Franklin Computer Corp., 714 F.2d 1240 (3d Cir. 1983), *cert. denied*, 464 U.S. 1033 (1984); Apple Computer, Inc. v. Formula Int'l Inc., 562 F. Supp. 775 (C.D. Cal. 1983), *aff'd*, 725 F.2d 521 (9th Cir. 1984).

19. 605 F. Supp. 816 (M.D. Tenn. 1985).

20. 609 F. Supp. 1307 (E.D. Pa. 1985), *aff'd*, 797 F.2d 1222 (3d Cir. 1986), *petition for cert. filed*, (U.S. Oct. 23, 1986).

21. 623 F. Supp. 1485 (D. Minn. 1985).

22. 625 F. Supp. 608 (S.D.N.Y. 1985).

23. 783 F.2d 421 (4th Cir. 1986).

24. Landsberg v. Scrabble Crossword Game Players, Inc., 736 F.2d 485, 488 (9th Cir. 1984), *cert. denied*, 469 U.S. 1037 (1984).

25. "If other programs can be written or created which perform the same function as an Apple's operating system program, then that program is an expression of the idea and hence copyrightable." 714 F.2d at 1253.

irrelevant. Even if the evidence established that there were numerous ways to write a particular program, close to literal copying would be necessary to amount to infringement.

The courts have avoided such an inflexible characterization and have instead played variations on the *Apple v. Franklin* idea/expression analysis, trying to determine whether there may be various expressions of the idea of a computer program. Thus, in *SAS Institute,* the court found that "[e]ven in the case of simple statistical calculations, there is room for variation, such as the order in which arithmetic operations are performed."[26] Similarly, in *Uniden* the court held that since virtually all "aspects of defendant's program could have been independently created," the defendant "has reproduced the expression, not merely the idea of plaintiff's copyrighted work."[27]

The Third Circuit, in the affirming opinion in *Whelan,* has attempted to build on the *Franklin* approach to bridge the seeming gap between utilitarian or "factual" works and other literary works. The court suggested that

> the purpose or function of a utilitarian work would be the work's idea, and everything that is not necessary to that purpose or function would be part of the expression of the idea. Where there are various means of achieving the desired purpose, then the particular means chosen is not necessary to the purpose: hence, there is expression, not idea.[28]

The formulation is not a panacea. Describing a work's purpose or function may be no easier than defining a work's idea, and how detailed the description is may well determine what is "not necessary" to the purpose of a program.[29] Nevertheless, the *Whelan* test allows the application of broad, traditional infringement analysis, avoiding the straightjacket of a requirement of literal or near-literal copying—a requirement which would emasculate copyright protection for computer programs.

Before this review is published, surely other influential precedent will be forthcoming. Given the pace and scope of the developing law, the success of the efforts of Messrs. Davis and Millard must rest, in large

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26. 605 F. Supp. at 825.

27. 623 F. Supp. at 1503; *see also Whelan,* 609 F. Supp. at 1320 ("[t]here are many ways that the same data may be organized, assembled, held, retrieved and utilized by a computer").

28. 797 F.2d at 1236 *(emphasis deleted and citations omitted).* Using traditional copyright analysis, the circuit court in *Whelan* and the district courts in both *Whelan* and *SAS* determined that the structure and organization of computer programs, as well the literal code, could be protected by copyright and that, under the circumstances of those cases, the structure and organization of the programs at issue were infringed.

29. *See* Midway Mfg. Co. v. Bandai-America, Inc., 546 F. Supp. 125, 148 (D.N.J. 1982).

part, upon the value of their works in enabling attorneys to gain a perspective on where we have been as an aid to predicting where we are going. Despite the fact that after reading Millard a lawyer will know more than perhaps he or she ever wanted to about the British, Canadian, and Australian program protection systems, he or she will also have a sound understanding of how the United States system of protection for computer programs has developed up to 1985.[30] Davis' book is of limited value to lawyers actively practicing in the software industry who read to gain new insights about intellectual property rights in computer programs, but it is a useful collection of information for software entrepreneurs. If one thing is certain after reviewing these two works, it is that software protection is a legal area which will evolve for many years to come.

30. Both amusing and enlightening is Millard's discussion of Canadian copyright law and the 1984 White Paper, in which the Canadian government declared its general intention to revise the Canadian copyright laws and to specifically create "an entirely new regime" of protection for computer programs. C. MILLARD, *supra* note 2, at 77-80. The description of the White Paper is instructive to show how people presumably of goodwill and intelligence can become hopelessly confused in attempting to work their way through a rational scheme of copyright protection for computer programs. According to Millard, the 1984 White Paper has been put aside and new efforts are under way. That this is a good thing can be illustrated by just one statement from the White Paper: "No act done with respect to a machine-readable program will be considered an infringing act with respect to the human-readable program upon which it is based." *Id.* at 78.

SOFTWARE REVIEWS

THE CITE CHECKER
Published by Legal Software, Inc., Palo Alto, 1985
$99.00; *and*

CITERITE: THE BLUEBOOK EXPERT
Published by JURISoft, Inc., Cambridge 1985
$395.00.

Reviewed By MARK J. WELCH †

As any attorney, professor, or law student knows from experience, checking citations is one of the least pleasant tasks involved in preparing legal materials. The work is time-consuming, monotonous, and almost inevitably imperfect. Computers may provide a welcome answer. After all, computers are relatively quick, excel at hideously boring tasks, and are perfect at implementing a designed set of instructions. Because many law offices have become computerized in recent years, it was inevitable that some industrious lawyer familiar with computer programming would develop a program to check citations in legal documents.

Two such programs were released in early 1986: THE CITE CHECKER, by Legal Software, Inc., and CITERITE: THE BLUEBOOK EXPERT, by JURISoft, Inc. Both programs run on the IBM PC and compatible computers and claim to locate certain citation errors in legal documents based on the fourteenth edition of A UNIFORM SYSTEM OF CITATION,[1] popularly known as the "BLUEBOOK." Both programs *do* find errors in legal briefs and articles. By using either program on the first draft, it is possible to quickly locate and correct many simple citation errors and typographical mistakes. By using one of the programs on a final draft, it is possible to catch embarrassing errors that slipped past human cite-checkers at two in the morning. These abilities should save any law firm more money than the programs cost.

Unfortunately, the programs can only be utilized as secondary tools in checking for citation mistakes. Both are limited in scope and thus do

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1. THE HARVARD LAW REVIEW ASS'N, A UNIFORM SYSTEM OF CITATION (14th ed. 1986) [hereinafter cited as the "BLUEBOOK"].

not check for many types of common citation errors. Any law office or journal that relied entirely on either program to check citations would probably be extremely embarrassed after the first document left the office.[2]

This review will first describe each program and its performance capabilities. It will then critically evaluate the usefulness of THE CITE CHECKER and CITERITE to legal practitioners, and will compare the pros and cons of each of the two programs. Finally, the review will suggest some features and capabilities of an "ideal" cite-checking program and will analyze THE CITE CHECKER and CITERITE in light of this "ideal."

I. DESCRIPTION OF THE TWO BLUEBOOKING PROGRAMS

A. THE CITE CHECKER

THE CITE CHECKER reads plain ASCII[3] text files rather than formatted word processing documents. THE CITE CHECKER reports citation errors to the screen and also stores the errors in a disk file. As it reads through a file, the program shows citations in the top third of the screen, errors in the bottom third, and status information in the middle. The user can select whether to have THE CITE CHECKER pause after each citation in a document is checked so that he or she can review the information generated by the program on the screen, or the user can simply have the program automatically check all the citations in a document and review the program's disk file afterwards in order to see where citation mistakes in the document were made. It is also possible to type citations directly into the cite-checking program in order to obtain an instantaneous response. When THE CITE CHECKER finds errors, users must either jot them down on a printed copy of the document, or print out the error message file. Either way, the user must reload a word processing program in order to edit the original document.

THE CITE CHECKER only checks case citations, essentially implementing many of the subsections of BLUEBOOK Rule 10. Statutes, services, books, and law review articles are completely ignored by the cite-

2. THE HARVARD LAW REVIEW ASS'N has issued Certificates of Assurance to both THE CITE CHECKER and CITERITE indicating that the software programs correctly implement BLUEBOOK rules. The tests performed by THE HARVARD LAW REVIEW ASS'N involved running a single test file through each program and apparently did not examine the computer-related aspects of the programs in detail. Telephone interview with Paul Engelmayer of the HARVARD LAW REVIEW (Jan. 9, 1987).

3. ASCII stands for "American Standard Code for Information Interchange," which is a standard character set for computers approved by the American National Standards Institute (ANSI).

checking program, as are BLUEBOOK Rule 4 (short citation forms) and Rule 5 (quotations). Because the ASCII standard does not allow for underlining or italicization, THE CITE CHECKER does not check these aspects of citations. The program also does not check capitalization (BLUEBOOK Rule 8) in citations, although ASCII text files maintain this information. THE CITE CHECKER does create a separate file containing a table of cases, however.

B. CITERITE

Although, like THE CITE CHECKER, CITERITE can cite-check an entire document file contained on a disk, it can also read text files created directly by nine popular word processing programs.[4] CITERITE has a memory-resident mode so that it can check on-screen citations at any time from within any of these word processing programs. Thus, the user can load CITERITE and any word processing program and can check and correct citations on the computer screen as he or she edits a document. The user must position the cursor over each citation to be checked and then must invoke CITERITE; the program cannot scan an entire screen at a time or detect citation errors as they are typed into a word processor. Since CITERITE knows about the formats of word processing files, it can also check for proper underlining and italicization. Like THE CITE CHECKER, CITERITE has an "immediate" mode which allows citations to be typed directly into the cite-checking program and immediately checked for accuracy.

Unlike THE CITE CHECKER, CITERITE requires that every citation in a file be preceded by a special control character. While the backslash symbol ("\") is normally used, any other character can be substituted. If the symbol is not placed before a particular citation, CITERITE will not check the citation. Of course, this special character must be removed before a document file is printed in final form.

CITERITE has a broader scope than THE CITE CHECKER. Besides case citations, it checks citations to statutes (BLUEBOOK Rule 12), services (Rule 18), constitutions (Rule 11), books (Rule 15), most law reviews (Rule 16), and some legislative, administrative, and executive materials (Rules 13 and 14). It does not handle newspapers or international citations. CITERITE also enables a user to add new reporters, treatises, and services to its dictionary. Thus, if citations are made frequently to a local or regional reporter, that citation form can be added to CITERITE. CITERITE does not create a table of cases or statutes.

4. CITERITE claims to know about the file and display formats used by WORDSTAR, WORDSTAR 2000, VOLKSWRITER, WORDPERFECT, XYWRITE (II+ and III), PC-WRITE, MULTIMATE, MICROSOFT WORD (2.0 and 3.0), and DISPLAYWRITE III.

II. AN EVALUATION AND COMPARISON OF THE TWO PROGRAMS

It is important to note at the outset that neither of these programs offer complete cite-checking capabilities. Both programs merely check legal citations for correct form according to the BLUEBOOK; they do not check the content or context of citations. Human labor is still needed to determine whether the citation and surrounding text make any sense. Furthermore, neither cite-checking program is capable of applying every BLUEBOOK rule, and neither program makes the actual corrections as it finds errors.

A. THE CITE CHECKER

THE CITE CHECKER is easy to operate, and thus most users will not need to spend more than a few minutes with its manual. In a test performed by the *High Technology Law Journal*, THE CITE CHECKER found more than half of the genuine errors in case citations, although it issued incorrect error messages for more than half of the correct case citations. Because it is limited to checking case citations, it misses far more than half of the BLUEBOOK errors in other citations. While THE CITE CHECKER detects most of the case citation mistakes in a typical memorandum or brief, it is imperative that every lawyer or student still spend time reviewing the citations in the documents themselves. THE CITE CHECKER could do far more harm than good by lulling the user into a false sense of security that a legal document contains only those citation errors which the software program locates and flags.

THE CITE CHECKER has a number of other problems, however. First, the cite-checking program often does not seem very "smart." THE CITE CHECKER occasionally created errors on its own. It consistently replaces the last character of every line with a space character, and then it complains about an imaginary extra space every time a citation is split across a line boundary, which comprised about half of all citations in the legal documents tested. At one point, THE CITE CHECKER also dropped the first character of a party name, turning "Synercom" into "ynercom," and it did not even notice that the resulting case name was not capitalized.

This error occurred in other files and cases as well. The program also has some difficulty determining exactly what is wrong with incorrect citations. While THE CITE CHECKER knew that a citation to "F. Supp"

was wrong, it could not determine why the citation was in error[5] and as a result failed to check the rest of the two-line citation.

Second, the program seems to be quite awkward in many respects. Each time THE CITE CHECKER is loaded, the user must wait while a logo is drawn and erased, and then must answer a list of option questions, such as whether or not the document should be checked for parallel pinpoint citations. Since these options will not be changed very often, there is simply no reason to ask them every time the program is loaded. Moreover, after a file is examined, THE CITE CHECKER terminates rather than allowing another file to be checked. Thus, to run the program on multiple files, THE CITE CHECKER must be reloaded repeatedly. Since THE CITE CHECKER erases its error message file each time it is loaded, that file must be renamed or printed before the next document is tested. Since it takes THE CITE CHECKER a long time to load in the first place, it should give users the option of checking more than one file at a time.

Another awkward aspect of THE CITE CHECKER is that it cannot check multiple files, so that it cannot examine a group of documents while its user is at lunch. Each file must be loaded separately. Also, unlike CITERITE, THE CITE CHECKER does not have a memory-resident mode and thus cannot check citations from within a word processing program. The user must reload a word processing program in order to correct any errors THE CITE CHECKER finds in the citations of a subject document.

Third, THE CITE CHECKER has some basic programming problems which need to be addressed by its authors. THE CITE CHECKER routinely failed while checking large files, delivering cryptic error messages when it did so.[6] Generally, THE CITE CHECKER "crashed" whenever it examined a file with more than about thirty citations, although it was not clear whether the number of citations or the length of the file (ten to fifteen pages) created the problem.

B. CITERITE

CITERITE is also easy to use, and is much less awkward in some respects than THE CITE CHECKER. Both cite-checking programs can check a document file and can also check citations typed into a computer

5. The correct citation form is "F. Supp." THE CITE CHECKER thought the citation was to a Federal Reporter (first) publication.

6. The error messages are not coming from THE CITE CHECKER but instead are being generated by Turbo Pascal, the programming language in which THE CITE CHECKER is written. This conclusion was deduced from the fact that the program file includes a hidden copyright message from Borland International, which publishes Turbo Pascal, and because the error messages are identical to those generated by other Turbo Pascal programs.

when the programs are in use. However, CITERITE also has a memory-resident mode that can check on-screen citations at any time from within a word processing program. As noted earlier, CITERITE claims to know about the file formats used by nine major word processing packages.[7] Like THE CITE CHECKER, CITERITE also echoes all its error messages to a disk file, but the memory-resident review mode eliminates any real need to utilize this feature.

CITERITE has a number of other advantages over THE CITE CHECKER. As noted earlier, CITERITE checks a much wider range of citations than THE CITE CHECKER, such as statutes, services, constitutions, books, law reviews, and some legislative, administrative, and executive materials. In addition, users who regularly cite to reporters, treatises, or services can add those works to CITERITE's dictionary. THE CITE CHECKER does not have a similar capability. Also, CITERITE, unlike THE CITE CHECKER, recognizes inaccurate punctuation in a citation. For example, THE CITE CHECKER became quite confused at citations to "123 P 456" or "123 Cal 456," claiming that it could find no jurisdictional clue, and thus stopped checking for other possible errors in those citations. In contrast, CITERITE recognized that only a period was missing and continued checking for additional citation errors.

Although CITERITE caught many more errors than THE CITE CHECKER, it still missed a few. For example, CITERITE had trouble with correct citations to "Cal. App. 2d Supp.," apparently considering them to be correct citations to "Cal. App. 2d," which is, of course, a different reporter series entirely.[8] Neither CITERITE nor THE CITE CHECKER checks dates completely, but both check to see that the case reporter was at least being published during the year cited.[9]

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7. *See supra* note 3. It remains to be seen whether this claim is entirely true. While CITERITE works with disk files created with Quicksoft's PC-WRITE, it did not recognize underlining in the files; every citation was incorrectly reported as not underlined. CITERITE did recognize underlining when the PC-WRITE citation was on-screen, however. CITERITE also recognized underlining in the WORDSTAR 2000 and MICROSOFT WORD files which were tested.

8. *See* BLUEBOOK at 139. A JURISoft programmer was concerned when this discovery was reported during a technical support call. Apparently, it was merely an oversight which should be repaired in all copies of the program delivered after our call. One advantage of CITERITE is that it offers technical support assistance by telephone. THE CITE CHECKER does not offer a similar service.

9. A citation to "Aa v. Bb, 123 U.S. 456 (1785)" was rejected by CITERITE with the following error message: "[f]ederal Supreme Court cases in 1785 are not found in any reporter in our dictionary; perhaps this reporter did not exist in 1785. See rule 10.4 and the tables in Part H." THE CITE CHECKER provided a more cryptic error message: "[n]o year found in last part of citation ending with '. 456 (1785)'. See Rule 10.5." Apparently, THE CITE CHECKER ignores dates before 1789. However, in response to an 1845 citation to "Cal.," THE CITE CHECKER recognized that the "[d]ate '1845' is out of range for this jurisdiction" and instructed the user to "[s]ee Table G" in the manual.

Both cite-checking programs also knew that a citation to "123 Cal. App. 2d 345

Unfortunately, CITERITE has one requirement which makes it very inefficient. Every citation in a file must be preceded by a special control character, such as a backslash symbol. If the special character is not inserted before a particular citation, CITERITE simply ignores that citation. Also, if the special character is inserted before the first of a string of citations separated by commas or semicolons, CITERITE stops its search after examining only the first citation. Many errors may be missed simply because a lawyer or typist neglects to insert the special character before every citation. Furthermore, this character must be stripped out of the file before its final printing. The need for a special citation flag would be slightly less troublesome if CITERITE included a utility program to remove the special characters from a file before a document is printed. Because CITERITE ignores citations that are not flagged, THE CITE CHECKER is a better program for checking case citations in final drafts of documents.

