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Legal Mindstorms: Lawyers, Computers and Powerful Ideas

Ronald W Staudt, *Chicago-Kent College of Law*

REFLECTIONS

LEGAL MINDSTORMS: LAWYERS, COMPUTERS AND POWERFUL IDEAS

Ronald W. Staudt*

I had been a successful student for sixteen years but, when I began law school in 1967, I found the classroom both frightening and baffling. My performance on the first set of examinations was poor. I studied diligently, but somehow I often missed the point in class. I had trouble finding the frame of reference for the questions or the best source of information for the answers. Then, about halfway through my first year of law school I began to catch on. I started to understand the type of discourse that my law professors wanted from me when they talked law. Not that I knew every answer to every question posed in the classroom, but I knew what type of answer was appropriate. I started to follow the conversation.

When I ask my second-and third-year law students today if they had a similar experience in their first year, most of them quickly say "yes" with a smile of recognition. Legal academics call this phenomenon learning how to think

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*Professor of Law and Director of Computer Development, IIT Chicago-Kent College of Law. B.A., B.S., St. Joseph's College, 1967; J.D., University of Chicago Law School, 1970.

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like a lawyer. We speculate on the reasons for this change in the ability of law students to understand and participate in legal analysis and discourse. Some of my colleagues suggest that the change occurs when students learn a disciplined approach to problem solving through the Socratic dialogue of the classroom. Others are convinced that the classroom helps students to develop the ability to think in terms of persuasion, to see both sides of an issue and to argue in favor of either side. Still others are persuaded that the accumulation of knowledge about the legal system, its processes and operation is the missing component.

In this essay, I argue that research in artificial intelligence may point to an answer to this mystery. In Part I, I describe the work of Seymour Papert who wrote a new computer language, LOGO, to help children master mathematics. Papert's theories may explain the nature of the leap in understanding that occurs in the first year of law school and offer a perspective on the nature of law itself. In Part II, I review some of the attempts to study legal reasoning using computers, especially two projects that explicitly use jurisprudence to guide the construction of computational models. Part III looks to the near future. A new type of computer software, hypertext, may offer law students and lawyers a powerful tool to help them think law.

I. MINDSTORMS

Ten years ago Seymour Papert published a remarkable monograph called *Mindstorms: Children, Computers and Powerful Ideas.*[1] The core idea of the book is that computers have the capacity to change the entire landscape of mathematics education for children. The mechanism for this change is the computer as an "object to think with" rather than the computer as a patient drill and practice tutor.[2]

In Papert's view, math phobia is the result of improper and oppressive methods of teaching mathematical concepts; the computer can liberate elementary education from the trap of drill and practice and memorization of multiplication tables. Papert and his MIT team built LOGO—a computer language that creates an environment within the computer to give students control over the computer's computational capabilities. LOGO creates a "Mathland" within the computer where children can manipulate objects, draw shapes, create mazes, and play. They do this by giving instructions to a cursor, called a turtle, to take steps in one direction or another and to repeat those steps in some type of sequence. These instructions are computer programs and also precise descrip-

[1] S. PAPERT, MINDSTORMS: CHILDREN, COMPUTERS AND POWERFUL IDEAS (1980).

[2] *Id.* at vi-viii, 19–23. From 1958 to 1964 Papert studied children and the nature of thinking in Switzerland under the noted child psychologist Jean Piaget. He then moved to the MIT Artificial Intelligence Lab where he worked with Marvin Minsky and other computer scientists and programmers investigating new approaches to using computers to help children learn mathematics.

tions of geometry. In this way, Papert aims to use the computer to empower students to explore mathematics.[3]

My vision of the use of computers by law students and lawyers is inspired by Papert's innovation. Instead of thinking of computers for law students as teaching machines that drill students on future interests, computers should be able to create an environment for law students to think law, in the same way that LOGO helps children think math.