CITERITE is also awkward in another respect. Whether or not it is in the memory-resident mode, CITERITE utilizes only half of the screen. In effect, there are only nine lines of text, and CITERITE usually double-spaces so that only five or six lines are visible. Because less information is displayed at a given time, it takes the user longer to locate and correct flagged citations than if the entire computer screen were available. CITERITE also cannot check multiple files at one time. As with THE CITE CHECKER, each document file must be loaded separately.

III. AN "IDEAL" CITECHECKING PROGRAM

An ideal cite-checking program would probably correct errors as it detects them, a task which neither CITERITE nor THE CITE CHECKER can presently perform. Both programs require that a human user intervene to correct mistakes. An ideal cite-checking program would at least allow the user to correct each citation as errors are noticed, and would then recheck the new version of the citation before continuing. Although CITERITE's memory-resident mode allows any citation to be explicitly checked from within a word processing program, the user must ask the program to review each citation separately by pointing the cursor at every cite. CITERITE thus takes up the user's valuable time reviewing citations with no mistakes. Even the ability to check all the citations on a given screen would be a major improvement.[10] Alternatively, a cite-

(1980)" was erroneous. The correct citation should be "123 Cal. App. 2d 345 (1954)."

10. Since there are several commercial programs that perform similar tasks, such as checking the spelling of words on an entire screen or in a file, it should not be difficult to enable CITERITE to perform in such a manner.

It is also not clear why THE CITE CHECKER does not also have a memory-resident mode since there is literally no cost and very little time or effort required to make a Tur-

checking program might have an option to insert an error message or special character into the document file next to each incorrect citation so that locating and correcting citation errors would be much quicker.

The ideal cite-checking program would probably be an integral part of a word processing program. If cite-checking were included in such a program, the program could automatically require the use of a full citation when it first appears, and then could automatically insert short forms of the citation thereafter. If a new citation to a case were inserted before the previous full citation, the "ideal" program would automatically insert the full citation into its new place and reduce the next instance of the citation to a short form. The ideal program would also be able to check both the text of a document and a corresponding footnote simultaneously. Indeed, users of CITERITE and THE CITE CHECKER will be disheartened to discover that, since both programs only check complete citations, they currently ignore any instance in which a case name is included in the text and the matching citation is in a footnote. A well designed program could recognize cases already mentioned in a document and could insert the corresponding citation of the case, prompting for pinpoint page numbers.

The ideal program would also cross-check to see that multiple citations to a particular case are consistent throughout a legal document, would check short citation forms such as *"Id.* at 479" or "345 P.2d at 876," and would rearrange *"supra"* or *"infra"* terms when changes in a document were made. Neither CITERITE nor THE CITE CHECKER performs any of these functions. Also, neither program checks for proper handling of quoted materials. This is understandable, since both programs essentially ignore line spacing and indentation. However, the ideal program would automatically indent quotations of fifty words or more, and would merge shorter quotations back into the text.[11]

While CITERITE allows a user to rename and add reporters, law journals, and services to its dictionary, an ideal cite-checking program could be altered to conform to a particular law firm's internal citation style. Further, the ideal cite-checking program would create tables of cases and statutes as they were input into the computer. Although THE CITE CHECKER already automatically creates a crude table of case citations for every file it checks, it makes no effort to recognize that two citations are to the same case.[12] The ideal cite-checking program would

bo Pascal program memory-resident. Complete source code for that purpose is available in the public domain through many user groups and electronic bulletin boards.

11. *See* BLUEBOOK Rule 5.1.

12. "A v. B, 123 U.S. 456" and "A v. B, 123 U.S. 456, 460" are listed as separate citations in THE CITE CHECKER's table of cases.

also have an important capability not found in CITERITE or THE CITE CHECKER: it would flag certain key words and phrases that threaten to haunt every legal writer. Such popular phrases include "cite to authority," "find a case," "check Lexis," and "someone must have said this."

The future promises a program that will automatically get correct citations for cases through an online database service like AUTOCITE, although it is not likely that such an ideal program will be designed in the next few years. A program that would look up a case on a database service, cite to it correctly, Shepardize it and provide a warning message if the case has been overruled or criticized in a particular jurisdiction would be any legal writer's dream. Somewhat similar capabilities, integrating data on a CD-ROM (compact disk read-only memory), are available for specialized financial databases, and both West Publishing Company (WESTLAW) and Mead Data Central (LEXIS) are working on CD-ROM legal products. If a combined word processing/cite-checking program could interact with an optical disk and online database automatically, it would probably find a huge customer base.

Finally, if a program could perform complete BLUEBOOK cite-checking, which is doubtful in the very near future, the next hurdle to overcome would be to design a program which would style-check a legal document based on the rules of a respected style manual,[13] with the ability to alter the style rules to match a particular law firm's or publication's style requirements.

CONCLUSION

The bottom line is that while both THE CITE CHECKER and CITERITE can save a user time and money and can increase his or her cite-checking abilities, no user should rely solely on either program to ensure that documents are properly cite-checked. Neither program is worth its price if the end user does not recognize that the programs cannot be trusted to guarantee perfection.

CITERITE clearly checks for more types of citations and finds more citation errors than THE CITE CHECKER. The fact that CITERITE can be memory-resident also makes it easier to use than THE CITE CHECKER. On the other hand, THE CITE CHECKER can check any ASCII document, so writers need not remember to insert a special character before each citation. Despite its limited scope, THE CITE CHECKER is thus better for checking case citations in final draft documents.

13. *E.g.* THE CHICAGO STYLE MANUAL (13th rev. ed. 1982); U.S. GOVERNMENT PRINTING OFFICE STYLE MANUAL (1984).

Given the usual time pressures involved in completing a legal document, most law firms and law reviews will probably place too much reliance on these cite-checking programs. If a law firm or law review purchasing either THE CITE CHECKER or CITERITE does not already do careful cite-checking, its documents will be improved by the use of either program. If a law firm or law review already carefully checks citations and continues to carefully examine their citations even after the programs have performed their "magic," the programs will probably save their purchasers some time cite-checking. However, if a careful law firm or review significantly reduces the amount of human attention given to the cite-checking task when using either CITERITE or THE CITE CHECKER, the result will be more, not fewer, citation errors.[14]

14. Other reviews of these two software programs include: Boyle, *The Cite Checker*, THE LAWYER'S PC, Sept. 16, 1986, at 6; Moses, *Checking the Rules with CiteRite*, THE LAWYER'S PC, July 1, 1986, at 6; *New Software Program Relieves Tediousness of Citechecking*, ATTORNEY'S COMPUTER REPORT, Oct., 1986, at 1 (review of CITERITE).

LEGISLATIVE UPDATE

INTRODUCTION

Legislative Update is a survey of recent federal and state legislation relating to various aspects of high technology.[1] The survey is comprised of brief summaries of new federal and state laws grouped under appropriate topic headings and listed thereafter alphabetically by jurisdiction, with federal law preceding state legislation. Each summary ends with a citation to the new law.

Although *Legislative Update* includes a broad selection of new federal and state technology-related legislation, it is not intended to be comprehensive. In addition, the summaries do not mention aspects of the new laws that are of limited significance to *High Technology Law Journal* readers.

I. BIOTECHNOLOGY

Louisiana The Louisiana legislature has enacted a comprehensive scheme governing human *in vitro* fertilization. The Act provides that an ovum fertilized *in vitro* is a biologically human juridical person until implanted *in vivo*, possessing a legal identity apart from that of the medical facility where it is held and capable of suing or being sued. However, *in vitro* fertilized ova possess no inheritance rights against their genetic parents under the Act, though they may assert claims vesting at live birth against the estates of their adoptive parents. Having ascribed the *in vitro* fertilized ovum a juridical entity, Louisiana then cloaks it in further protective legislation: the ovum may not be destroyed, owned, sold, or used for any purpose other than the "complete development

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1. *High Technology Law Journal* wishes to thank Information For Public Affairs of Sacramento, California for providing us with access to their comprehensive computerized database of state legislation.

of human *in utero* implantation." Moreover, persons associated with *in vitro* fertilization are charged with the affirmative duties owed to the ovum. Thus, any physician or facility causing fertilization is "directly responsible" for an ovum's "safekeeping," and the patients who fertilized the ovum "owe it a high duty of care and prudent administration." Act of Aug. 30, 1986, No. 964, 986 La. Sess. Law Serv. 346 (West) (to be codified at LA. REV. STAT. ANN. §§ 9:121–133 (West Supp. 1986)). For a general article providing insight into the motivation behind this legislation, *see* Lorio, *Alternative Means of Reproduction: Virgin Territory For Legislation*, 44 LA. L. REV. 1641 (1984).

II. HIGH TECHNOLOGY AND CRIME

A. Computer Crime

United States The Computer Fraud & Abuse Act of 1986 makes computer fraud, information destruction, and password trafficking federal crimes. It is now a felony to commit an unauthorized act of computer trespass into a "federal interest computer" with the intent to defraud. A "federal interest computer" is defined as any computer used exclusively by the federal government or by a financial institution, or any computer used by the government or a financial institution whose operation is affected by the trespasser's conduct. Any computer trespass in a federal interest computer that causes a loss in excess of $1,000 or which "potentially" modifies or impairs an individual's medical records is also a felony. All of the above felonies are punishable by up to five years in prison or a $100,000 fine, or both. The new law also makes it a misdemeanor to traffic in computer passwords with an intent to defraud, or to disclose similar information without authorization if such trafficking affects interstate or foreign commerce or if the accessing of a federal interest computer is involved. This latter provision is intended to protect large business computer networks by discouraging "pirate bulletin boards," in

which "hackers" exchange secret codes to gain unauthorized computer access.

A more limited computer fraud statute was enacted in 1984, but this earlier law only provided criminal penalties for stealing national security data or for trespassing into government computers for the purpose of obtaining information pertaining to an individual's credit history. The new law asserts federal jurisdiction where there is a "compelling federal interest," reflecting a congressional intent that states handle most computer abuse crimes. Computer Fraud and Abuse Act of 1986, Pub. L. No. 99-474, 100 Stat. 1213 (to be codified as amended at 18 U.S.C. §§ 1030(a), 1030(a)(2)-(3) (1986)).

Louisiana

It is now a criminal offense to (1) transfer an access device to another person with an intent to defraud, (2) possess an access device of another person without authorization and with an intent to defraud, or (3) possess or transfer a counterfeit access device or any equipment used to produce counterfeit devices with such intent. An "access device" is defined as any code, account number, plate, or other means of access to a financial account. An "access device" thus includes credit cards or ATM access cards within its domain. Any violation of these provisions is punishable by a fine of not more than $2,000 or imprisonment for not more than two years, or both. Previously, prosecutions for such acts of fraud or theft were made either pursuant to conspiracy statutes, which required an overt act, or pursuant to theft statutes, under which there was ambiguity as to whether the item stolen had any inherent value. Act of July 2, 1986, No. 555, 1986 La. Sess. Law Serv. 56 (West) (to be codified at LA. REV. STAT. ANN. § 14:70.4 (West 1986)). Separate legislation provides criminal penalties for persons who provide false information in attempting to obtain an access device. Act of July 10, 1986, No. 871, 1986 La. Sess. Law Serv. 36 (West) (to be codified as amended at LA. REV. STAT. ANN. § 14:70.2 (West 1986)).

Oklahoma It is now unlawful to communicate with, store data in, or retrieve data from a computer network for the purpose of using such access to violate any Oklahoma statute. Violation of this provision is a felony punishable by a fine of not more than $5,000 or imprisonment for not more than five years, or both. Act of Mar. 21, 1986, ch. 26, 1986 Okla. Sess. Laws 48 (second regular session) (to be codified at OKLA. STAT. tit. 21, § 1124 (Supp. 1986)).

Utah The Utah Computer Fraud Act of 1979 has been repealed and reenacted as the Utah Computer Crimes Act. It is now a felony to intentionally gain or attempt to gain access to computer-related property without authorization, and to damage, alter, tamper with, modify, or disclose the contents of such property. If the amount of damage is less than $1,000, however, the offense is reduced to a misdemeanor. The use of computers in performing any of the above acts is also a felony. In addition, using or knowingly permitting another to use a computer or computer-related property to devise or execute a scheme to defraud is a felony. Computer-related property includes networks, systems, programs, software, and other computer property. It is a misdemeanor to intentionally interfere with or interrupt the provision of computer services to someone entitled to receive them. Computer Crimes Act of 1986 (codified as amended at UTAH CODE ANN. § 76-6-705 (1986)) (repealing and reenacting UTAH CODE ANN. § 76-6-703 (1985)).

B. Proprietary Rights

California The California Penal Code has been amended to include computer software in its protection of proprietary information rights. Originally, section 653w of the Penal Code only protected rights in various sound recording media by requiring that the package in which such a recording is sold disclose the name of the performer and the name and address of the manufacturer. The definition of "recording" has been amended to include all "tangible media upon which information . . . or images are . . . stored." Knowing or intentional failure to

make disclosure for commercial advantage or private gain subjects an offender to a fine not to exceed $5,000 or imprisonment for not more than six months, or both. Act of July 15, 1986, ch. 367, 1986 Cal. Legis. Serv. 294 (West) (codified as amended at CAL. PENAL CODE § 653w (West Supp. 1986)).

C. Theft of Services

Nebraska A statute making the unauthorized use of telecommunications services a crime has been amended to specifically include cable television services. The new law also makes it a misdemeanor to knowingly make, possess, sell, advertise for sale, or tamper with devices used to fraudulently obtain unauthorized telecommunications services. Act of Mar. 28, 1986, 1986 Neb. Laws 464 (codified as amended at NEB. REV. STAT. § 28-515 (1986)).

Tennessee Existing provisions in the Tennessee Code regarding the theft of telecommunications signals have been enhanced. Under new amendments, the mere presence of an unauthorized cable tap is *prima facie* evidence of an intent to steal. Theft of a signal from a "microwave multi-point distribution system station" ("MDS") is also explicitly prohibited by the statute. An MDS is a system wherein signals are picked up from a satellite and relayed by microwave signals from a tower transmitter to home receivers. The new amendments also delete a subsection of prior law which specifically exempted satellite reception dishes from the provisions of the cable television signal theft laws. Act of July 1, 1986, 1986 Tenn. Pub. Acts 59 (codified as amended at TENN CODE ANN. § 39-3-1136(a)-(g) (West Supp. 1986)).

D. Electronic Surveillance, Databases, and Privacy

United States The Electronic Communications Privacy Act of 1986 updates and expands existing federal wiretap law by protecting the privacy of both aural and data communications transmitted via modern communications devices. The statute extends the protections currently enjoyed by telephone communications to nearly all types of electronic communications, thereby outlawing eavesdropping on electronic mail networks, computer-to-computer data transmissions, remote computing services, private video conferences, and cellular car telephone conversations. However, the radio portion of cordless telephone conversations, tones transmitted to paging devices, specified transmissions via audio subcarrier, and satellite transmissions of satellite cable programming are exempt from protection under the statute. Also exempt under the law is any other radio communication made through an electronic communications system that is "readily accessible to the general public," such as aeronautical, marine, or public emergency transmissions that can be received by a ham radio.

The Act establishes both civil and criminal penalties for the willful and unauthorized interception of private electronic communications. Individuals who gain unauthorized access to protected communications systems for purposes of commercial advantage, malicious destruction, or private commercial gain will be subject to fines of up to $250,000 (organizations may be fined up to $500,000) or a prison sentence of up to five years, or both. If the crime committed under the statute (1) is a first offense, (2) is not for a tortious or illegal purpose, and (3) the interception involves a radio transmission other than a cellular telephone conversation, the violator is subject to a fine of up to $100,000 and a prison term of not more than a year, or both. If the interception involves a cellular telephone call, the individual is subject only to a $500 fine for a first offense. Civil penalties consist of the greater of actual damages plus any profits made by the violator, or $10,000. Furthermore, the Act provides protection for stored electronic communications, such as electronic mail messages which are stored

on the service provider's computer for long periods of time.

The Act also protects customer privacy by limiting the circumstances in which a service provider can make disclosures of communications. Providers of communications may not disclose a communication to any person other than the intended recipient of the communication under threat of criminal and civil penalties. Of course, communications may be disclosed if the disclosure is incident to the rendition of the communications service. The Act does allow service providers to give federal law enforcement officials access to an individual's electronic communications if such officials first obtain a warrant (or a court order under specified circumstances). Cooperating service providers are protected from any civil actions arising from compliance with such court orders. The Act also has provisions governing the use of pen registers and mobile tracking devices by law enforcement officials. The Act was intended to adapt federal wiretap law, primarily title III of the Omnibus Crime Control and Safe Streets Act of 1968, 18 U.S.C. §§ 2510 *et seq.*, to recent technological advances in the communications industry. Electronic Communications Privacy Act of 1986, Pub. L. No. 98-473, 99-508 (to be codified as amended at 18 U.S.C. §§ 2232, 2510-2513, 2515-2520 and codified at 18 U.S.C. §§ 2520-2521, 2701-2710, 3117, 3121-3126 (1986)).

Arkansas Legislation passed in 1985, which required the issuance of a judicial *ex parte* order prior to the interception of certain wire or oral communications by investigative or law enforcement agencies, has been repealed. The efforts of law enforcement were determined to be severely hampered by the old law. Act of Apr. 30, 1986 (second extraordinary session), Act No. 1 (repealing ARK. STAT. ANN. §§ 41-4501, -4509 (1985)).

Louisiana It is now a criminal offense to manufacture, assemble, sell, offer for sale, advertise for sale, possess, transfer, import, or furnish to another any device which is primarily or exclusively designed or intended for eavesdropping on or recording of the confidential communications of another. Violation of these provisions is

punishable by a fine of not more than $2,000 or imprisonment for not more than one year, or both. Act of June 23, 1986, No. 96, 1986 La. Acts 7 (to be codified at LA. REV. STAT. ANN. § 14:323 (West 1986)).

Louisiana It is now a crime to willfully eavesdrop upon or record a confidential communication by means of any electronic amplifying or recording device without the consent of all parties to the communication. No information obtained by violating this statute will be admissible in any judicial, administrative, legislative, or other proceeding except as proof in a prosecution for violation of this statute. However, the law does not apply to law enforcement agencies or their authorized agents. Act of June 23, 1986, No. 97 (to be codified at LA. REV. STAT. ANN. § 14:323 (West 1986)).

III. TECHNOLOGY AND DEVELOPMENT

A. Technology Transfer and Intellectual Property

United States The Japanese Technical Literature Act of 1986 directs the Secretary of Commerce to establish and maintain a program, both in the United States and Japan, to monitor Japanese technological activities. The law also provides for the translation of selected Japanese technical documents and the compilation of a directory listing all programs and services that collect, abstract, translate, and distribute Japanese technical information in the United States. Additionally, it directs the Secretary to consult with United States businesses, professional societies, and libraries regarding their informational needs on Japanese technology. The new law amends section 5 of the Stevenson-Wydler Technology Innovation Act of 1980, 15 U.S.C. § 3704, which was intended to facilitate technological advances in the United States. Japanese Technical Literature Act of 1986, Pub. L. No. 99-382, 100 Stat. 781 (to be codified as amended 15 U.S.C. § 3704 (1986)).

Arizona The policies of the Arizona Board of Regents have been changed to allow the liberalized transfer to private sector entities of technology developed by university employees. The new legislation essentially requires the disclosure to the Board of (1) potential relationships between university employees and technology transferees, and (2) the benefit or detriment to the state and university of such relationships. Any such relationship must be approved by the Board. The Act also allows the state institution to share in the proceeds of any patent, licensing, or royalty rights which it grants. Act of Apr. 9, 1986, 198 Ariz. Legis. Serv. 839 (to be codified at ARIZ. REV. STAT. ANN. § 41-1509 (1986)).

Louisiana The Code of Governmental Ethics has been amended to encourage the development of new technology by state employees. Section 1101 of the Code, LA. REV. STAT. ANN. § 42:1101(B) (West 1965), announced the state's general rule that "public . . . employment not be used for private gain." The new law liberalizes this policy by creating an exemption from section 1101 for the "receipt of or sharing in the proceeds of any patent, copyright, licensing right, or royalty" by faculty and staff of state institutions of higher learning. The new exception applies only to activities consistent with a university's mission and approved by the employing campus' president and management board. Act of July 2, 1986, No. 374, 1986 La. Sess. Law Serv. 409 (West) (to be codified at LA. REV. STAT. ANN. § 42:1123(9) (1986)).

B. Employee Competition

California Any employee can now be required to assign, or offer to assign, his or her rights to an invention which, at the time of conception or marketing of the invention, (1) results from any work performed by the employee for the employer, or (2) relates to the business, actual, or anticipated research goals of the employer. Any invention developed on an employee's own time without the use of the employer's equipment, supplies, facilities, or trade secret information cannot be required to be assigned or offered to be assigned by contract. Act of July

15, 1986, ch. 346, 1986 Cal. Legis. Serv. 237 (West) (to be codified at CAL. LABOR CODE § 2870(a)(1) (1986)).

C. Technology and Government Agencies

United States The Secretary of Agriculture has been authorized to make grants to public and non-profit institutions to operate centers of rural technological development. The purpose of this legislation is to stimulate the economies of rural areas suffering from high unemployment, low incomes, and few industries and agribusinesses. Rural Industrial Assistance Act of 1986, Pub. L. No. 99-409, 100 Stat. 923 (to be codified as amended at 7 U.S.C. §§ 1932(a), 1932(f)(1)- (3) (1986)).

California The University of California is requested to establish an experimental technology transfer and education project under its aegis to initially serve five Bay Area counties. The project, which may continue through July 1, 1990, will provide assistance to small and medium-sized businesses on a sliding scale fee-for-service basis. The project will seek to provide the following services: (1) technology education to familiarize business owners with the business opportunities available to them because of the development of new technologies; (2) technology assessments and any other advice and assistance which might be appropriate to aid small businesses which produce scientifically-based products; (3) technology development and transfer studies to adapt technological advances to the needs of small businesses; and (4) an inner-city small business technology service which will assist minority inner-city enterprises in identifying their needs and potentials for using new technologies. Act of Aug. 28, 1986, ch. 595, 1986 Cal. Legis. Serv. 199 (West) (to be codified at CAL. EDUC. CODE §§ 92680-92687 (1986)).

Kentucky The Office of Business and Technology (the "Office") has been created within the Office of the Commerce Cabinet. The Office will be responsible for coordinating and monitoring the various activities of state agencies which relate to the adaptation of advanced technologies to the workplace. The Office will also study the

possibility of establishing research and technology centers in the state. Act of Jan. 22, 1986, 1986 Ky. Acts 228 (codified as amended at KY. REV. STAT. ANN. § 12.020 (Michie/Bobbs-Merrill 1986)).

D. Governmental Venture Capital Corporations

Connecticut The Connecticut Product Development Corporation has been given the power to enter into limited partnerships and other contractual arrangements with the private sector to provide financial assistance to Connecticut ventures during the early stages of their development. The purpose of this legislation is to encourage additional capital investment, the establishment of new businesses, the creation of new jobs, and increased commercially-oriented research and development. Act of June 22, 1986, Pub. Act No. 86-255, 1986 Conn. Legis. Serv. 20 (West) (codified at CONN. GEN. STAT. §§ 32-36 and 32-39a (1986)).

Kansas Kansas Technology Enterprise Corporation ("KTEC") has been created to (1) finance basic research, applied research and development, and technology transfer at educational institutions; (2) award applied research matching grants to private enterprises and educational institutions; (3) provide seed-capital financing to emerging businesses in Kansas; and (4) provide technical referral services to all businesses within the state. KTEC is also authorized to establish Centers of Excellence for basic research, applied research, and technology transfer at educational institutions in the state. Finally, KTEC has been directed to develop a matching-grant program for innovative research by small businesses. Act of May 8, 1986, ch. 284, 1986 Kan. Sess. Laws 1513 (codified at KAN. STAT. ANN. § 74-8101 (1986)).

Nebraska The Research and Development Authority has been created to promote innovation in existing and new Nebraska industries, and to create and maintain employment in "areas of importance in the state's economy." The Authority is empowered (1) to provide financial assistance through contracts, grants, equity investments, and loans to technological research and development

projects which are likely to lead to commercialization; (2) to establish incubator facilities across the state to assist entrepreneurs and enterprises; and (3) to develop a communications network and database cataloging various types of assistance available to new and established companies. Act of Apr. 18, 1986, Legis. Bill 850, 1986 Neb. Laws 1259 (codified at NEB. REV. STAT. §§ 58-401 -439 (Supp. 1986)).

New Mexico The Research and Development Institute ("Institute") has been created (1) to implement a research and development plan for state support of technologies and products which offer the "greatest opportunities" for economic development in the state, and (2) to acquire applied research and development funds from sources other than state government. The Institute will replace the Energy Research and Development Institute ("ERDI"). The new Institute will receive any funds held by ERDI, but also will be bound to ERDI's contracts and duties. Act of Feb. 28, 1986, ch. 38, 1986 N.M. Laws 811 (codified at N.M. STAT. ANN. §§ 9-15-16 to -15-26 (1986)); (repealing N.M. STAT. ANN. §§ 71-4-9 to -4-20 (1978) and amending N.M. STAT. ANN. § 9-15-13 (1978)).

New Mexico Four million dollars has been appropriated for technical centers in the state. Of this total, $3.9 million will go to the Technical Excellence Centers in the Rio Grande research corridor which were established in 1983 to provide research centers for advanced technologies, including research involving high technology materials, diagnostic techniques in medicine, computer applications, genetic engineering, and explosive technology. The remaining $100,000 will go to the Technological Innovation Center, which assists inventors and technology development companies in planning, financial packaging, resource acquisition, cooperative ventures, and other areas. Act of Feb. 28, 1986, ch. 37, 1986 N.M. Laws 808 (codified as amended at N.M. STAT. ANN. § 21-19-9 (Supp. 1986) (Technical Excellence Centers) and N.M.

STAT. ANN. § 21-19-8 (Supp. 1986) (Technological Innovation Center)).

Tennessee The Tennessee Economic Development Corporation ("TEDC") was created and authorized to make investments of seed capital in enterprises located in economically depressed areas of Tennessee. The purpose of the corporation is to create jobs for the state's residents. Investment by TEDC is limited to $500,000 per enterprise and this investment must comprise less than 50% of the capital in the enterprise. In addition to repayment of these loans, participating enterprises are required to contribute 5% of their profits to TEDC. Act of July 1, 1986, ch. 867, 1986 Tenn. Pub. Acts 342 (codified at TENN. CODE ANN. §§ 4-17-101 to -111 (West Supp. 1986)).

Vermont The Vermont Venture Capital Corporation ("VVCC") was created to provide investment capital, especially equity capital, to new and existing Vermont firms which may not be able to obtain such financing from other sources. The Act also establishes a limited tax credit for investors in VVCC. Act of May 7, 1986, No. 171, 1986 Vt. Acts 264 (codified at VT. STAT. ANN. tit. 10, §§ 281-285; tit. 32, § 5830(b); tit. 16, § 1943(a)(3); tit. 3, § 472(a)(3); and tit. 24, § 5063(a)(3) (1986)).

IV. TELECOMMUNICATIONS

A. Regulation of Telecommunications Corporations

United States The Low Power Cable Television Station Act of 1986 clarifies the definition of "local service area" for low power television stations. The new law allows cable television networks to carry low power television signals as local broadcasts rather than as distant signals. It also modifies the cable compulsory license section of the Copyright Act, 17 U.S.C. § 111, in order to eliminate the notice of identity and the notice of change requirements for cable television systems. Act of Aug. 27, 1986, Pub.

L. No. 99-397, 100 Stat. 848 (to be codified as amended at 17 U.S.C. § 111(d) and (f) (1986)).

Nebraska Telecommunications companies which provide services within the state will now be regulated by the Public Service Commission ("PSC") in order to provide for the orderly and effective development of the industry. The PSC is empowered to certify and license local and long distance companies doing business in the state and may require performance bonds to protect consumer advances or deposits held by telecommunications companies. The PSC is also empowered to waive, limit, or remove licensing and other administrative requirements not established by statute when it will benefit the public interest, and may revoke such waivers, limitations, and exemptions when it deems appropriate. Rate increases may be initiated *sua sponte* by the PSC or by consumers. The bill exempts one-way broadcast transmissions of radio or television signals, cable television transmissions, and mobile radio, radio paging, and cellular services from PSC regulation. The new law preempts all regional and local regulation of telecommunications companies. Act of Apr. 18, 1986, Legis. Bill 835, 1986 Neb. Laws 835 (codified as amended at NEB. REV. STAT. §§ 75-109, 75-604, 75-609 (1986)).

Wisconsin A variety of code sections have been amended substituting terms such as "telecommunications utility" in place of "telephone company" in order to explicitly manifest the authority of the Public Utilities Commission ("PUC") over the entire spectrum of telecommunications and information services. However, telecommunications companies with intrastate gross operating revenues exceeding $100,000,000 are not required to obtain written approval of their contracts from the PUC when the amount of the contract does not exceed $100,000. The statute includes most telecommunications facilities within the definition of "public utilities," but excludes telecommunications cooperatives and certain small telecommunications facilities. Specific amendments thwart the possibility of monopolization in the telecommunications industry by stipulating the holdings which non-local telecommunications companies can maintain. Act of Apr. 25, 1986, Act No. 297 (vetoed in part), 1985

Wisc. Laws 1294 (codified as amended in scattered sections of WISC. STAT. ANN. (West Supp. 1986)).

B. Telecommunications for State Agencies

Connecticut The State Office of Information and Technology (the "Office") has been established within the Office of Policy and Management. The Office is responsible for developing a comprehensive strategy by February 1, 1988, for implementing state telecommunications goals, which are to include the following: (1) the creation of a telecommunications system to serve state agencies; (2) the provision of emergency telecommunications capabilities sufficient to support state functions; and (3) the implementation of statewide 911 and E-911 systems. The bill also creates a state agency information and advisory committee composed of designees from state agencies, and a private sector information and technology advisory committee composed of representatives from private sector entities which have large information systems, in order to assist the Office in developing these telecommunications goals. Act of June 4, 1986, Pub. Act No. 86-292, 1986 Conn. Acts 292 (codified at CONN. GEN. STAT. §§ 16a-110 to -112 (1986)).

Indiana The development of a statewide telecommunications network has been authorized, to be overseen by an administrative body known as the Intelenet Commission. The Commission will "design, develop, contract for, and manage a statewide integrated telecommunications network . . . to telecommunicate documents, pictures, data, sounds or other symbols from place to place." The system will be for the exclusive use of state agencies, schools and state universities, non-commercial television and radio companies, political subdivisions, other users specified in the statute. The Commission was created in response to the increasing telecommunications requirements of various Indiana state agencies. Act of Mar. 7, 1986, Pub. L. No. 54-1986, 1986 Ind. Acts 847 (to be codified at IND. CODE ANN. § 5-21 (West 1986)).

C. Taxation of Telecommunications

Connecticut

A six and a half percent tax has been imposed on gross receipts earned from providing competitive telecommunications services. Equipment used to provide competitive services is also subjected to the local personal property tax. Under prior law, all telecommunications companies were subject to a nine percent tax and their equipment was exempt from property tax. Under this statute, the nine percent tax and the personal property tax exemption continue only for rate-regulated monopoly services and equipment.

Regulated telecommunications companies are required to pay two-ninths of their nine percent gross receipts tax on monopoly services directly to the towns in which they operate. Payments are to be apportioned according to each town's share of the company's total number of resident and business basic telephone exchange lines. The statute also sets up a procedure for apportioning among towns the taxable personal property of a company which provides both competitive and monopoly telecommunications services. Finally, the Act makes conforming and clarifying changes in the law imposing the gross receipts tax on telephone, telegraph, cable express, and cable television companies.

The Act is intended to address recent advances in telecommunications technology, the divestiture of AT&T, and the entry of competition into the telecommunications field. The law is also intended to stop the multiple taxation of carrier access charges and any other charges unique to interconnecting the local telecommunications companies with long distance carriers. These charges were previously taxed twice, once in the earnings of the long distance carriers and again in the earnings of the local telecommunications companies. Act of June 4, 1986, Pub. Act No. 86-410, 1986 Conn. Legis. Serv. 357 (West) (codified as amended at CONN. GEN. STAT. §§ 12-255(a)-(s), 12-256(a)-(c), 12-258, 12-268(j) (1986)).

Louisiana Previous law relating to the lease-procurement of telecommunications equipment has been amended and re-enacted to provide that the terms of such procurement shall not exceed ten years. Previously, such terms were not to exceed five years. The amendments were intended to maximize the state's tax flexibility and were enacted in response to the useful working life schedules of the Internal Revenue Service imposed upon equipment procured by the state, which often exceeded five years. Act of July 10, 1986, No. 778, 1986 La. Sess. Law Serv. 643 (West) (codified as amended at LA. REV. STAT. ANN. §§ 39:1752(3), 39:1753(C)(3) (West 1986)).

Maine New law requires that every person providing telecommunications services pay an annual excise tax. The Act defines telecommunications services to include the transmission of any interactive, two-way electromagnetic communication, including voice, image and data transmissions made via wires, cables, optical waves, light waves, or any combination of these or similar media. Telecommunications services include telegraph services, but they do not include value-added non-voice services in which computer processing applications are used to act on the form, content, code, and protocol of the information to be transmitted (unless those services are provided under tariff approved by the Public Utilities Commission). The Act, is intended to modernize the state's excise tax by extending the tax to MCI, SPRINT, and the other telecommunications companies that have entered the market since the AT&T divestiture. Previously, the excise tax applied only to AT&T and NET. Act of Apr. 11, 1986, ch. 651, 1986 Me. Legis. Serv. 1 (codified at ME. REV. STAT. ANN. tit. 36, §§ 2691-2696 (1986)).

New York Equipment used in the transmission of news wire services is excluded from real property tax. Such equipment will now be treated in the same manner as equipment used in the transmission of television, cable television, or news and entertainment radio signals. Act of May 21, 1986, ch. 822, 1986 N.Y. Laws 1946 (codified as amended at N.Y. REAL PROP. TAX LAW § 102.12(i) (McKinney Supp. 1986)).

V. CONSUMER PROTECTION AND ELECTRONIC EQUIPMENT

A. Sales and Warranties of Electronic Equipment

Connecticut To protect consumers from "gray market merchandise," retailers and mail-order businesses who knowingly sell such goods must disclose that their merchandise is *not* (1) accompanied by a manufacturer's warranty, (2) eligible for a rebate offered by a manufacturer, or (3) accompanied by instructions in English if such is the case. Violation of the Act is deemed an unfair or deceptive trade practice under Connecticut law and entitles a consumer to return unused and undamaged goods for a refund within twenty days of purchase. "Gray market merchandise" is defined as any brand-name consumer product normally accompanied by a valid warranty which is imported through channels other than the manufacturer's authorized distributor and which may not be accompanied by a valid manufacturer's warranty. Retailers who provide written warranties offering equal or greater protection than the manufacturer's warranty and backed by a financially sound warrantor are exempt from the law. Act of May 2, 1986, Pub. Act No. 86-302, 1986 Conn. Acts 302 (codified at CONN. GEN. STAT. § 42-210 (1986)).