In 1980, Papert's proposal that computers be provided to virtually all elementary schoolchildren was aggressive and controversial. Today, many elementary schools and most law firms have access to computers in large numbers. In fact, preliminary results of the 1990 IIT Large Firm Survey indicate that 45 percent of lawyers in large law firms have a computer or terminal on their desks. The computer on lawyers' desks today has word processing, communications software to contact ABAnet, WESTLAW and LEXIS, an outlining program for planning, and a few utilities to do calculations, dial the telephone, and keep track of time. If, as I contend, the same computer will include software to extend and enhance the lawyer's thinking capabilities, then scholars who are expert lawyers will have helped computer scientists to plan and develop the lawyer's computer.

Papert predicted that thousands of microcomputers would be available to students in grade schools. These computers equipped with LOGO, his new computer language, could empower students to learn mathematics in a natural and more enjoyable way. Papert came to this conclusion by drawing parallels between his own experience in learning mathematics and Piaget's studies of how children learn. As a child, Papert was fascinated by gears. He counted teeth and imagined the direction and number of turns that various gear combinations would produce. Later on, gears became his "object to think with" when he learned multiplication tables and algebraic equations. When he studied with Piaget he concluded that gears connected with ideas in formal mathematics and also with the sensorimotor schemata of himself as a child.

> You can be the gear, you can understand how it turns by projecting yourself into its place and turning with it. It is this double relationship—both abstract and sensory—that gives the gear the power to carry powerful mathematics into the mind. . . . The gear acts here as a transitional object.[4]

Papert saw the computer as the type of machine that could allow children to create "for themselves something like what the gears were for me."[5]

Papert believed that children are able to use computers to learn mathematics in a Piagetian fashion, that is, without didactic instruction through a sort of

[3] *Id.* at 1–13. Papert identifies a variety of problems with elementary education and proposes a rich array of solutions. For example, he proposes that young children can learn problem solving, planning, debugging, physics, and parts of the conceptual framework of calculus using LOGO.

[4] *Id.* at viii.

[5] *Id.*

cultural assimilation. By speaking mathematics to a computer turtle, Papert suggested that children would make mathematics their own in the same way that they learn language. The turtle accomplishes this transformation in much the same way that gears served as transitional objects in Papert's youth. For example, children give instructions to the turtle to solve problems that match their own body senses. To draw a square, children are encouraged to walk in a square and then tell the turtle to take the same steps that they took. To write a program to draw squares, students are told to teach the turtle a new word, SQUARE, that lists all the steps the turtle has to take.[6]

Papert based much of his work on a set of foundation experiments conducted by Piaget. Piaget studied the way children learn to understand their environment in order to develop insights on the nature of knowledge itself. Piaget discovered that children around the world develop an understanding of quantity at about the same age. Before that age, when children are presented with two equal short fat glasses of liquid and watch one of the glasses emptied into a tall thin glass, almost all of them will say that the tall thin glass has more liquid than the short fat glass. At about six or seven years of age, almost all children change their mind and become convinced that the amount of liquid is the same despite the different appearances of the two containers. This is one of many "conservations" that children learn on their own without much direct teaching.[7]

Papert suggests that in children's minds there are "agents" that judge quantities in a very simpleminded way.[8] One agent called HEIGHT judges the extent of liquid and other things by its height. Another agent, WIDTH, determines quantity by horizontal extent. A third agent, HISTORY, says to the child's mind that quantities are the same that once were the same. Papert thinks that in preconservationist children, all of these agents offer their solution to the child and HEIGHT wins because it speaks the loudest. In postconservationist children, a fourth agent has been created, GEOMETRY, that acts as a supervisor between HEIGHT and WIDTH. GEOMETRY knows only whether its subagents HEIGHT and WIDTH agree or disagree and in what direction. When they agree, GEOMETRY passes on their message with great authority. When they disagree, the voices of each is neutralized. The new agent is important to avoid the neutralization of HISTORY. The society of agents gathered by the supervisor agent, GEOMETRY, does not include HISTORY. Therefore, when GEOMETRY neutralizes its subagents HEIGHT and WIDTH, HISTORY has the ability to control the decision. This grouping of agents in an

[6] *Id.* at 63–68.

[7] *Id.* at 166–67.

[8] Agents are the building blocks of mind for both Papert in MINDSTORMS and for Marvin Minsky in THE SOCIETY OF MIND (1986). Agents are to thinking what atoms are to matter. Papert and Minsky suggest that to explain the mind it is important to show how it is built from mental elements that are smaller and simpler than anything we consider smart. In THE SOCIETY OF MIND, Minsky proposes that intelligence is like a society of many agencies that themselves are not intelligent. These agents are organized in our mind, actually to form our mind, like a society. They interact, relate to one another, conflict, and agree in various ways to form our thoughts..

administrative structure is the learning that takes place when a child assimilates the conservation of liquids.[9]

Marvin Minsky was the director of the MIT Artificial Intelligence Lab while Papert worked on the research underlying *Mindstorms*. Minsky collaborated with Papert in joint work on an early effort to write a book on the Society of Mind theory.[10] Minsky examines a number of reasons why younger children might fail to understand the conservation of liquids. Perhaps younger children are unduly influenced by the larger extent of space taken up by a taller glass; perhaps they are more influenced by the changing factors rather than the factors that remain the same; or perhaps they have not yet developed reasoning tools needed to understand the concept of quantity. Each of these explanations, according to Minsky, has some truth but none of them reach the central reason for the change. There is evidence that younger children have each of these abilities but are unable to apply them when faced with this demonstration.

> One might say that they lacked adequate *knowledge about their knowledge*, or that they have not acquired the checks and balances required to select or override their hoards of agents with different perceptions and priorities. It is not enough to be able to use many kinds of reasoning; one must know *which to use in different circumstances*! Learning is more than the mere accumulation of skills. Whatever we learn, there is always more to learn—about how to use what was already learned.[11]

For Papert and Minsky, the Piaget example prompted a theory to explain thinking—a theory that they could use to build computer models of the mind. Minsky calls the insight drawn from Piaget's experiments "Papert's Principle":

> *Some of the most crucial steps in mental growth are based not simply on acquiring new skills, but on acquiring new administrative ways to use what one already knows.*[12]

The explanation of the difference in thinking capability between preconservationist and postconservationist children offered by Papert may explain the change that I experienced during my first year of law school. I learned new administrative ways to use the knowledge that I brought to law school. Those new organizational techniques helped me to assimilate and use new information that I acquired in my law studies. At a more detailed level, my new learning about learning probably took the shape of concepts that organized other concepts in patterns that are appropriate for legal discourse.

The description by Papert of mental agents, combining within a society of concepts in conflict also matches my intellectual picture of the law. Like Papert's mental agents, cases and other original sources of law are often inconsistent. Yet it is rare for cases to be overruled and discarded as wrong. Somehow

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[9] S. PAPERT, *supra* note 1, at 167–70.

[10] Ultimately, Minsky wrote THE SOCIETY OF MIND on his own when his work and Papert's took different directions. M. MINSKY, *supra* note 8, at 324–25.

[11] *Id.* at 100.

[12] *Id.* at 102.

the legal system allows all of its chaotic and conflicting material to be considered the law. Because there are conflicting rules, Ronald Dworkin posits that legal reasoning is often a fight to determine which rule to apply rather than to determine the result that will ensue if the rule is applied.

> In adjudication, unlike chess, the argument for a particular rule may be more important than the argument from that rule to the particular case; and while the chess referee who decides a case by appeal to a rule no one has ever heard of before is likely to be dismissed or certified, the judge who does so is likely to be celebrated in law school lectures.[13]

Edward Levi describes the life and death of legal concepts derived from cases as follows:

> The first stage is the creation of the legal concept which is built up as cases are compared. The period is one in which the court fumbles for a phrase. Several phrases may be tried out; the misuse or misunderstanding of words itself may have an effect. The concept sounds like another, and the jump to the second is made. The second stage is the period when the concept is more or less fixed, although reasoning by example continues to classify items inside and outside of the concept. The third stage is the breakdown of the concept, as reasoning by example has moved so far ahead as to make it clear that the suggestive influence of the word is no longer desired.[14]

Now, consider Minsky's description of learning new hierarchies as a model for how the common law develops:

> How could a brain continue functioning while changing and adding new agents and connections? One way would be to keep each old system unchanged while building a new version in the form of a detour around or across it—but not permitting the new version to assume control until we're sure that it can also perform the older system's vital functions. Then we can cut some of the older connections.[15]

Although there are differences between Minsky's description of thinking and the description of legal reasoning by leading jurisprudential theorists, they bear

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[13]R. DWORKIN, TAKING RIGHTS SERIOUSLY 112 (1977).