B. Regulation of Electronic Repair Dealers

California The Electronic and Appliance Repair Dealer Registration Law was amended to include dealers who install and replace electronic devices such as computers or satellite receiving equipment. The amendments also require that estimates be made for all repair work or installation of electronic devices and appliances before such work begins. Act of June 26, 1986, ch. 207, 1986 Cal. Legis. Serv. 66 (West) (codified as amended at CAL. BUS. & PROF. CODE §§ 9801, 9806, 9841, 9842, 9844, 9844.5, 9852; and codified as amended at CAL. BUS. & PROF. CODE § 9844.1 (West 1986)).

VI. TECHNOLOGY AND GOVERNMENT SERVICES

A. Technology and Education

New Mexico An appropriation has been made from the general fund, to be matched by funds from private corporations and participating school districts, to support Project Uplift. The project will expose high school students in the state to "high technology preparedness training," career information, and site visitations. Act of Mar. 3, 1986, ch. 59, 1986 N.M. Laws 901.

B. Government Procurement

New Mexico The Information Systems Act was enacted to coordinate state agency information systems and to provide an organized purchasing and recording system. Under the Act, the Information Systems Council has the duty to develop an annual master plan specifying the policy and direction with which state agencies must comply to various automated systems development and support standards and data base management standards. The Council will serve as the central purchasing agent for information systems resources. Also, the new law creates revolving funds under the auspices of the state treasury for the purpose of acquiring and replacing data processing and communications equipment. Finally, state agencies and other users of state data processing and communications equipment must pay monthly depreciation and replacement fees for the use of such equipment. The Information Systems Act, ch. 81, 1986 N.M. Laws 993 (codified at N.M. STAT. ANN. §§ 15-1-1 to -1-13 (1986)) (repealing N.M. STAT. ANN. §§ 15-1-1 to -1-10, 15-2-6, 15-2-7 (1978)).

South Carolina The Tax Commission is now authorized to contract for computer and other electronic data processing services. Also, information contained in or produced from any tax return, document, or tape must not be published or disclosed, except to the commission or as provided by law. The Act provides penalties for violating the latter provisions. Act of Mar. 7, 1986, 1986 S.C. Acts 2032

(codified at S.C. CODE ANN. § 12-3-260 (Law. Co-op Supp. 1986)).

C. Electronic Voting

New York Voting machines which have removable electronic or computerized devices which record the total votes cast on such machines may now be used after the close of polls to provide unofficial primary or general election tally results. Act of July 1, 1986, ch. 262, 1986 N.Y. Laws 447 (codified as amended at N.Y. ELEC. LAW §§ 1-104(29)-(31), 3-222, 7-104(4)(b), 7-104(7), 7-200 to -208, 9-102, 9-120, 9-126 (McKinney Supp. 1986)). Furthermore, the state Board of Elections must promulgate rules and regulations setting minimum standards for computerized record keeping systems maintained by the Board of Elections in each county in order to facilitate compatibility between the systems used by the various county and state Boards. Act of July 17, 1986, ch. 425, 1986 N.Y. Laws 877 (codified as amended at N.Y. ELEC. LAW § 3-103 (McKinney Supp. 1986)). *See also* Act of July 21, 1986, ch. 425, 1986 N.Y. Laws 877 (codified as amended at N.Y. ELEC. LAW §§ 3-220(6), 4-134(2), 5-506, 8-304(1) -(2), 8-306(3) (McKinney Supp. 1986)).

VII. TAXATION[2]

A. Sales, Use and Property Taxation

Idaho The definition of tangible personal property subject to sales and use taxes has been expanded to include computer software. However, custom computer programs are considered intangible personal property and are excepted from this provision. A custom computer program is defined as software written or modified specifically for the owner. The change is enacted to avoid the extended litigation that has affected other states concerning the taxation of software. Act of Apr. 2, 1986, ch. 192, 1986

2. *See also supra* at *Legislative Update* § I(D) (Taxation of Telecommunications).

Idaho Sess. Laws 488 (codified as amended at IDAHO CODE § 63-3616(b) (Supp. 1986)).

South Carolina

From July 1, 1986 to June 30, 1991, the maximum sales or use tax to be levied on each item of machinery purchased for research and development purposes is $300. Such machinery must be used directly and exclusively for experimental and laboratory purposes in developing new products, designing new uses for existing products, or improving existing products. The machinery must also be located in a separate facility devoted to research and development.

In addition, the facilities of all new enterprises engaged in research and development and all additions to existing facilities of research and development enterprises valued at $50,000 or more are now exempt from *ad valorem* taxation. This exemption is applied in the same manner as the existing exemption to new manufacturing establishments: the exemption includes machinery and equipment installed in the facility, but it does not include exemptions from school or municipal taxes. Eligibility for this exemption is conditioned upon meeting the same limitations outlined above concerning sales and use taxes. Act of Mar. 7, 1986, 198 S.C. Acts 550.

B. Corporate Income Tax Incentives

Louisiana

The State Board of Commerce and Industry is now empowered to offer a $5,000 tax credit to aviation and aerospace industries in the state for each new job created. This credit is in lieu of the $2,500 tax credit per net new employee given to companies in other industries. The aviation and aerospace industry tax credit may be applied to any state income or franchise tax liability within the next ten years. The purpose of the legislation is to provide the Board with another incentive to attract aviation and aerospace industries into the state. Act of July 8, 1986, No. 701, 1986 La. Sess. Law Serv. 443 (West) (codified as amended at LA. REV. STAT.

ANN. §§ 51:1787(A)(2), 51:1787(C)(2) (West Supp. 1986)).

Mississippi Mississippi's Advanced Technology Initiative Act of 1984 has been amended and expanded to embrace high technology businesses. The Act, which provides sales and use tax exemptions, employment based tax credits, and industrial revenue bond finance assistance, originally applied only to certain enumerated industries. It now covers any new or existing business expanding into an area which has been determined by the state's Board of Economic Development to be of an advanced technology nature. Act of Mar. 24, 1986, ch. 376, 1986 Miss. Laws 144 (codified as amended at MISS. CODE ANN. § 57-54-5 (Supp. 1986)).

RESEARCH PATHFINDER

EXPERT SYSTEMS AND LAW †

INTRODUCTION

This pathfinder is a research guide to materials which address the various legal issues raised by the emerging viability of computerized expert systems. Although this guide attempts to overview the issues critical to the evolution of this unique area of the law by cataloging and annotating applicable statutes, cases, texts, articles, notes, and comments, it is not exhaustive.

The development and use of expert systems within society raises new and important questions of law. How will tort and contract law be applied to expert systems? What role will expert systems play in the practice of law? What proprietary rights will inure to the developers, manufacturers, and owners of expert systems and from the output of those systems? Finally, what forms of product approval and administrative regulation will expert systems be subject to?

This pathfinder is divided into four sections. Part I will focus on legal issues of tort and contract liability stemming from the development, sale and use of expert systems. Part II addresses the past, present and future role of expert systems as tools in the legal profession. Part III concerns itself with legal issues of ownership both of expert systems and their output. Finally, Part IV focuses on the subject of administrative regulation of expert systems and their developers.

Each section is further subdivided by topic or by type of source material, and begins with a short introduction summarizing the legal issues relating to expert systems which are currently at the forefront of this emerging technology. In developing a compilation of source materials available to answer these and other questions raised by the emergence of expert systems as a viable technology, the primary focus will be on materials that specifically address the issues that are unique to expert systems. In addition, materials which have general application to all computer software will be cataloged where they provide insight to expert systems issues. When a question is currently best answered by material

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of general applicability to all computer software, only that material which is considered to be of major significance will be included.

I. TORT AND CONTRACTUAL LIABILITY STEMMING FROM THE USE OF EXPERT SYSTEMS

Tort and contract theories relating to expert systems pose some of the most interesting and novel questions facing the legal profession today. Does strict liability for defective products apply to expert systems? If so, what constitutes a defective system? When should a negligence standard apply? What constitutes negligence in the design and manufacture of an expert system? What other theories of tort liability may apply when expert systems cause injuries?

In many jurisdictions strict products liability is not available for purely economic harms. This may be a desirable way to shield developers and manufacturers of expert systems from the somewhat harsh standards of strict liability for defective products. However, the economic harms doctrine would not protect developers of medical expert systems where personal injuries may occur due to design defects. Should doctors then assume full responsibility for any tort liability resulting from the use of the medical expert systems? Should the proper standard be one of strict products liability or professional malpractice? Should legislative answers be provided to promote the development of this technology?

Additional questions are raised when the injured party is in contractual privity with the software vendor. Do the provisions of the Uniform Commercial Code pertaining to the sale of goods apply to software, or is software actually an intangible good or a service? Should exculpatory clauses which are normally allowed by the U.C.C. be disallowed in the case of computer systems because of unique considerations of unconscionability?

A. Statutes

1. *Contract Law*

The Magnuson-Moss Act, 15 U.S.C. § 2300 (1982).

> A full warranty cannot be accompanied by any type of disclaimer of any warranty which has been created under state law. Limited warranties cannot limit the liability provided by implied warranties except as to the duration of the implied warranty. Disclaimers of consequential damages found in a full or limited warranty must be conspicuous.

RESTATEMENT (SECOND) OF CONTRACTS § 208 (1981).

> Defines when a contract term is unconscionable, and the effect of a finding of unconscionability.

U.C.C. § 2-314(1) (1978).

Unless excluded or modified, the sale of goods contains an implied warranty of merchantability when sold by a dealer of those goods. It is unclear whether software is considered to be "goods" under Article Two of the U.C.C.

U.C.C. § 2-315 (1978).

Unless excluded, a product carries an implied warranty of fitness for the particular purpose intended by the purchaser, provided that the seller knows of such purpose.

U.C.C. § 2-316 (1978).

Implied warranties of merchantability and of fitness for a particular purpose may be disclaimed by clear language evidencing that intent. The phrase "[t]here are no warranties which extend beyond the description of the face hereof" is expressly sufficient as a disclaimer.

U.C.C. § 2-607(3) (1978).

Notice must be given to the seller a reasonable time after the buyer discovers or should have discovered a breach.

U.C.C. § 2-725 (1978).

Warranty actions must be commenced within four years of the purchase of a product.

2. *Tort Law*

Cal. Bus. & Prof. Code § 2051 (West 1987).

Defines the unauthorized practice of medicine.

Cal. Civ. Code §§ 1709-1710 (West 1985).

The assertion of an untrue statement by a person who has no reasonable grounds for believing it can give rise to a cause of action for fraud. Thus, a negligent misrepresentation can be actionable.

Model Uniform Product Liability Act, 44 Fed. Reg. 62713-62750 (1979).

Defines the liability of manufacturers and vendors of products and goods to consumers for injuries stemming from the use of those products and goods.

RESTATEMENT (SECOND) OF TORTS § 402(a) (1965).

Defines when a seller is strictly liable for injuries caused by defective products.

RESTATEMENT (SECOND) OF TORTS § 552 (1977).

Defines when a negligent misrepresentation is actionable.

B. Cases

United States Welding v. Burroughs Corp., 615 F.Supp. 554 (D. Col. 1985).

> Plaintiff leased a computer system and software from the defendant. The system was returned because the plaintiff was dissatisfied with its performance. Plaintiff brought actions alleging contractual breaches, as well as a tort claim for negligent misrepresentation. The court held that, under RESTATEMENT (SECOND) OF TORTS § 552, a claim for pecuniary losses caused by a negligent misrepresentation is allowed provided the parties have sufficient privity. The court distinguished the rule that pure economic harms are not recoverable in a strict products liability claim. The court also held that the tort claim would lie despite the existence of contemporaneous contractual claims.

Antel Oldsmobile Cadillac v. Sirus Leasing Co., 101 A.D.2d 688, 475 N.Y.S.2d 944 (1984).

> Plaintiff sued for damages resulting from the loss of stored data caused by the breakdown of a computer system. The court held that since the only recovery sought was for economic damages, no cause of action lay in strict products liability or in negligence. Plaintiff was relegated to contractual remedies.

Invacare Corp. v. Sperry Corp., 612 F. Supp. 448 (N.D. Ohio 1984).

> Plaintiff's allegation that defendant negligently recommended the purchase of its own computer system was sufficient to state a valid cause of action for fraud. Also where a contract for a computer system is fraudulently induced, a limitation of action period contained in the contract is invalid.

Swiss Air Transport v. Benn, 467 N.Y.S.2d 341 (N.Y. Civ. Ct. 1983).

> Plaintiff airline was estopped from recovering money from passengers who had innocently purchased counterfeit tickets and had been allowed to use the tickets. The airline argued that is was unable to discover that the tickets were counterfeit prior to the time they were used because it did not possess sufficient computer technology. The court held that plaintiff's failure to use computer technology to detect the fraud constituted a breach of the duty to exercise reasonable care.

Black, Jackson and Simmons Ins. Brokerage v. IBM Corp., 109 Ill. App. 3d 132, 440 N.E.2d 282 (1982).

> Plaintiff sought to redress grievances caused by the sale of a computer system and software which did not function as represented. The court held that an action based on negligence for purely economic harms was not allowed in Illinois. A claim based on warranty was allowed.

Applications, Inc. v. Hewlett-Packard Co., 501 F. Supp. 129 (S.D.N.Y. 1980), *aff'd*, 672 F.2d 1076 (2d Cir. 1982).

Damages for economic harm are not recoverable under a products liability theory. Rather, injury to person or property must be shown before a products liability action may be maintained.

Chatlos Sys. v. National Cash Register Corp., 479 F.Supp. 738 (D.N.J. 1979), *aff'd*, 635 F.2d 1081 (3d Cir. 1980).

The court refused to extend professional malpractice liability to software developers, reasoning that allowing a new cause of action in tort for malpractice would expose software producers to greater liability without sufficient justification.

Triangle Underwriters v. Honeywell, Inc., 604 F.2d 737 (2d Cir. 1979).

Plaintiff alleged that the defendant was negligent in the design, manufacture, and installation of a computerized accounting system. The system was installed in January, 1971 and never worked as had been represented by the defendant. Plaintiff's personnel continued to attempt to debug the software until sometime in 1972 with no success.

Suit was brought in August, 1975, but the court held that the negligence actions were barred by New York's three year statute of limitations since the damage was apparent at the time of the original installation. The court refused to apply the "continuous treatment" doctrine, viewing the attempted debugging during 1972 as analogous to a machinery manufacturer trying to fix a machine rather than to a continuing professional relationship.

Quad County Distrib. Co. v. Burroughs Corp., 68 Ill. App. 3d 163, 385 N.E.2d 1108 (1979).

In a contract dispute, the court held that that a computer program is covered by the U.C.C. provisions pertaining to the sale of goods.

Pompeii Estates, Inc. v. Consolodated Edison Co., 397 N.Y.S.2d 577 (N.Y. Civ. Ct. 1977).

Reliance on erroneous computer output where examination of non-computer files would have detected error held a violation of standard of due care.

District of Columbia v. Universal Computer Assocs., 465 F.2d 615 (D.C. Cir. 1972).

The court held that personal property taxes could not be levied against computer programs because of their intangible nature.

Clements Auto Co. v. Service Bureau Corp., 44 F.2d 169 (8th Cir. 1971).

The court allowed a cause of action for fraud where a computer system purchaser justifiably relied on a false representation of the system's suitability for the purchaser's application.

C. Articles, Notes, and Comments

Comment, *Medical Expert Systems: Grappling With Issues of Liability*, 1 HIGH TECH. L.J. xxx (1986).

> This comment surveys the use of medical expert systems and explores the legal issues emanating from this rapidly expanding technology. Medical expert systems are categorized into two groups: expert systems used by laypersons, and systems utilized only by professional medical personnel. As to the former category, the article concludes that the underlying policy considerations relating to mass-marketed consumer goods warrant extension of strict products liability to medical expert systems. Regarding the latter category, the author believes that the argument for strict products liability is less compelling due to the bifurcated sales/service nature inherent in the use of these expert systems, and thus that a negligence standard should be applied.

Note, *A Comprehensive Statute of Limitations for Litigation Arising from Defective Custom Computer Systems*, 37 STAN. L. REV. 1539 (1985).

> This note examines litigation that arises when the purchaser of a custom computer system finds the delivered system to be inadequate or unworkable. The note evaluates when the statute of limitations should commence to run in such instances, including an in depth analysis of policy considerations. It concludes that the statute of limitations should accrue upon installation of the computer system rather than upon discovery of the defect.

Note, *Strict Products Liability and Computer Software: Caveat Vendor*, 4 COMPUTER L.J. 373 (1984).

> This note deals with the question of whether computer software constitutes a product or a service. Answering this question is crucial to determining whether strict products liability should be applied to software developers and vendors. The author concludes that the determination should hinge upon how the software is marketed. Off-the-shelf software which is mass-marketed should be treated as a product, whereas custom designed software should be viewed as a service. However, the authors suggest that even custom designed software might be treated as a product if it affects a large number of consumers.

Note, *Frankly, Incredible: Unconscionability in Computer Contracts*, 4 COMPUTER L.J. 695 (1984).

> This note examines the many cases where computer system users have sought recourse from the manufacturers or sellers of such systems for damages caused by system failures. Standard contract forms routinely exculpate the seller from consequential damages. Plaintiffs in these cases often seek to avoid the contract terms by using unconscionability theories. After exploring the arguments for

discarding traditional freedom of contract principles in such circumstances, the author concludes that there is insufficient justification for not holding plaintiffs to the terms of their contracts since computer system purchasers are capable of making intelligent purchasing decisions. The author also emphasizes that the imposition of higher standards of liability upon computer system manufacturers could stifle technological development and competition, which would hurt consumers in the long run.

Comment, *The Warranty of Merchantability and Computer Software Contracts: A Square Peg Won't Fit in a Round Hole,* 59 WASH. L. REV. 511 (1984).

This comment reasons that Article Two of the U.C.C., while applicable to computer hardware transactions, is not and should not be applicable to computer software because of the intangible nature of computer programs. It concludes that existing causes of actions in contract and tort provide software users with adequate protection from harm caused by defective software.