[14]E. LEVI, INTRODUCTION TO LEGAL REASONING 8-9 (1949). *See also* Rissland & Skalak, *Interpreting Statutory Predicates*, in PROCEEDINGS OF THE SECOND INTERNATIONAL CONFERENCE ON ARTIFICIAL INTELLIGENCE AND LAW (Vancouver, B.C. 1989) [hereinafter PROCEEDINGS], offering a fascinating analysis of modeling statutory interpretation. Rissland and Skalak find parallels between the accounts of statutory interpretation proposed by Karl Llewellyn and Clarence Morris on the one hand, and the account of mathematical problem solving by the famous mathematician Polya on the other. Both disciplines, according to Rissland, combine case-based reasoning and rule-based reasoning in an alternating interplay to solve difficult problems.

Papert also refers to this type of problem solving:

> [T]he process reminds one of tinkering; learning consists of building up a set of materials and tools that one can handle and manipulate. Perhaps most central of all is the process of working with what you've got. We're all familiar with this process on the conscious level, for example, when we attack a problem empirically, trying out all the things that we have ever known to have worked on similar problems before. S. PAPERT, *supra* note 1, at 173.

[15]M. MINSKY, *supra* note 8, at 107.

remarkable similarities. But perhaps it is myopic to think that these similarities are remarkable. Law can be viewed as the structure that human society creates for itself. It stands to reason that men and women will create a structure for their society that matches the society of their own mental agents.

If we assume a symmetry between Papert's ideas about children's learning using computers, and law students' learning using computers, then our quest should be to find a LOGO of the law. What set of computer tools will serve as the law student's learning environment? In the next section I will examine the difficulties encountered by artificial intelligence researchers who have tried to model some part of the law in a computer. In the final section, Part III, I will suggest that these lessons from artificial intelligence point to a new computer tool, hypertext, that may be the basis for the law student's LOGO.

II. INVESTIGATING THE NATURE OF LEGAL REASONING: STUDIES IN JURISPRUDENCE AND ARTIFICIAL INTELLIGENCE

Expert systems are a type of artificial intelligence program that enable a computer to store and use the knowledge of persons skilled in a particular set of tasks. The distinguishing feature of an expert system is that it contains a knowledge base—an organized body of knowledge in a narrow area usually derived from experts in that field. Expert systems are usually composed of three components: a knowledge base, an inference engine, and a user interface. The knowledge base contains rules or examples or some other form of information coded into the computer in an organized way. The inference engine is software that uses information from the knowledge base to solve the user's problem. The user interface is software that accepts information from the user and delivers it in an acceptable way to the inference engine.[16]

For example, an expert system could determine whether conduct constitutes rape as defined by the Model Penal Code.[17] The expert system would ask the user a series of questions about contact, penetration, consent, and the victim's age. Based on the user's response the inference engine would analyze its knowledge base about the definition of rape to determine the answer to the question. The answer might be provided as a simple "yes" or "no" or "unknown." A more helpful system would offer a listing of the rules or examples in the knowledge base that determine the answer.

Expert systems in law span a range of uses from the very practical to the highly theoretical. Practical systems contain legal information to help lawyers

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[16] P. CAPPER & R. E. SUSSKIND, LATENT DAMAGE LAW—THE EXPERT SYSTEM 1-3 (1988); G. Greenleaf, Legal Expert Systems—Robot Lawyers? 5,6 (1989) (unpublished manuscript available in the IIT Chicago-Kent Library). *See generally* BUILDING EXPERT SYSTEMS (F. Hayes-Roth, D. A. Waterman & D. B. Lenat eds. 1983).