Legal Expert Sees Problems, COMPUTERWORLD, July 9, 1984, at 19.

Miles Zaremski, chairman of the ABA Committee on Law and Medicine, states that programmers and software suppliers could face legal liability for medical malpractice, comparing defective expert systems to a faulty thermometer. However, Dr. Homer Warner, developer of the HELP medical diagnosis expert system, disagrees, reasoning that the expert system only aids the physician, who is still responsible for accepting or rejecting the expert system's analysis.

Special Committee on Computers and the Law, *Tort Theories in Computer Litigation,* 38 REC. A.B. CITY N.Y. 426 (1983).

In this report, the committee considers whether causes of action in tort should be allowed in computer system failure litigation. The report concludes that, with the exception of intentional fraud, the contract terms should control and traditional contract law should apply. The committee took the position that the interest in freedom of contract outweighs arguments that commercial purchasers should be given greater protection due to the complexity of computer purchases and the serious effects computer failures can have upon a business. The report also contains a dissenting opinion.

The report was prompted by the increasing frequency with which non-contractual theories of liability have been asserted. The report emphasizes that most jurisdictions do not allow claims for negligence and strict liability when only economic harms are alleged. Claims under the Lanham Act, 15 U.S.C. § 43(a), are also not allowed because that Act was intended to protect persons engaged in commerce from unfair competition; purchasers thus have no standing to sue under the Act.

Comment, *Computer Software and Strict Products Liability*, 20 SAN DIEGO L. REV. 439 (1983).

> This comment examines two questions assumed to be necessary to resolve the issue whether strict products liability should be applicable to computer programs. First, are computer programs a product or a service? Second, can strict products liability be applied to "intangibles" (as the author describes computer programs)? The author concludes that at the very least computer programs should be treated as a hybrid transaction involving a product and a service, and therefore strict products liability actions should be allowed.

Note, *Computer Malpractice: Are Computer Manufacturers, Service Bureaus, and Programmers Really the Professionals They Claim to Be?*, 23 SANTA CLARA L. REV. 1065 (1983).

> This note examines whether users of computer programs have a cause of action against computer manufacturers or software consultants for computer malpractice. Since the potential harm which can be caused by negligently developed or installed software or hardware is great, the author concludes that plaintiffs should have a cause of action in tort for computer malpractice.
>
> The author also argues that treating software developers as professionals would affect when the statute of limitations would begins to run under the doctrine of "continuous treatment." When applicable, this doctrine provides that the statute of limitations does not begin to run until the relationship between the professional and her client ends.

Holmes, *Application of Article Two of the Uniform Commercial Code to Computer System Acquisitions*, 9 RUTGERS COMPUTER & TECH. L.J. 1 (1982).

> Computer system acquisition can be a high risk venture for many purchasers. Often, vendors will attempt to drastically limit their liability for system failures through contract exculpatory clauses. This article acknowledges that if the U.C.C. is applicable to these transactions, computer system purchasers will have substantially more protection than they would have otherwise. The article maintains that courts are often confused by the hybrid nature of computer system acquisition transactions, which include both sales and services. The U.C.C. adds to the confusion by referring to both a "sale of goods" and "transactions in goods." The article concludes that courts should recognize that U.C.C. § 2-105(i) provides rules governing for specially manufactured goods, which should apply to goods produced through labor intensive services. Additionally, equipment leases should be viewed as Article Two transactions.

Gemignani, *Product Liability and Software*, 8 RUTGERS COMPUTER & TECH. L.J. 173 (1981).

This article examines various legal theories under which computer software malfunctions might be redressed. An express warranty from the manufacturer in the purchasing contract covering the malfunction is the easiest answer to prevent future controversy. If no such warranty exists, the courts should consider both negligence and strict liability theories. With regard to negligence, the article reasons that expert testimony should be required since the principle of *res ispa loquitur* should not be applicable. As for strict liability, the article concludes that given the potentially devastating harm that can occur and the general applicability of the strict liability policy rationale to "products," strict liability actions may be appropriate for defective software.

Brannigan & Dayhoff, *Liability for Personal Injuries Caused by Defective Medical Computer Programs*, 7 AM. J.L. & MED. 123 (1981).

This article addresses the potential tort liability of manufacturers and users of medical computer programs under the traditional theories of negligence and product liability. The authors conclude that the makers of the medical expert systems and doctors who rely on the information generated by such systems should be held strictly liable for any injuries caused by program defects.

Note, *Negligence: Liability for Defective Software*, 33 OKLA. L. REV. 848 (1980).

This note argues that the most important consideration for determining liability for defective software should be how the software is marketed rather than the nature of the software itself. The author concludes that the determination of whether strict products liability should be applied to computer software should hinge upon policy considerations rather than upon arbitrary definitions of products or chattels.

Nycum, *Liability for Malfunction of a Computer Program*, 7 RUTGERS J. COMPUTERS, TECH. & L. 1 (1979).

This article provides an overview of various theories upon which a computer system purchaser may recover against a manufacturer or developer. The theories examined include: the breach of an express warranty; the breach of implied warranties; the breach of a third party beneficiary contract; negligence; and strict products liability. Additionally, the author discusses ways that the parties to a computer system transaction can allocate the risks of computer system failures at the outset of the transaction.

Note, *Computer Programs as Goods Under the U.C.C.*, 77 MICH. L. REV. 1149 (1979).

> This note explores the question of whether the purchase of a computer program is a "transaction in goods" and thus covered by Article Two of the U.C.C., or whether a computer program is a "service" and thus not covered by Article Two. The article analogizes software to books or records, which have as their essence merely ideas but become a good when reduced to an individual copy. The author argues that when someone purchases a computer program she is purchasing a concrete set of instructions which a computer executes, not simply a set of ideas. Therefore, the article concludes, computer programs should be given Article Two protection.

Chandler, *Computer Transactions: Potential Liability of Computer Users and Vendors*, 1977 WASH. U.L.Q. 405 (1977).

> This article explores theories under which computer users and vendors might be liable for harm caused by the failure or negligent design of computer systems. The theories discussed include the breach of implied or express warranties and various types of tort liability. Additionally, the article suggests ways for vendors and users to avoid or limit their liability risks.

II. USE OF EXPERT SYSTEMS IN THE PRACTICE OF LAW

As the technology of expert systems continues to develop, lawyers will be provided with a fundamentally new resource for solving legal problems. Indeed, transfers of knowledge are at the very heart of the legal profession. Accordingly, much of the material in this section consists of texts and articles which discuss the technological state of the art of legal expert systems and the policy issues underlying their development and implementation.

Yet, as legal expert systems have increasingly become a reality, legal problems related to such systems have simultaneously been bred. For example, is a manufacturer or user of a legal expert system who is not a licensed attorney in violation of prohibitions against the unauthorized practice of law? Many cases have held that the sale to the general public of self-help kits does not constitute the unauthorized practice of law because it does not involve the giving of individualized advice. However, given that expert systems operate interactively, should courts hold that they are inherently more than self-help kits, and thus involve the unauthorized practice of law? This question seems to be an open one. If the expert systems do potentially constitute the unauthorized practice of law, then can the infirmity be wholly cured if the expert system is developed and marketed by a licensed attorney?

A. Statutes

Cal. Bus. & Prof. Code §§ 6125-6126 (West 1974).

Defines what constitutes the unauthorized practice of law and prescribes the penalties therefor.

N.Y. Judiciary Law § 460 (McKinney 1983).

Requires all attorneys practicing in New York to be examined and licensed.

N.Y. Judiciary Law § 476a (McKinney 1983).

Defines what constitutes the unauthorized practice of law and prescribes the penalties therefor.

B. Cases

In re Thompson, 574 S.W.2d 365 (Mo. 1978).

The court held that the advertisement and sale of do-it-yourself "divorce kits" does not constitute the unauthorized practice of law.

State Bar of Michigan v. Cramer, 399 Mich. 116, 249 N.W.2d 1 (1976).

The mere sale and advertisement to the general public of forms and documents necessary for obtaining a divorce does not constitute the unauthorized practice of law. However, when a non-attorney advertises professional guidance and gives advice concerning the use of the divorce forms, a violation of the statutory provisions prohibiting the unauthorized practice of law has occurred.

Oregon State Bar v. Gilchrist, 272 Or. 552, 538 P.2d 913 (1975).

The court held that merely publishing, advertising and selling do-it-yourself divorce kits does not constitute the "practice of law." However, any personal contact with kit consumers involving consultation, explanation, recommendation, or advice does constitute the practice of law and laypersons are prohibited from engaging in such activity.

Florida Bar v. Stupica, 300 So.2d 683 (Fla. 1974).

The court held that the publication of a "divorce kit," containing forms and explanations to be used in obtaining a divorce, constitutes the unauthorized practice of law. This holding represents the minority view.

State v. Winder, 42 A.D.2d 1039, 348 N.Y.S.2d 270 (N.Y. 1973).

The court held that the general publication and distribution of a "divorce yourself kit" does not constitute the unauthorized practice of law.

Florida Bar v. American Legal & Business Forms 274 So.2d 225 (Fla. 1973).

The court held that the sale of a package of forms and instructions to be used to obtain a dissolution of marriage by a layman constitutes the unauthorized practice of law.

New York County Lawyers' Ass'n v. Dacey, 21 N.Y.2d 694, 234 N.E.2d 459, 287 N.Y.S.2d 422 (1967).

> The court held that the publication and distribution of *How to Avoid Probate*, a book giving general advice on probate matters and providing sample forms, does not constitute the practice of law because the book is directed to the general public and not to any specific individual.

C. Articles, Notes, and Comments

deBessonet & Cross, *An Artificial Intelligence Application in the Law: CCLIPS, A Computer Program that Processes Legal Information*, 1 HIGH TECH. L.J. 329 (1986).

> This article analyzes and discusses the mechanics, capabilities and goals of an existing expert system called CCLIPS. CCLIPS is designed to instruct an attorney in the intricacies of a highly complicated civil code in light of specific practice problems presented to it. The goal of the development of this expert system is to provide lawyers with the capability for conceptual data retrieval and other forms of advanced legal research and automation. The article also discusses the implications and benefits to the legal profession of the development of this and other advanced legal expert systems, and examines ways in which the legal profession can assist in the realization of those benefits. The article contains technical appendices in order to provide expert system developers with a more scientific survey of how CCLIPS was designed.

Gruner, *Thinking Like a Lawyer: Expert Systems for Legal Analysis*, 1 HIGH TECH. L.J. 259 (1986).

> The article examines the past, present, and future of legal expert systems beginning with the history of computerized expert systems and a functional description of how an expert system works in lay terms. An analysis of the characteristics of an "ideal expert system" based on the needs of attorneys is provided, and the whole array of existing legal expert systems are analyzed in light of this ideal program.

Willick, *Professional Malpractice and the Unauthorized Practice of Professions: Some Legal and Ethical Aspects of the Use of Computers as Decision-Aids*, 12 RUTGERS COMPUTER & TECH. L.J. 1 (1986).

> This article explores the impact of the emergence of computer technology upon the legal and other professions. The issues focused upon include whether attorneys are under a duty to use computer systems as an aid in the services they provide, the effect of relying or not relying on a computer system in providing professional services, whether there is recourse to the computer system manufacturer

when such a system causes injury to a client, and finally what problems of unauthorized practice might emerge resulting from the widespread availability of "do-it-yourself" computer programs.

Susskind, *Expert Systems in Law: A Jurisprudential Approach to Artificial Intelligence and Legal Reasoning,* 49 MOD. L. REV. 168 (1986).

This article provides an introduction to expert systems in the law and examines the benefits to be derived from the development of expert legal systems. The article further analyzes how "jurisprudential rigor" can be implemented through legal knowledge acquisition, representation, and utilization. The article concludes by identifying problems which must be surmounted for continued advancement in this field.

McCarty, *Intelligent Legal Information Systems: Problems and Prospects,* 9 RUTGERS COMPUTER & TECH. L.J. 265 (1983).

This article hypothesizes that the "most critical task in the development of an intelligent legal information system . . . is in construction of a conceptual model of the relevant legal domain." The article then goes on to explore the considerations relevant in the construction of such a model.

deBessonet, *An Automated Intelligent System Based on a Model of a Legal System,* 10 RUTGERS COMPUTER & TECH. L.J. 31 (1983).

This article discusses a legal expert system called CCLIPS which was being developed to process the Louisiana Civil Code. The article provides information on the goals of the system and the mechanics of how it works, as well as discussing significant policy considerations behind the development of the program. The author has written a more recent article discussing, *inter alia,* the improvements in the system made since 1983, which appears in this issue of *High Technology Law Journal.*

Thomas, *Unauthorized Practice and Computer Aided Legal Analysis Systems,* 20 JURIMETRICS J. 41 (1979).

The author discusses a recommendation by an ABA committee that computer systems that provide legal analysis only be used by lawyers. The author disagrees with the recommendation, noting that it was *not* adopted by the ABA. The author reasons that computer systems only perform logical analysis, whereas an attorney makes professional judgments. This distinction leads him to conclude that the use of expert systems by laypersons will not constitute the unauthorized practice of law.

However, part of the author's premise is based on the limited sophistication of past expert systems. As legal expert systems become more sophisticated, the distinction between logical analysis and professional judgments will become increasingly more tenuous.

McCarty, *Reflections on TAXMAN: An Experiment in Artificial Intelligence and Legal Reasoning*, 90 HARV. L. REV. 837 (1977).

> The author discusses an artificial intelligence program he developed called TAXMAN, which provides a legal analysis of the taxation effects of corporate reorganizations. The article also discusses the methodology of legal reasoning and how a computer program can emulate that reasoning.

Popp & Schlink, *JUDITH, A Computer Program to Advise Lawyers in Reasoning a Case*, 15 JURIMETRICS J. 303 (1975).

> This article outlines a legal expert system called JUDITH, being developed at the Universities of Heidelberg and Darmstadt in Germany.

Comment, *A Computer Method for Legal Drafting Using Propositional Logic*, 53 TEX. L. REV. 965 (1975).

> This comment suggests and explores the possibilities of using the logical principles underlying computer programming languages in legal drafting, with the goal of eliminating or reducing ambiguities.

Buchanan & Headrick, *Some Speculation About Artificial Intelligence and Legal Reasoning*, 23 STAN. L. REV. 40 (1970).

> This article proposes that research be undertaken to determine the capacity of computers, through the use of artificial intelligence techniques, to model legal reasoning. The authors maintain that such research will have two important benefits: first, legal thought processes might become better understood; and second, computer systems might be developed which can perform legal analysis functions. The article explores possible thought process techniques by analyzing an expert system called "Heuristic DENDRAL." The article concludes by speculating on the future of artificial intelligence in the legal profession.

Lorinczi, *When Does the Computer Engage in Unauthorized Practice?*, 54 A.B.A. J. 379 (1968).

> This article discusses legal data retrieval systems and when their use might constitute the unauthorized practice of law. The author distinguishes between systems which merely retrieve raw data and those which provide a legal analysis. The author argues that the former should be available to the public at large, but that the latter should be limited in use to those authorized to practice law in at least one jurisdiction within the United States.

D. Miscellaneous

Ranney, *Estate Planning Programs Find Market,* INFOWORLD, Mar. 10, 1986, at 17.

> Estate planning and will-drafting self-help software has been developed, and sales are significant. For example, Nolo Press has sold 9,000 copies of "Willwriter" without the help of a distributor or an advertising campaign.

AAAI-86: IBM Validates AI, THE SPANG ROBINSON REP., Sept. 1986, at 2.

> According to this article, IBM currently has approximately seventy expert systems under development, some of which apply to law.

Arthurs, *Counsel Debate Computer's Value in Settlement Talks,* LEGAL TIMES, Aug. 6, 1984, at 1.

> Computer analysis is being used in the Northern District of Ohio by Judge Thomas D. Lambros in approximately ninety state and federal asbestos cases. The new approach received mixed reviews in the first ten cases in which it was used.

III. OWNERSHIP PROTECTION EXTENDING TO EXPERT SYSTEMS

This area of the law has seen an explosion of literature in recent years. Since the main focus of this pathfinder is on legal questions presented by the emergence of artificial intelligence rather than on intellectual property issues arising from computer software, this section is less comprehensive. Rather, only a sampling of the literature available on proprietary rights is included, with fuller coverage of materials which specifically pertain to expert systems.

A. Protecting the Expert System

1. *Copyright Protection for Computer Software*

a. Statutes

The 1976 Copyright Act, 17 U.S.C. §§ 101-118 (1982).

> These sections define the subject matter and scope of copyright protection. Section 102 extends copyright protection to original works of authorship fixed in any tangible medium of expression from which they may be perceived or reproduced, and withholds protection from any idea, procedure, process, system, method of operation, concept, principle, or discovery.

Copyright Act Amendments of 1980, 17 U.S.C. §§ 101, 117 (1982).

> Section 101 defines "computer program," and section 117 provides a limited right to copy computer programs. A copy can only be made

if it is either necessary in the utilization of the computer program or if the copy is for archival purposes.

The Semiconductor Chip Protection Act of 1984, 17 U.S.C. § 906 (Supp. II 1984).

An example of a *sui generis* approach to ownership protection which could be a model for protection of expert systems and their output.

37 C.F.R. § 202.1 (1985).

Specifies material which is not subject to copyright.

b. Cases

Whelan Assocs. v. Jaslow Dental Laboratory, 609 F. Supp. 1307 (E.D. Pa. 1985), *aff'd*, 797 F.2d 1222 (3d Cir. 1986).

The court held that protected expression within a computer program included "the manner in which the program operates, controls and regulates the computer in receiving, assembling, calculating, retaining, correlating and producing useful information either on a screen, print-out or by audio communication." 609 F. Supp. at 1320. Thus, the substantial translation of a program used in managing dental laboratories from one programming language to another constituted a copyright infringement.