[17] Layman Allen and Charles Saxon have written a simple expert system using their AutoPrologue software that does this analysis.

prepare documents and analyze legal problems. Researchers in more theoretical projects are building expert systems to learn more about the nature of human intelligence, the limits of logic, and the nature of legal reasoning.

Two research projects explicitly draw on jurisprudence to help direct their inquiry into the ability of computers to model the law. Anne v.d.L. Gardner and Richard Susskind each took doctorates in computer science based on research in artificial intelligence and law. Their dissertations have been published as books that analyze the literature in legal theory to identify achievable objectives for their computer models of the law.[18] Both examine the jurisprudential literature to provide perspective on the nature of legal reasoning. The special focus of their inquiries is on the use of rules in legal reasoning. Because the computer is excellent at deductive reasoning using rules, both scholars try to determine, from a review of jurisprudential theory, whether any significant portion of legal reasoning can be described as simple deductive reasoning from a given set of rules. Both scholars also look to jurisprudence to help define the types of cases that cannot be solved by the rules alone.[19]

Gardner's book describes her efforts to "create a model of the legal reasoning process that makes sense from both jurisprudential and AI (artificial intelligence) perspectives.[20] Gardner built a computational tool to model a small area of contract law. Her computer system was designed to analyze fact sets resembling examination problems in a first year contracts course. The program determines whether the facts pose an easy or hard question of contract formation. Easy cases are those problems that the computer can handle using the rules coded into its knowledge base and hard cases are those problems that defy computer solution and must be left to the user.[21]

The common law is dynamic. Even when there is an excellent compilation of rules like the *Restatement of Contracts,* conflicting rules coexist and new rules emerge as cases are decided. These characteristics of the law are difficult to duplicate in an expert system. Further, as Gardner concedes, her model is unable to contain knowledge about the purpose or goal of the rules. As Gardner attempts to develop a computer program that can identify and solve easy cases, this limitation ensures some erroneous results. Lacking the ability occasionally to refer to justice or fairness, Gardner's system will be unable to avoid these erroneous results.[22]

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[18] A. GARDNER, AN ARTIFICIAL INTELLIGENCE APPROACH TO LEGAL REASONING (1987); R. SUSSKIND, EXPERT SYSTEMS IN LAW: A JURISPRUDENTIAL INQUIRY (1987).

[19] For a different approach to modeling the common law *see* Ashley, *Toward a Computational Theory of Arguing with Precedents: Accommodating Multiple Interpretations of Cases, in* PROCEEDINGS; Rissland & Skalak, *Interpreting Statutory Predicates,* in PROCEEDINGS. Edwina Rissland, Kevin Ashley, and their colleagues focus on case-based reasoning and analogy. Using a computer tool called HYPO they code in the cases and develop an inference system that identifies the cases that support a three-ply argument—for the plaintiff, for the defendant, and reply.

[20] A. GARDNER, *supra* note 18, at 1.

[21] *Id.* at 6-16, 24, 37.

[22] *Id.* at 31-32.

In addition, the language in legal texts is often open textured.[23] Terms of art such as "due process" and "negligence" can be identified as problem words that require special handling. Another difficult problem for a computer system is that the law commonly takes ordinary words and does violence to their natural meaning.[24]

Gardner's solution to some of these problems is to develop heuristics, which are problem solving "rules of thumb" that mirror the techniques used by lawyers to do their work. She establishes some common sense rules to find tentative definitions of the words used in the problem sets. She also develops a knowledge base of examples or cases that her system can use when the rules drawn from the *Restatement* run out. Her heuristics define the techniques that the computer will use to solve problems by reference to the rules of law, common sense rules, and cases. For example, if reference to her common sense rules can solve the problem and no objections can be found in her knowledge base of cases, then the program determines that the problem is "easy" and delivers the solution.[25]

By design, Gardner's system is limited. She acknowledges that the system is not a model of the law, but a secondary source. She does not attempt to include the reason for rules as separate knowledge in the system, relying on the user to identify and avoid the absurd results that occasionally occur when rules are followed literally.[26] She admits that a wide range of "hard cases" are beyond the capabilities of her system. Included within these hard cases are problems that require use of variable standards and undefined legalistic phrases like "inherently dangerous."[27] Her software will not find solutions that require new rule formulations.[28] She settles for an attempt to provide a machine "conceptually based in traditional jurisprudence."[29] Her long quote from Jerome Frank's musing about a cybernetic engine signals the limits that she expects in this inquiry:

> Anyone who believes such a machine can supplant the human process of judging is hoping to revert, in a scientific way, to the "mechanical" method of the ordeals. I, who have done my fair share of jeering at "mechanical jurisprudence," have no such hope. Yet I think there is much merit in the idea of such a machine. . . . [I]t seems to me that judges and lawyers would benefit from having relatively simple problems . . . speedily and correctly answered, and from having put before them promptly all possible alternative solutions of more complicated problems.[30]

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[23]H.L.A. HART, THE CONCEPT OF LAW 124–25 (1961).

[24]I do not intend to raise at this point, nor does Gardner, all of the problems of determining the meaning of texts discussed by Stanley Fish and become embroiled in the interpretivist debates. I am simply referring here to the problem at issue in the classic Hart/Fuller debate over the meaning of "vehicle" in a rule that forbids the entry of vehicles into a public park.

[25]A. GARDNER, *supra* note 18, at 50–59.

[26]*Id.* at 84 ("A sense of what is fair and reasonable is what the program lacks.").

[27]*Id.* at 36, 37.

[28]*Id.* at 42.

[29]*Id.* at 68.

[30]*Id.* at 67–68 (quoting J. FRANK, COURTS ON TRIAL 206–07 (1949)).

Another ambitious attempt to use jurisprudence to guide an artificial intelligence model of the law was reported by Richard Susskind in his first book, *Expert Systems in Law: A Jurisprudential Inquiry.*[31] Susskind's central thesis is that "there are no theoretical obstacles, from the point of view of jurisprudence, to the development of rule-based expert system in law of limited scope."[32] While he concedes that building a deep model of the law, as distinguished from a model relying exclusively on rules, may be the most challenging jurisprudential task,[33] he rejects the effort because such a conceptual model will necessarily "embody a contentious and tendentious theory,"[34] rather than a safe consensus.[35]

Susskind, like Gardner, explores the issue of rule skepticism raised by legal realists. Citing Dworkin and Hart, he concludes that rules can be derived from cases and the rules so derived will have a fair amount of consensus.[36] Susskind admits that rules are expressed in open textured language and are subject to implied exceptions based on principle or purpose. While rules themselves cannot be said to be clear, he asserts, their application in certain cases is clear. Dworkin's notion of acontextual meaning[37] forms the foundation for Susskind's technique for identifying clear cases:

> According to the semantic theory of clear cases, then, these cases are, roughly, those in which the facts of the case can, in accordance with the conventional and "acontextual" use of legal and ordinary language, be subsumed unambiguously within the terms of valid legal rules. In summary, rule-based expert systems in law can assist in the solving of such clear cases and can identify the literal interpretations of rules as they apply to the facts of cases.[38]

Susskind's system is less ambitious in its attempt to model the law than Gardner's effort. His work points to a practical application of expert system research focused on providing expertise to sophisticated users.[39] His latest book, *Latent Damage Law—The Expert System,* contains a computer disk

[31]R. Susskind, *supra* note 18.

[32]*Id.* at vii.

[33]Thorne McCarty is the leading proponent of deep models. *See* McCarty, *A Language for Legal Discourse*, in Proceedings *supra* note 19, at 180. For a criticism of the call for deep models *see* Bench-Capon, *Deep Models, Normative Reasoning and Legal Expert Systems*, in Proceedings, at 37.

[34]R. Susskind, *supra* note 18, at 154.

[35]Susskind's work succeeds as a careful study of the inability of rule-based expert systems to model the law. He fails to open new avenues in jurisprudence with his computer tools. Where serious debate or issue is raised by his examination of the jurisprudential guides he admires, Susskind curtails his system to find consensus. When he faces the ultimate criticism that his system is trivial, he resorts to common sense to assert that what he has left is an important expert system because it is able to give advice on easy cases in a complex field. His work, therefore, points the way to practical rather than theoretical applications of computers to law.