NEC Corp. v. Intel Corp., No. 84-20799 WAI (N.D. Cal. 1986).

The court held that copyright protection applies to microcode.

E.F. Johnson Co. v. Uniden Corp. of Am., 623 F. Supp. 1485 (D. Minn. 1985).

The court held that the translation of a program from one assembly language to another was an infringement of a valid copyright.

SAS Institute v. S & H Computer Sys., 605 F. Supp. 816 (M.D. Tenn. 1985).

The court found copyright infringement where a computer program had been translated from one language to another. In reaching its conclusion, the court considered the defendant's conduct in the preparation of the allegedly infringing copy.

Q-Co Indus. v. Hoffman, 625 F. Supp. 608 (S.D.N.Y. 1985).

The translating of a computer program from one programming language to another, accompanied by incidental modifications, did not constitute infringement. This result is at odds with *Whelan*, *Johnson*, and *SAS*.

Apple Computer v. Franklin Computer Corp., 714 F.2d 1240 (3d Cir. 1983), *cert. dismissed*, 464 U.S. 1033 (1984).

An operating system expressed in binary form is copyrightable subject matter.

Midway Mfg. Co. v. Artic Int'l, 547 F. Supp. 999 (N.D. Ill. 1982), *aff'd*, 704 F.2d 1009 (7th Cir. 1983).

The court held that a computer program imprinted on a silicon chip was copyrightable.

Videotronics, Inc. v. Bend Elecs., 564 F. Supp. 1471 (D. Nev. 1983).

The 1976 Copyright Act and its subsequent amendments preempt the state common law of trade secrets for video game programs.

Tandy Corp. v. Personal Micro Computers, 524 F. Supp. 171 (N.D. Cal. 1981).

A computer program imprinted on a silicon chip is copyrightable. The court rejected defendant's arguments that a Read Only Memory ("ROM") chip did not constitute a tangible medium of expression.

Data Cash Sys. v. JS&A Group, Inc., 480 F. Supp. 1063 (N.D. Ill. 1979), *aff'd*, 628 F.2d 1038 (7th Cir. 1980).

Copyright protection is available to program flowcharts, source code, and assembly code, but not to object code. This result is now in doubt due to the Copyright Act amendments of 1980 and cases interpreting them.

Gross v. Seligman, 212 F. 930 (2d Cir. 1914).

The plaintiff must prove that the alleged copy has a substantial similarity to the copyrighted work.

Baker v. Seldon, 101 U.S. 99 (1879).

Actual appropriation of language is necessary for copyright infringement.

c. Texts[1]

COMPUTER SOFTWARE AND CHIPS 1986: PROTECTION AND MARKETING (M. Goldberg ed. 1986).

A compilation of articles and statutes on the protection and marketing of computer software and semiconductor chips.

G. DAVIS III, SOFTWARE PROTECTION (1985).

This book is reviewed in this issue of *High Technology Law Journal.*

C. MILLARD, LEGAL PROTECTION OF COMPUTER PROGRAMS AND DATA (1985).

This book is reviewed in this issue of *High Technology Law Journal.*

R. NIMMER, THE LAW OF COMPTER TECHNOLOGY (1985).

This treatise provides a comprehensive examination of intellectual property law relating to computer technology. Copyright, patent,

1. The reader should also reference the Annotated Bibliography of Books Received, Part B (Intellectual Property Rights and Unfair Competition), in this issue of *High Technology Law Journal.*

trade secret, and unique issues of ownership are covered in depth. Additionally, extensive coverage of computer system transactions, tort liability stemming from the sale or use of computer systems, antitrust considerations, international trade considerations, and "information age issues" is provided. Mr. Nimmer was honored by the American Association of Publishers which named this treatise the Best Law Book of 1986.

J. SOMA, COMPUTER TECHNOLOGY AND THE LAW (1983).

A cross between a user's guide and a treatise, this book attempts to deal with legal problems involving most of the major issues in computer law. Software protection, contracts for computer services, antitrust, privacy protection, and computer crime are covered, as well as problems involving the regulation of the telecommunications industry, the importing and exporting of high technology products, and the use of computers in the banking industry.

D. BENDER, COMPUTER LAW — SOFTWARE PROTECTION (1978).

A treatise with annual supplements. Subjects covered are the development of computer technology, patent, copyright, trade secret, and international trade protection of computer software.

d. Articles, Notes, and Comments

Bender, *Protection of Computer Programs: the Copyright/Trade Secret Interface*, 47 U. PITT. L. REV. 907 (1986).

This article deals with two questions raised by the current explosion in computer software products: whether § 301 of the 1976 Copyright Act preempts state trade secret law; and, if it does not, whether it is possible to obtain protection under both the 1976 Copyright Act and state trade secret law simultaneously. The article examines the case law of both protection schemes and concludes that the Copyright Act does not preempt state trade secret law, and that dual protection under both schemes is possible.

Stern, *The Bundle of Rights Suited to New Technology*, 47 U. PITT. L. REV. 1229 (1986).

This article deals with novel protection schemes which should be accorded emerging technologies. Focusing first on the protection to be given to the non-code aspects of software, such as software's look and feel, the article goes on to propose a generalized scheme for protecting ownership rights in emerging technologies.

Davidson, *Common Law, Uncommon Software*, 47 U. PITT. L. REV. 1037 (1986).

The author of this article believes that the complex problems of ownership protection of computer software should not be solved by legislative action, but are better resolved by simple common law principles applied to specific problems as they arise. The author

posits that most complicated legislative solutions, such as the Internal Revenue Code or the 1952 Patent Code, quickly become obsolete. Furthermore, many complex areas of the law, such as torts, contracts, and property, are handled through the application of common law principles. The author argues that intellectual property protection for software should be based on a concept of the misappropriation of expression (but not of ideas). The article concludes that implementing such a principle through the common law can help to avoid painful legislative mistakes.

Raskind, *The Uncertain Case for Special Legislation Protecting Computer Software*, 47 U. PITT. L. REV. 1131 (1986).

After reviewing recent articles advocating *sui generis* legislation for the protection of computer software, Professor Raskind analyzes existing copyright statutes and case law in conjunction with the interests of authors, manufacturers, distributors, and users of software. The author argues that a *sui generis* approach is not necessarily required to protect these interests and that incremental change to existing copyright law may be the best means available to accomplish the goal of clearly defining the scope of ownership protection and the scope of permissible use.

Goldstein, *Infringement of Copyright in Computer Programs*, 47 U. PITT. L. REV. 1119 (1986).

According to the author, two arguments are generally made in support of extending copyright protection to computer software. First, copyright law offers allegedly inadequate protection to ensure vigorous pursuit of desirable technological advances. Second, computer software, being utilitarian in nature, is said to be out of place among other forms of intellectual property which copyright was primarily created to protect. In this article, Professor Goldstein argues that both of the above arguments are inadequate to reject copyright protection of software. The article concludes "that we can live with copyright protection for computer programs."

Note, *Defining the Scope of Copyright Protection for Computer Software*, 38 STAN. L. REV. 497 (1986).

This note discusses current limits of copyright protection of computer software and proposes criteria for determining when copying is proper. The author argues that courts should not consider the development process of an allegedly infringing work in connection with substantial similarity, but instead should consider the overall structure of the programs. The note concludes that screen displays should be considered part of the copyrighted software.

Conley and Bryan, *A Unifying Theory for the Litigation of Computer Software Copyright Cases*, 63 N.C.L. REV. 563 (1985).

> This article argues that rather than comparing competing programs for "substantial similarity" as is normally done, an infringement inquiry should focus on the conduct of the alleged infringer.

Harris, *Legal Protection for Microcode and Beyond: A Discussion of the Applicability of the Semiconductor Chip Protection Act and the Copyright Laws to Microcode*, 6 COMPUTER L.J. 187 (1985).

> This article examines the applicability of existing intellectual property law and the Semiconductor Chip Protection Act of 1984 to microcode. The article concludes that Congress should state explicitly whether either of these schemes is applicable to microcode.

Samuelson, *Creating a New Kind of Intellectual Property: Applying the Lessons of the Chip Law to Computer Programs*, 70 MINN. L. REV. 471 (1985).

> The author argues that machine readable programs should be given ownership protection on a *sui generis* basis. Applauding the approach taken in protecting semiconductor chips, the author argues that trying to fit machine-readable programs into principles of traditional copyright law under CONTU recommendations is inconsistent with the doctrine that utilitarian works should not be copyrightable.

Kidwell, *Software and Semiconductors: Why Are We So Confused?*, 70 MINN. L. REV. 533 (1985).

> The author sets out to explain why the number of articles written about protecting computer software was so large. He reasons that it is due to the difficulty of solving the problem and not necessarily to its importance. The article goes on to explain why the author believes the problem is so difficult.

Samuelson, *CONTU Revisited: The Case Against Copyright Protection for Computer Programs In Machine-Readable Form*, 1984 DUKE L.J. 663.

> In this article, Professor Samuelson argues that CONTU erred when it determined that programs in machine-readable form should be allowed copyright protection because both statutory and case law make clear that utilitarian works are not copyrightable.

Davidson, *Protecting Computer Software: A Comprehensive Analysis*, 1983 ARIZ. ST. L.J. 611.

> This Report of the Proprietary Rights in Software Committee of the American Bar Association Section of Science and Technology examines several aspects of ownership protection for computer software. The Report disagrees with the conventional view that trade secret law is the best form of protection for computer software. According to the Report, the traditional view is based on the notion that software is primarily of an intangible nature, is not generally patentable, and is easily changed to defeat copyrights. The Committee believes that software should qualify for patentability without being

tied to some other unique mechanical process because it is tangible in nature. The Report contains a dissenting opinion.

Note, *Copyright Infringement of Computer Programs: A Modification of the Substantial Similarity Test,* 68 MINN. L. REV. 1264 (1984).

This note presents an overview of software technology, the scope of copyright protection for software, the history of the substantial similarity test, and an analysis of actual applications of the substantial similarity test to computer software. The author proposes modifying the substantial similarity test in favor of an "iterative" test. An iterative test would focus on whether the copy was a "restatement in substantially the same form of a substantial portion of the copyrighted work."

Comment, *Softright: A Legislative Solution to the Problem of Users' and Producers' Rights in Computer Software,* 44 LA. L. REV. 1413 (1984).

This comment examines copyright, patent, and trade secret protection available to software developers and explores the reasons why software developers are dissatisfied with the existing state of the law. The article goes on to propose that a new "softright" act be passed which would continue the disclosure goals of current copyright and patent laws and prohibit disclaimers of implied warranties of merchantability and fitness for a particular purpose. In return, software developers would be allowed significant recoveries, including punitive damage awards and "liberal attorney fee awards" in cases where illegal copying is proved.

Note, *Recent Developments: Substantial Similarity Between Video Games: An Old Copyright Problem in a New Medium,* 36 VAND. L. REV. 1277 (1983).

This note begins with an overview of the substantial similarity test and its applications in the video game genre. The author argues that, while courts correctly recognize that copyright protection extends to video games, they often incorrectly analyze whether infringement has taken place. The note concludes that the goals of copyright protection would best be served if courts look at not only "visual videographic game features," as is currently done, but additionally examine the similarity between overall game play.

Note, *Copyright Protection of Computer Program Object Code,* 96 HARV. L. REV. 1723 (1983).

This note argues that the 1976 Copyright Act, in plain language, protects computer programs in in all forms, including object code. Furthermore, such protection is consonant with copyright goals of encouraging investment in creative labor. The note concludes that object code as well as source code should be afforded copyright protection.

Note, *Toward a Unified Theory of Copyright Infringement for an Advanced Technological Era*, 96 HARV. L. REV. 450 (1982).

This note addresses intellectual property problems caused by the prevalence of technological advances. First, the author considers that rapid advances in technology have increased the ease with which intellectual and cultural works can be copied. Next, the author stresses that technological advances also give rise to an increased number of available works to be copied. Finally, the author proposes a protection scheme whereby copyright infringement would be determined by examining both the relationship between the original and the copy and the type of economic gain sought by the user of the copy.

2. *Patent Protection for Computer Software.*

a. Statutes

35 U.S.C. §§ 100-104, 111-122 (1982 & Supp. II 1984).

A person may secure patent protection for any invention or discovery of a process, machine, manufacture, or composition of matter, or any new and useful improvement thereof that is new and useful, novel, and nonobvious. The requirements for obtaining a patent application include a written specification of the invention and how it is manufactured, a drawing, model or specimen of the invention, and the inventor's oath that he believes himself to be the original inventor of the subject matter in question. The specification requirement thus obliges an inventor to disclose his invention.

35 U.S.C. § 271(a) (1982).

Other than the patent owner, one who "makes, uses or sells any patented invention" has infringed a patent.

b. Cases

Paine, Webber, Jackson & Curtis, Inc. v. Merrill Lynch, Pierce, Fenner & Smith, Inc., 564 F. Supp. 1358 (D. Del. 1983).

The court affirmed Merrill Lynch's patent on its "cash management account." The court rejected arguments that the patent dealt only with a method of doing business and held that the account as implemented by Merrill Lynch was statutorily patentable under 35 U.S.C. § 101.

Diamond v. Diehr, 450 U.S. 175 (1981).

The Court held that software that controlled a rubber molding process constituted patentable subject matter.

Diamond v. Bradley, 450 U.S. 381 (1981).

The Court held that a computer program implemented in a computer hardware configuration described in a "means plus function" format was patentable due to its proximity to the machine.

Parker v. Flook, 437 U.S. 584 (1978).

The Court held that a program which merely adds post-solution activity to a mathematical formula is not sufficient to transform an unpatentable principle into a patentable process.

Dann v. Johnston, 425 U.S. 219 (1976).

The Court held that computer programs which represent obvious advances are unpatentable.

Gottschalk v. Benson, 409 U.S. 63 (1972).

The Court held that a program is unpatentable if it would preempt a mathematical algorithm and effectively be a patent on the algorithm itself.

c. Articles

Chisum, *The Patentability of Algorithms,* 47 U. PITT. L. REV. 959 (1986).

This article analyzes the Supreme Court decision in *Gottschalk v. Benson,* which held that algorithms are unpatentable because they are analogous to laws of nature. The author believes that the case was wrongly decided based on previous case and statutory law and underlying patent policy considerations, and further believes that the decision has left nothing but confusion and turmoil in its wake. The article concludes that patent protection for those algorithms which meet the requirements of novelty and nonobviousness are needed to encourage technological development in the field of computer software.

Newell, *Response: The Models are Broken, The Models are Broken!,* 47 U. PITT. L. REV. 1023 (1986).

This article represents a "computer-scientist's perspective on the issue of patentability and algorithms" and is mainly a response to Professor Chisum's article appearing in the same issue. The author argues that even if *Gottschalk v. Benson* had been decided differently as Professor Chisum urges, there would still exist much confusion regarding algorithm patentability primarily due to the ambiguity of the definition of an algorithm and problems associated with finding substantial similarity. The article concludes that regardless of whether or not algorithms are patentable, confusion in this area of the law will continue to exist until a more workable model for understanding algorithms is developed.

Chabal, *Publisher Seeks Patent for Parts of a Program,* INFOWORLD, Mar. 31, 1986, at 11.

The United States Patent and Trademark Office has reportedly approved a patent application for an expert system that runs on an IBM personal computer. Only the portion of the underlying algorithm that was related to the physical process of the expert system was patentable. The attorney representing the expert system

manufacturer said that patent protection was often impracticable for software due to marketing considerations.

Syrowik, *Disclosing Computer Programs in an Application for a United States Patent—A Trap for the Unwary*, 26 JURIMETRICS J. 21 (1985).

This article discusses the patentability of computer software in view of the holding in *White Consolidated Industries v. Vega Servo-Control*, 713 F.2d 788 (Fed. Cir. 1983). The article focuses generally on the outlook for obtaining patent protection for computer-related inventions and discusses the theory and policy underlying disclosure requirements, the mechanics of meeting disclosure requirements, and the ramifications of a failure to disclose.

Becker, *Means-Plus-Function Claims in Computer Related Patent Applications Within the United States*, 5 COMPUTER L.J. 25 (1984).

The article distinguishes between patent claims for inventions described functionally rather than structurally. The author argues that functional language is better suited for computer systems and discusses how such language can be drafted in light of United States Patent Office requirements.

Anthony & Colwell, *Litigating the Validity and Infringement of Software Patents*, 41 WASH. & LEE L. REV. 1307 (1984).

This article discusses the advantages and disadvantages of securing proprietary rights in computer software through patent protection. The article then goes on to discuss the case history of patentability of computer software and concludes that the current trend is towards increased ease of patentability of software.

3. *Trade Secret Protection for Computer Software*

a. Statutes[2]

RESTATEMENT (FIRST) OF TORTS, § 757 (1939).

Misappropriation of a trade secret gives rise to a cause of action in tort.

Cal. Labor Code § 2860 (West 1971).

Everything acquired by an employee by virtue of his employment, except the employee's compensation, belongs to the employer.

2. The reader should reference the trade secret statutes found in Research Pathfinder, *Biotechnology and Law*, 1 HIGH TECH. L.J. 233 (1986), for additional material.

b. Cases

White Consolidated Industries v. Vega Servo-Control, 713 F.2d 788 (Fed. Cir. 1983).

The court held that when an invention to be patented embodies a trade secret, patent disclosure laws require that the trade secret be disclosed in order for the patent to be effective.

Kewanee Oil Co. v. Bicron Corp., 416 U.S. 470 (1974).

In this landmark decision, the Court held that federal patent law does not preempt state trade secret law, at least to the extent that such trade secret law does not conflict with the operations of federal patent and copyright laws. The Court recognized that the protection of trade secrets promotes research and the dissemination of knowledge, as well as maintaining commercial ethics.

Lear v. Adkins, 395 U.S. 653 (1969).

The issue in this case was the validity of license agreements covering inventions that either were, or later became, patented. The Court held that a licensee of an invention that was patented *at the time* the license agreement was formed may attack the validity of the patent. The court also held that a licensee of an invention that is patented *after* the license agreement is formed may attack the validity of the patent. However, the Court refused to rule on the question of whether a licensee may attack the license agreement *before* an invention is patented on the grounds that the invention is "unpatentable." Such a possibility was rejected by the Court in *Sears, Roebuck & Co. v. Stiffel Co.*

Sears, Roebuck & Co. v. Stiffel Co., 376 U.S. 225 (1964).

The Court held that a state unfair competition law which prohibited copying articles not protected under the federal patent system was invalid because it was in conflict with the federal patent scheme and was thus prohibited by the Supremacy Clause. Initially, this case raised the question of the continued validity of state trade secret law. However, subsequent cases have shown that state trade secret laws, if properly drafted, will be upheld by the courts.

c. Articles and Notes

Note, *Patenting Inventions that Embody Computer Programs Held as Trade Secrets*—White Consolidated Industries v. Vega Servo-Control, 713 F.2d 788 (Fed. Cir. 1983), 59 WASH. L. REV. 601 (1984).

This note criticizes *White* as deterring inventors from patenting inventions which embody trade secrets. The author suggests that alternative means to trade secret disclosure should be found so that patent law's goal of disclosure and information exchange, at least as to the non-secret portion of the invention, would not be deterred. Suggested alternatives include a depository system for the secret

components of an invention or licensing of the secret components as part of the patent.

Note, *All the King's Horses—Irreparable Harm in Trade Secret Litigation*, 52 FORDHAM L. REV. 804 (1984).

This note provides an expose of current trade secret law and discusses two competing theories of trade secret liability: a property theory and a confidential relationship theory. The author opines that the property theory is more consonant with the goal of trade secret law to encourage technological development. The note goes on to discuss the requirement of showing irreparable harm in order to obtain injunctive relief against an alleged misappropriation and discusses what constitutes irreparable harm.

Bender, *Trade Secret Protection of Software*, 38 GEO. WASH. L. REV. 909 (1970).

This article examines existing case and statutory law providing for trade secret protection of computer software as well as the mechanisms and scope of that protection. The author points out that, while trade secret law may not offer wholly satisfactory protection for computer software and may discourage disclosure, it is still the most prevalent protection scheme in practice because of difficulties in obtaining protection from copyright or patent law. Furthermore, recent promulgation of criminal trade secret statutes has furthered the protection offered by the trade secret approach.

B. Protecting the Output of the Expert System

1. *Articles and Notes*

Samuelson, *Allocating Ownership Rights in Computer-Generated Works*, 47 U. PITT. L. REV. 1185 (1986).

In this article, Professor Samuelson considers the question: who, if anyone, should be entitled to the ownership rights for computer-generated works? The article explores five different possibilities. Ownership rights might be allocated to the program user, to the programmer, to both jointly, to no one, or to the computer. The article goes on to analyze the reasons for and against each of the alternatives and concludes that the program user should be allocated full ownership rights to computer generated output.

Goldstein, *Derivative Rights and Derivative Works in Copyright*, 30 J. COPR. SOC'Y 209 (1982).

This article examines the history of copyright protection of derivative works. The author emphasizes 17 U.S.C. §§ 106 and 107 (1982), which according to the author, clearly establish copyright protection for derivative works. The author then considers several areas of copyright law where underlying policy seems to suggest that derivative rights should be treated differently then reproduction rights.

The article then concludes that in determining rights to be accorded derivative works, the courts should apply the underlying principles of copyright law to resolve issues raised by the ever increasing breadth and volume of derivative works.

Note, *Can a Computer Be an Author? Copyright Aspects of Artificial Intelligence*, 4 COMM/ENT L.J. 707 (1982).

As the technology of artificial intelligence emerges, computers are rapidly creating products that once where thought to be the exclusive domain of man. Computer programs have written articles appearing in national magazines, automatic code generators are now available, and devices using automatic programming techniques are becoming marketable. This article discusses whether these artificial intelligence products should be given copyright protection, and if so, who the copyright owner should be. The article concludes that the courts should allocate ownership on an *ad hoc* basis.

Milde, *Can a Computer be 'An Author' or an 'Inventor'?*, 51 J. PAT. OFF. SOC'Y 378 (1969).

This article discusses whether computer generated works fall within the constitutional requirements of being either the writing of an author or the discovery of an inventor in order to receive copyright or patent protection. The article concludes that Congress should enact legislation attempting to articulate its policy on this question since rationales exist for the courts to adopt either alternative.

IV. REGULATION OF EXPERT SYSTEMS

As expert system technology becomes more complex, governmental regulation and programmer licensing may be needed. This seems particularly plausible for expert systems that are sold directly to end users. Such regulation may, in addition to protecting consumers, benefit manufacturers and developers by establishing standards of competence for expert systems. Regulation would also probably make it more difficult, though surely not impossible, for a plaintiff to establish negligence on the part of a manufacturer who fully complied with the requirements of a regulatory body.

Two types of regulation seem plausible. The most commonly discussed is that of licensing computer programmers. Another possibility would be to require product approval before an expert system could be brought "online" or marketed to the public, in the same manner that the Food and Drug Administration regulates drugs. In considering either of these proposals, the effectiveness of the proposed regulation in achieving the goal of error-free expert systems must be balanced against the effects of increased development costs made necessary by regulation.

A. Statutes

Fair Labor Standards Act of 1938, 29 U.S.C. §§ 201-219 (1982).

Deals with the regulation of labor conditions of certain industries and occupations.

29 C.F.R. § 541.302(h) (1986).

Computer programmers and analysts are not professionals under the Fair Labor Standards Act.

18 U.S.C. § 1029 (Supp. 1986).

Regulates fraud and related activities in connection with access devices.

18 U.S.C. § 1030 (Supp. 1986).

Regulates fraud and related activities in connection with computers.

Vt. Stat. Ann. tit. 8, § 79 (Supp. 1986).

All data processing services for regulated banking institutions, whether performed in-house or by an outside contractor, are subject to regulation and examination.

B. Cases

Pezzillo v. General Tel. & Elects. Information Sys., 414 F. Supp. 1257 (M.D. Tenn. 1976), *aff'd per curiam*, 572 F.2d 1189 (6th Cir. 1978).

The court held that computer programmers are not professionals under the Fair Labor Standards Act of 1938, 29 U.S.C. §§ 201-219 (1982).

C. Articles

O'Connor, *Computer Professionals: The Need for State Licensing*, 18 JURIMETRICS J. 256 (1978).

"Computers allow man to make mistakes faster than he ever before dreamt possible." *Id.* at 256. This article explores the potential catastrophic results of computer system design errors and recent attempts to regulate computer programmers. The author argues that the decision to regulate should be based on the public need for such regulation, and that considerations of industry degradation should be at most secondary.

The article examines the 1974 proposal by the Society of Certified Data Processors ("SCDP") that data processing personnel be required to obtain a license through a state licensing board. The SCDP proposal was considered by three states, all of which rejected it. The article advocates a modified SCDP proposal which would require that only those data processing personnel who work on computing systems which affect the public in "critical areas" be required to obtain licenses.

BOOKS RECEIVED

The books listed below have been received by *High Technology Law Journal* within the past year for potential review. Books presently being considered for review in the next issue of *High Technology Law Journal* do not contain annotations, and will thus either be reviewed or annotated subsequently.

The books are catalogued by subject and are listed alphabetically by title within each subject. Each annotation begins with a citation to the book received, including publisher and price information. All prices listed are for cloth editions except where noted.

I. COMPUTER LAW

A. Computer Technology and Law

BERNACCHI ON COMPUTER LAW: A GUIDE TO THE LEGAL AND MANAGEMENT ASPECTS OF COMPUTER TECHNOLOGY, 2 vols., by Richard L. Bernacchi, Peter B. Frank, and Norman Statland. Boston: Little, Brown and Company, 1986. Pp. 1,056; $160.00 (looseleaf).

> This two-volume treatise is a comprehensive guide to the legal issues involved in acquiring, marketing, and managing computer hardware, software, and telecommunications. It attempts to provide guidance to corporate executives, managers of information systems, lawyers, accountants, and consultants. Beginning with an overview of the basic concepts and legal and technical issues involved in computer law, the treatise presents materials on such diverse topics as: a systems approach to contracting; the role of senior management in controlling data processing and procurement activities; the acquisition of packaged or preconstructed software, maintenance, service bureau, and facilities management contracts; and tax and other financial considerations. The extensive appendices include a sample GSA/FAR contract, a checklist of contractual terms, a sample project timetable, materials on the use and misuse of microcomputers in business, and information on the arbitration of contract disputes.

COMPUTER TECHNOLOGY AND THE LAW by John T. Soma. Colorado Springs, Colo.: Shepard's/McGraw-Hill, 1983. Pp. xviii, 486; 1985 Supp. Pp. iii, 145; $80.00.

> A cross between a user's guide and a treatise, this book attempts to deal with legal problems associated with computers in a manner tailored to practitioners. Most of the major issues involved in computer law are examined, including those involving software

protection, contracts for computer services, antitrust, privacy protection, and computer crime. Also covered are problems involving the regulation of the telecommunications industry, the importing and exporting of high technology products, and the use of computers in the banking industry. The book includes a glossary of computer terms, comprehensive indices of cases, statutes and regulations, and an extensive bibliography.

COMPUTER ETHICS by Deborah G. Johnson. Englewood Cliffs, N.J.: Prentice-Hall, Inc., 1985. Pp. xv, 110; $13.95.

As part of a series of books by the publisher on occupational ethics, COMPUTER ETHICS considers the moral dilemmas which computer professionals face and the philosophical tools needed to resolve them. The book begins with a brief review of ethical theory, followed by an examination of the Association for Computing Machinery Code of Professional Conduct. The book then treats a variety of computer ethical dilemmas, including problems involving liability and responsibility in the creating and marketing of computer products, the effects of computer use on privacy and the distribution of power in society, and various problems involving ownership and copying of computer programs. Although COMPUTER ETHICS provides an interesting overview of some select problems, it is not, nor is it meant to be, an exhaustive treatment of all the philosophical questions suggested by the increased use of computers in today's society.

COMPUTER LAW ANNUAL 1985 edited by Miles R. Gilburne, Ronald L. Johnston & Allen R. Grogan. New York: Law & Business, Inc./Harcourt Brace Jovanovich, 1985. Pp. xi, 413; $60.00.

This anthology on recent developments in computer law contains twenty articles previously published in THE COMPUTER LAWYER. The articles, written by attorneys practicing in the computer law field, are grouped together by subject area with each section accompanied by a short introduction written by the editors. The issues covered include proprietary rights, antitrust, product distribution and marketing, computer contracts, venture financing, and taxation.

COMPUTER LAW DEVELOPMENTS: 1985 edited by Computer Law Reporter. Wash., D.C.: Computer Law Reporter, Inc., 1986. Pp. vii, 424; $110.00 (paper).

COMPUTER LAW DEVELOPMENTS contains a collection of materials previously published in COMPUTER LAW REPORTER during 1985. The materials selected reflect the broad scope of computer law, and serve as an update for the practitioner on the many ways in which computer technology has affected private, business, and government

affairs. Included are the transcript of a panel discussion from a symposium on the Semiconductor Chip Act of 1984, an article on protection against counterfeit semiconductor imports, and selected case law summaries.

LAW OF COMPUTER TECHNOLOGY by Raymond T. Nimmer. Boston: Warren, Gorham & Lamont, Inc., 1985. Pp. xxxii, 641; $79.50.

This treatise is a comprehensive legal resource on computers and information technology. Copyright, patent, trade secret, and unique issues of ownership are covered in depth. Additionally, the book provides extensive coverage of computer system transactions, tort liability stemming from the sale or use of computer systems, antitrust considerations, and international trade issues. There are also chapters on electronic funds transactions and electronic publishing, as well as on other "information age issues." Professor Nimmer was honored by the American Association of Publishers which named this treatise Best Law Book of 1986.

B. Intellectual Property Rights and Unfair Competition

COPYRIGHT FOR THE EIGHTIES: CASES AND MATERIALS, 2d ed., by Alan Latman, Robert Gorman & Jane C. Ginsburg. Charlottesville, Va.: Michie Company, 1985. Pp. xxii, 624; 1985 Supp. Pp. iii, 150; $50.00.

This is a general casebook on copyright law. It has sections defining the purpose of copyright protection, describing the nature of materials to which copyright is available, and examining the rights and formalities involved in obtaining a copyright. It also has a brief section on the international dimension of copyright law and on the preemption of state law by the federal Copyright Act. A section devoted to computers is included as well as a section on the copyright of typeface designs.

DRAFTING PATENT LICENSE AGREEMENTS by Harry R. Mayers & Brian G. Brunsvold. Edison, N.J.: BNA Books. Pp. xv, 252; $40.00.

This guide combines practical instruction on the technical aspects of drafting license agreements with textual discussions of relevant case law. The book also contains chapters on legal issues concerning patents which are often the source of litigation, such as problems involving the construction, execution, and termination of license agreements. This book concludes with a chapter on foreign patent license agreements. Its appendices contain sample license agreements.

FAIR USE PRIVILEGE IN COPYRIGHT LAW by William F. Patry. Edison, N.J.: BNA Books, 1985. Pp. xxv, 544; $75.00.

This comprehensive study reviews the development of the fair use doctrine in copyright law from its origin in 18th century cases through its modern statutory manifestations. Part I presents chronological case-by-case summaries and analyses of the leading English and American cases. Part II discusses the legislative history of fair use, analyzing the various bills, hearings, and reports which resulted in the final version of the 1976 Copyright Act. Legislative and administrative actions affecting fair use between 1976 and 1981 are also examined. Part III presents an analysis of the fair use doctrine as applied to specific types of works and uses. Finally, Part IV considers the relationship between fair use and the first amendment. The book concludes with a brief survey of the procedural issues involved in fair use litigation.

INTELLECTUAL PROPERTY LAW DICTIONARY by Stephen R. Elias. Berkeley: Nolo Press, 1985. Pp. ix, 222; $17.95 (paper).

This is a legal dictionary which defines and discusses words and phrases dealing with intellectual property law. It attempts to explain commonly used legal terminology in an uncomplicated, straightforward manner comprehensible to users outside the field of law. The book also provides the context in which various terms commonly arise, and contains a brief overview of the principal legal issues in major intellectual property subject areas.

LEGAL PROTECTION OF COMPUTER HARDWARE AND SOFTWARE MARKETED IN EUROPE by JJ&J Consultants (The Netherlands). Sudbury, Mass.: Technology & Business Communications, Inc., 1986. Pp. 222; $950.00 (paper).

This guide provides the legal practitioner with what the authors claim is the only currently available, thorough English compilation of European law on the subject of marketing and protecting computer technology. By segmenting its treatment of the law into easily identifiable issues and jurisdictions, the work provides a useful checklist of issues and precedent that practitioners unfamiliar with the panoply of European litigation will no doubt find helpful. The authors collect and condense a vast array of material not otherwise readily available. Readers will find that the work competently catalogues the pre-1985 state of the law as it applies to software protection, computer contracts, and computer crime for the United Kingdom, the Scandinavian countries, the Netherlands, France, and the Federal Republic of Germany. The section on Belgian law is particularly valuable in so far as only one other secondary English source addresses the subject. An introductory chapter on computer-related

legal topics provides an overview of international transactions and dispute resolution in Europe, while a section on data protection deals with the concomitant privacy issues. A selected bibliography of related English references concludes the work.

PROTECTION OF INTELLECTUAL PROPERTY RIGHTS IN COMPUTER PRODUCTS by Computer Law Reporter. Wash., D.C.: Computer Law Reporter, Inc., 1985. Pp. iv, 277; $100.00 (paper).

This resource is a collection of materials from recent issues of the COMPUTER LAW REPORTER regarding intellectual property and computer products. It includes articles written by practitioners and scholars addressing copyright, trade secret, patent, trademark, and international trade issues as well as a discussion of the Semiconductor Chip Act of 1984.

SEMICONDUCTOR CHIP PROTECTION ACT OF 1984, 2 vols., edited by Gary Rinkerman. Wash., D.C.: Computer Law Reporter, Inc., 1985. Pp. iii, 271; $140.00 (paper).

This work contains proceedings from a symposium sponsored by the COMPUTER LAW REPORTER on the Semiconductor Chip Act of 1984. Included are the text of the Act, excerpts from the House and Senate hearings, and other legislative and informational materials.

THIRD PARTY PROTECTION OF SOFTWARE AND FIRMWARE by John J. Borking. New York: Elsevier Science Publishing Company, Inc., 1985. Pp. xx, 521; $74.00.

This book examines protection of computer software throughout Europe, Japan, and the United States. It begins with a technical analysis of the operation of computers and software. The book then discusses the various forms of software protection applied in different countries, making recommendations for legal, commercial, and technical improvements in the protection of international proprietary rights.

TRADE SECRETS LAW HANDBOOK by Melvin F. Jager. New York: Clark Boardman Company, Ltd., 1985. Pp. xx, 667; $85.00 (looseleaf).

This "handbook" aims to be both a scholarly treatise and a practical guide for trade secrets litigation. It begins by reviewing the history and development of trade secrets law from its Anglo-American common law source to its modern day statutory conceptions. Subsequent chapters analyze issues which arise in trade secrets litigation: procedural issues such as the proper forum, choice of law, and the burden of proof; the elements necessary for establishing a trade secrets cause of action; remedies; and the termination of trade secrets by disclosure. One chapter is devoted specifically to trade secrets

protection for computer programs. Other chapters deal with trade secrets in a variety of legal contexts, including issues involving antitrust, restrictive covenants, taxation, and the Freedom of Information Act. The appendices, which comprise one-third of the book, contain sample pleadings and jury instructions, sample confidential disclosure agreements and licenses, excerpts of pertinent statutes, a comprehensive bibliography, and other materials which a practitioner would find useful.