[36]R. Susskind, *supra* note 18, at 90–114.

[37]R. Dworkin, Law's Empire 17 (1986).

[38]Paper delivered by Richard Susskind, Pragmatism and Purism in Artificial Intelligence and Legal Reasoning 11 (May 3, 1989) (Expert Systems in Law Conference, Bologna, Italy).

[39]Susskind, *The Latent Damage System: A Jurisprudential Analysis*, in Proceedings, at 24.

which is an example of lawyers using computers to deliver expertise to their colleagues.[40] The expert systems that will come out of such efforts will be self consciously shallow. They will not pretend to be rich and full models of the law in all of its detail and complexity.

III. HYPERTEXT, CONCEPTUAL MAPS, AND LEGAL EDUCATION

The expert systems just described are retrieval tools that offer advice and the sources of advice to the user. As explained above, these systems are limited in their ability to mirror the open texture and conceptual complexity of the law. Most of the systems operate by asking the user a series of questions to elicit information about the problem at hand. While this method has the advantage of controlling the direction of inquiry, like leading questions on cross-examination, it does not allow the user to browse through the knowledge base which is inaccessible to the unsophisticated user. Updates, changes, and annotations must be furnished by the publisher of the system.[41]

All of these features limit the potential of traditional expert systems to help new law students learn to think like lawyers.[42] Two recent technological developments point the way to overcoming these limitations. One new product is the CD-ROM (compact disc read only memory), a new type of information storage

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[40]P. CAPPER & R. SUSSKIND, *supra* note 16. Susskind describes this system as the first expert system in law to be built in the United Kingdom (UK) by lawyers for lawyers. Capper, who was the chairman of the Oxford law faculty during most of the project, is the leading authority on the law of latent damages in the UK.

[41]If Thorne McCarty and other theoretical researchers are successful in their more ambitious efforts to build deep models of the law, their systems will not be subject to the first of these limitations. McCarty asserts that his Language for Legal Discourse will "provide a uniform framework for the construction of a legal analysis/planning/retrieval system . . . that matches as closely as possible the way a lawyer actually thinks about a legal problem." McCarty, *A Language for Legal Discourse*, in PROCEEDINGS, *supra* note 19, at 180. On the other hand, these deep models will be aimed at lawyers rather than novices, and will, by definition, be highly structured. It does not appear that such systems, alone, will offer the flexible, powerful and comfortable environment for learning envisioned by Papert.

[42]Traditional expert systems have significant pedagogical value for more advanced students and practicing lawyers. Using such a system will demonstrate to students the careful marshalling of facts necessary for legal reasoning and the complex interplay of legal concepts. Each question and answer interaction with the computer narrows the range of possible outcomes. The questions must be precise and clear. Expert systems can also serve as excellent research tools if help systems refer the user to the original sources that form the basis for the computerized rules. These systems can also serve as models for a more dynamic and powerful learning exercise—student attempts to construct expert systems themselves

Several law professors have developed seminars that lead students through expert system building as the student work product in the place of a typical seminar paper. Paul Brest, now dean at Stanford Law School, used the IBM Expert System Environment developed at the Palo Alto Scientific Center for such a seminar. Henry Perritt teaches a seminar at Villanova Law School in which students use several programming techniques to write expert systems. Law students learn the complexity of law and experience firsthand the problems described by Gardner and Susskind when they attempt to create a model of a particular domain.

system for computers. The second change is the emergence of "hypertext"—a software tool that might be able to turn microcomputers into the Papert's "objects to think with" for entering law students. Some combination of these tools may serve as the LOGO for law students, helping them to assimilate legal reasoning in a Piagetian exploration of a flexible computer map of the law.