TRADEMARKS AND UNFAIR COMPETITION, 2d ed., 2 vols., by J. Thomas McCarthy. Rochester, N.Y.: Lawyer's Co-operative Publishing Company, 1984. Pp. xlvi, 1116 (vol. 1), xl, 1153 (vol. 2); $169.00; 1985 Supp. Pp. 81 (vol. 1), 103 (vol. 2); $28.00.

This two-volume treatise is a comprehensive study of the law of trademarks and unfair competition. The initial chapters introduce the basic principles and policies behind these areas of law, with some emphasis on their historical development, and discuss the scope and nature of the protection afforded different types of trademark formats. Aimed primarily at the practitioner, the book contains several chapters on legal transactions, such as the assignment, licensing, and registration of trademarks, and on administrative proceedings. Litigators will find useful the chapters devoted to the issue of trademark infringement and those on the incidence of unfair competition arising from false advertising, from competitive restrictions on the sale of businesses and property, and from employment contracts. Of equal interest to litigators are the chapters outlining remedies and defenses, and the chapter on procedural issues involved in trademark infringement and unfair competition litigation, which includes sample pleadings and forms. The book concludes with checklists of legal claims and defenses and an appendix containing excerpts from relevant statutes. The author is Professor of Law at the University of San Francisco.

C. Artificial Intelligence

BUILDING EXPERT SYSTEMS edited by Frederick Hayes-Roth, Donald A. Waterman & Douglas B. Lenat. Reading, Mass.: Addison-Wesley Publishing Company, Inc., 1983. Pp. xvi, 444; $38.95.

This book is an anthology of studies written by researchers and developers of expert computer systems. The book begins with an introductory section presenting an overview of the history and nature of expert systems. Following this introduction, the book is organized into several sections involving the building and evaluating of expert systems. The work concludes with a case study describing a system that manages inland oil and hazardous chemical spills. The editors intended this book to be a teaching tool aimed at computer science

and decision-support students. Thus, exercises appear at the end of each chapter and an extensive bibliography is included.

COMPUTING POWER AND LEGAL REASONING edited by Charles Walter. St. Paul: West Publishing Company, 1985. Pp. xiv, 871; $36.75.

A review of this book will appear in the next issue of HIGH TECHNOLOGY LAW JOURNAL.

INTRODUCTION TO ARTIFICIAL INTELLIGENCE by Eugene Charniak & Drew McDermott. Reading, Mass.: Addison-Wesley Publishing Company, Inc., 1985. Pp. xvii, 701; $36.95.

This textbook serves as an introduction to basic artificial intelligence concepts and their underlying theories. The authors assume that readers have a background in computer programming. However, because the authors stress the interdisciplinary nature of the artificial intelligence field, readers may find a background in formal logic, calculus, and linguistics helpful for the chapters devoted to theory. The first seven chapters of the book introduce and build on ideas surrounding the concepts of internal representation and reasoning, as well as the use of the programming language LISP. The final four chapters examine reasoning under uncertainty, robot planning, and language comprehension.

D. Legal User's Guides

AMERICAN STANDARD HANDBOOK OF SOFTWARE BUSINESS LAW by John C. Lautsch. Reston, Va.: Reston Publishing Company, Inc./Prentice-Hall, Inc., 1985. Pp. xxi, 417; $34.95 (cloth), $13.95 (paper).

This book is intended to be a user's guide for software writers. It attempts to give software writers a "broad survey of the legal scenery that surrounds [them]." It includes chapters which give an overview of the American legal system, tort law, and contract law. The bulk of the book is devoted to the laws relating to patent, copyright, and trade secret protection of software. The book also includes a large section on warranty liability and products liability. The book has a twenty-page appendix listing software publishers interested in freelance submissions. Primary markets, desired specifications, and other marketing information is given for each software publisher listed.

COMPUTER USER'S LEGAL GUIDE by R. Lee Hagelshaw. Radnor, Pa.: Chilton Book Co., 1985. Pp. viii, 232; $17.95 (paper).

This book is written both to acquaint the non-lawyer with legal issues to consider when acquiring computer supplies, and to aid the software developer in marketing and protecting software. It provides

general explanations of contract terms as well as copyright, trade secret, and patent protections, and gives hypothetical and real examples of how problems arise. One chapter of the book is devoted entirely to "Computers and Taxes," and describes income tax deductions and credits available for personal and business purchasers of computer supplies, as well as for developers and sellers of software. Another chapter is devoted solely to how computer professionals can limit their liability by offering some practical suggestions for avoiding legal problems. A section is also included on organizing a company and raising capital, describing partnerships and corporations and giving examples of a general partnership agreement, articles of incorporation, and an outline of what may or should be included in corporate bylaws. Of particular interest to the software developer are three chapters and appendices containing information and examples regarding work-for-hire agreements, license agreements, marketing contracts, copyrights and patents, and warranties. The book ends with a postscript on hiring an attorney.

LAW OFFICE GUIDE TO SMALL COMPUTERS by Forrest Dean Rhoads & John Edwards. Colorado Springs, Colo.: Shepard's/McGraw-Hill, 1984. Pp. xxvi, 431; 1985 Supp. Pp. v, 32; $22.00.

This book serves as a survey of computer technology available for use in the modern law office. The authors provide basic information on how computers work and what they are capable of doing as well as advice on the selection and use of a computer system and software. The book also contains discussions of on-line database research services and office management programs, all in non-technical language easily comprehensible by lawyers and law office personnel. The appendices include a glossary of computer terminology and a list of computer resources.

LEGAL ASPECTS OF COMPUTER USE by Stuart R. Wolk & William J. Luddy, Jr. Englewood Cliffs, N.J.: Prentice-Hall, Inc., 1986. Pp. xii, 192; $19.95 (paper).

This book was written by two professors of management and is aimed generally at both software developers and computer users. The book contains chapters on protecting proprietary rights, computer crime, and personal liability related to computer use arising in tort and contract. The appendices include model software license and development agreements, as well as texts and analyses of selected state computer crime statutes.

LEGAL CARE FOR YOUR SOFTWARE by Daniel Remer. Berkeley: Nolo Press, 1984. Pp. 272; $24.95 (paper).

This manual is written largely for a lay audience and describes pertinent legal concerns for software developers. The introduction of the work provides perhaps the best description of what the book includes: "[t]his book covers hiring programmers, understanding trade secrets, establishing a trademark for your program name, copyrighting your work, protecting yourself from irate customers, [and] negotiating and writing contracts . . . ." The book also contains sections on contracts, test agreements, license agreements, patents, limiting liability, remedies, and international software law. The book makes very few references to statutes and other legal materials and is therefore limited as a research tool. The extensive appendices provide examples of the various forms and contracts discussed in the text.

II. BIOTECHNOLOGY

BIOTECHNOLOGY AND THE LAW by Iver P. Cooper. New York: Clark Boardman Company Ltd., 1982. Pp. xxv, 723; $86.50 (looseleaf).

This treatise presents an overview of legal issues involving biotechnology. The book begins with an introduction to the patent system, followed by chapters on the patentability of biological inventions, the policy and philosophical questions implicated by such patents, and problems involved in applying the "law of nature" doctrine to biotechnology. Of particular interest to practitioners is the chapter on claiming and enforcing utility patents for microbiological inventions, which includes sections on the drafting of claims and available defenses. Another chapter of practical interest contains guidelines for complying with disclosure requirements. Several chapters are devoted to the statutory protection of new plant varieties. The book also contains a chapter discussing statutory protection of biological inventions in Eastern and Western Bloc nations and in the Third World. The book concludes with a discussion of available trade secret protection for biotechnology. The appendices include United States Utility Patent Law materials and excerpts from relevant international treaties and conventions.

GENE BUSINESS: WHO SHOULD CONTROL BIOTECHNOLOGY? by Edward Yoxen. New York: Oxford University Press, 1983. Pp. ix, 230; $7.95 (paper).

This book begins by describing some of the potential uses of biotechnology, such as creating new medicines, increasing crop yield, and developing new energy resources from biodegradable wastes. The author argues that, despite this potential, biotechnology is not currently being used beneficially to solve world problems. The reason for this, the author explains, is that biotechnology is currently

controlled by "short-sighted" multinational corporations who are motivated purely by profit and who ignore the long-term potential of this new technology. For example, the author notes that the creation of sugar substitutes in laboratories has caused a decrease in the world price of sugar, resulting in further economic problems for the already poor sugar-growing nations of the Third World. The author argues for greater government involvement in the future development of biotechnology, both through the use of affirmative measures, such as offering research support to biotechnology corporations in exchange for input concerning planning and development decisions, and through the use of negative measures, such as withholding patents in order to control the direction and pace of biotechnological development.

III. TELECOMMUNICATIONS

DEREGULATION OF INTERNATIONAL TELECOMMUNICATIONS by Ronald Eward. Dedham, Mass.: Artech House, Inc., 1985. Pp. vii, 425; $50.00.

This is a detailed study of the series of actions taken by the Federal Communications Commission ("FCC") between 1979 and 1980 which were intended to benefit consumers by increasing competition in the area of international record services. The main purpose of the study is to assess the potential impact of the FCC actions on the international telecommunications market. The author attempts to explain the policy goals behind the FCC actions, the strategy used to implement those goals, and evaluates the overall success of the FCC actions. Parts of this analysis were originally commissioned by the United States Department of Commerce.

PROTECTING PRIVACY IN TWO-WAY ELECTRONIC SERVICES by David H. Flaherty. White Plains, N.Y.: Knowledge Industry Publications, Inc., 1985. Pp. viii, 173; $34.95.

In this book, the author examines the ways in which consumers' privacy can be compromised in the course of using new forms of information technology, including interactive television services delivered over cable or telephone lines into individual homes. The personal data collected in the course of using interactive services could be translated into user profiles and sold to interested parties, such as market research firms. Also, the government could conceivably obtain information on citizens from such profiles. The author evaluates various government and industry remedies that are proposed (or which already exist) for protecting privacy through the use of such means as corporate policy and software design. The author favors a combined industry and governmental approach in order to protect the privacy of consumers, stressing the minimal cost of self-regulation at an early stage in the development of the new

technologies. He also recommends that cable subscribers be made aware of what information will be collected from them and what it will be used for. The appendices include the text of selected privacy codes and the pertinent sections of the Cable Communications Policy Act of 1984.

IV. ANTITRUST AND CORPORATE VENTURES

ANTIMONOPOLY LAWS OF JAPAN by Hiroshi Iyori & Akinori Uesugi. New York: Federal Legal Publications, Inc., 1983. Pp. xxv, 356; $85.00.

Japan is today one of the most powerful and important nations in the world economy. In this book, the authors argue that one explanation for Japan's extraordinary economic development and competitiveness in the world market since World War II is the degree of competition among Japanese firms caused by economic democratization measures imposed after the War. Beginning with an examination of the Japanese economy prior to World War II, when economic power was concentrated in cartels and monopolies (in the so-called Zaibatsu), the authors outline the development of Japanese economic policy with respect to competition, tracking the development of the Antimonopoly Act, its amendments and its enforcement.

CALIFORNIA ANTITRUST LAW AND PRACTICE by Ralph H. Folsom & Robert C. Fellmeth. Seattle: Butterworth Legal Publishers, 1983. Pp. xxi, 271; 1985 Supp. Pp. 35; $65.00.

This treatise on California antitrust law begins with a discussion of California's Cartwright Act and the Unfair Practices Act, including analyses of applicable case law. The work then proceeds to a discussion of other California statutes related to antitrust, such as those laws which regulate specific industries. The authors, both professors from the University of San Diego School of Law, intended this book to be a practice guide in addition to being a scholarly treatise. Therefore, the authors provide a chapter comparing antitrust litigation in California courts to litigation in federal courts, and devote a chapter to antitrust trial tactics. The book concludes with an appendix containing model litigation forms.

INTERNATIONAL LAW OF TAKE-OVERS AND MERGERS: ASIA, AUSTRALIA & OCEANIA by H. Leigh Ffrench. New York: Quorum Books, 1986. Pp. ix, 457; $65.00.

This book is intended as a reference tool for companies, law firms, and regulatory bodies concerned with foreign merger and acquisition activity. It examines securities law and the regulations governing mergers and acquisitions for the nations in northern and southeast Asia, the Indian subcontinent, Australia, and Oceania. The author, a professor of commerce at the University of Queensland, Australia,

also discusses antitrust laws, foreign investment laws, labor laws, regulatory institutions, and potential legislative changes.

R & D PARTNERSHIPS: STRUCTURING THE TRANSACTION by Lee R. Petillon & Robert Joe Hull. New York: Clark Boardman Company, Ltd., 1985. Pp. xii, 212; $85.00.

This book is a practical guide on tax and legal issues involving research and development partnerships. It is intended for those who are charged with structuring and preparing the documentation necessary to complete the formation of a research and development partnership (e.g. private placement memoranda and collateral agreements). The authors devote chapters to financial planning and document drafting. The advantages and disadvantages of research and development partnerships, and alternatives to such partnerships are also discussed. The appendices comprise over two-thirds of the book and contain relevant tax provisions and securities regulations, accounting materials, sample financial projections charts, and numerous sample agreements involving such matters as licensing options, joint ventures, technology purchases, employee confidentiality, and patent transfers.

SHERMAN ACT INDICTMENTS: 1955-1980, 2 vols., by James M. Clabault & Michael K. Block. New York: Federal Legal Publications, 1981. Pp. xxxv, 1070; $135.00.

Volume One contains a case chart for every criminal indictment instituted under the Sherman Act from the time of the amendment of Section One in July of 1955 through December 31, 1980. Each indictment is classified by Blue Book Number and is accompanied by such information as the specific charge(s) brought, the defendant's plea and the penalty imposed, if any. Volume Two contains texts of various speeches made by officials in the Antitrust Division of the United States Department of Justice expressing the Department's official positions on plea bargaining, sentencing, prosecutorial discretion, and on other related issues. Volume Two also contains numerous statistical tables including, for example, a table of the average fines imposed and the volume of antitrust cases heard by the courts between 1955 and 1980.

V. SCIENCE AND THE LAW, AND OTHER ISSUES

HIGHEST COST OF HIGH TECH: THE DARK SIDE OF THE CHIP by Len Seigel & John Markoff. New York: Harper & Row, 1985. Pp. 247; $16.00.

This book is presently being considered for review in the next issue of HIGH TECHNOLOGY LAW JOURNAL.

HIGH TECH REAL ESTATE by Alan D. Sugarman, Andrew D. Lipman & Robert F. Cushman. Homewood, Ill.: Dow-Jones-Irwin, 1985. Pp. xxi, 639; $50.00.

This book is presently being considered for review in the next issue of HIGH TECHNOLOGY LAW JOURNAL.

LAW, SCIENCE & MEDICINE by Judith Areen, Patricia A. King, Steven Goldberg & Alexander Morgan Capron. Mineola, N.Y.: The Foundation Press, Inc., 1984. Pp. lxxxiii, 1494; $34.50.

Recent developments in science and medicine, such as those involving genetic engineering and nuclear energy, have fostered important new legal and public policy questions. This book is the first edition of a casebook which aims to cover this emerging area of law. The casebook editors approach this topic by organizing the readings (most of which are excerpts from works written by scientists, doctors, philosophers, and sociologists) around issues of private and public policy interests in the control of science and medicine. The second half of the book examines specific problems in science and medicine, such as human experimentation and euthanasia.

OUTER SPACE: NEW CHALLENGES TO LAW AND POLICY by J.E.S. Fawcett. New York: Oxford University Press, 1984. Pp. 159; $29.95.

The author divides his work into two basic areas. The first section of the book explores space as an international frontier and analyzes the international documents which have been developed thus far to regulate the usage of space. Also included is a discussion of international conflict resolution. The author discusses in detail the roles of the principal space operators: private enterprise, government agencies, and international joint ventures. The second section provides a detailed look at the specific uses of space and the international regulation of these particular areas. Subject areas discussed include telecommunications, remote sensing, space stations, and strategic uses of outer space. However, because the book was published in 1984 this latter section makes no reference to President Reagan's SDI/"Star Wars" program.

SOLAR LAW by Sandy F. Kraemer. Colorado Springs, Colo.: Shepard's/McGraw-Hill, 1978. Pp. ix, 364; 1986 Supp. Pp. 103; $75.00.

The book begins with a "solar perspective," evaluating present solar technology and its potential. The text then reviews the law relating to easements, covenants, zoning, land use regulation, public and private nuisance, eminent domain, the approbation doctrine, transferable development rights, air pollution, and building codes. Extensive recommendations for application of these bodies of law to the further development of solar energy are made by the author.

Proposals for new public laws and private agreements are included, with detailed explanations. The supplement includes a new chapter devoted to "Solar Consumer Protection." The appendices include a glossary of solar terminology, a summary of potential legal issues, and materials on tax incentives, financing of solar energy systems, insurance and warranties, a social acceptance survey, and a bibliography.

TRADEOFFS: IMPERATIVES OF CHOICE IN A HIGH-TECH WORLD by Edward Wenk, Jr. Baltimore: Johns Hopkins University Press, 1986. Pp. xii, 238; $19.95.

This book is presently being considered for review in the next issue of HIGH TECHNOLOGY LAW JOURNAL.

WORLD OF SCIENCE AND THE RULE OF LAW by John Ziman, Paul Sieghart, and John Humphrey. New York: Oxford University Press, 1985. Pp. vi, 343; $37.00.

This book examines the human rights policies of the thirty-five nations which signed the Helsinki Accords in 1975 in order to determine the impact of human rights violations on scientists. The authors do not propose that scientists should receive more rights and privileges than average citizens, but warn that the denial of human rights by a government to its population will have a disproportionate effect on the scientific community, which in turn will ultimately slow down the progress of science. The authors conclude that the Communist nations have been far more violative of the human rights of scientists than have the other signatories of the Helsinki Accords, and argue that there is a need for greater enforcement of international human rights agreements.