CD-ROM disks display text in word processing format on a personal computer. About 300,000 pages of double spaced text can fit on one disk. Peter Martin, a professor and former dean of Cornell Law School, is acting as his own knowledge engineer to adapt his new treatise on social security law to this new medium. The key question facing a CD-ROM author is how to use this enormous capacity to be sure that his readers read only what they want to read. Martin's proposed solution to the retrieval problem is hypertext, a type of text data base that allows the author to organize material within hierarchical outlines, and then to link points on the outline to one another or to other lists or outlines or text.[43] CD-ROM disks have so much capacity that the author can use hypertext links in the same way a print treatise author uses footnotes, but instead of simply referring to the illustrative examples, the entire text of each example can be included in the hypertext treatise.

The user of a treatise organized with hypertext can move through the treatise in a variety of different ways. For example, the treatise will generally have a table of contents structured as a collapsible outline that can be expanded or contracted by the user to show varying levels of detail. At the bottom of the outline will be the author's description of the law. Cases, statutes or other materials referred to in the text can be displayed in citation form or in full text. These texts can be linked to one another and to other parts of the treatise. Because the CD-ROM information is displayed using a computer, all of the capabilities of the computer to manipulate information can be applied to the job of delivering expertise to the user. To illuminate the material for the user, hypertext software can call on interactive computer lessons, graphics and images, formal expert systems like those described in Part II, and computational tools like spreadsheets.

CD-ROM treatises can be coordinated with the local magnetic storage devices of the user's computer so that she can annotate the treatise with personal insights or cross references. The marginalia linking her own research objectives or client needs, on the one hand, and the treatise on the other, can be incorporated and saved for convenient retrieval. Hypertext software can also help the user call up external data bases, like LEXIS or WESTLAW.[44] The treatise author, or the user, can prepare key word searches in advance to coordinate

[43]Paper delivered by Peter Martin, Design Requirements of a CD-ROM Based Reference System Capable of Replacing Print Materials in a Field of Law (May 5, 1989) (Expert Systems in Law Conference, Bologna, Italy).

[44]PREMISE, the software used by West Publishing Company in its CD-ROM products, has some of these features. West has published CD-ROM treatises in several areas including tax, civil procedure, bankruptcy, and government contracts.

with the treatise and the personal work product stored by the user. In this way lawyers automatically can update their conceptual map of the law.

Hypertext is a deceptively simple yet very powerful tool. David Johnson has described its power and potential for lawyers:

> Lawyers think naturally in hypertext. Their fondness for footnotes and cross references indicates their healthy awareness of the potential complexity of any real legal issue. . . . Hypertext systems will provide the tools with which—or rather in which—lawyers will embody their expertise so as to make it much more suitable for easy distribution to and use by others.[45]

Johnson is also enthusiastic about the conceptual match between the power of hypertext and the law:

> The world of printed text is linear; all ideas are represented at a particular place in a long string of text. Jumping from place to place is difficult at best. The world of the computer data base and spreadsheet is planar. It consists, in essence, of a series of boxes or cubbyholes. The world of the outline program . . . is a three dimensional tree, because certain branches can be hidden behind the main topics at any time. With the development of hypertext systems, we have been provided with the ability to create and navigate through a more complex, multidimensional space. . . . [O]ur documents . . . can take the form that most naturally fits the shape of the ideas themselves. . . . *With hypertext systems, lawyers are finally able to build models of the legal domain that are complicated enough to do justice to the materials we wrestle with every day.*[46]

Papert describes the dissonance between our ideal of knowledge and its human reality as a serious problem for learning:

> Educators sometimes hold up an ideal of knowledge as having the coherence defined by formal logic. But these ideals bear little resemblance to the way in which most people experience themselves. The subjective experience of knowledge is more similar to the chaos and controversy of competing agents than to the certitude and orderliness of p's implying q's. The discrepancy between our experience of ourselves and our idealizations of knowledge has an effect: It intimidates us, it lessens the sense of our own competence, and it leads us into counterproductive strategies for learning and thinking.
>
> Many older students have been intimidated to the point of dropping out, and what is true for adults is doubly true for children.[47]

This passage has parallel application to the work of AI researchers trying to model a piece of legal reasoning in a computer as well as to educators trying to develop an understanding of the difficulties of the struggling first year law student. Papert's description of our "subjective experience of knowledge" sounds like the conclusions of jurisprudential scholars analyzing the operations

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[45]Johnson, Building and Using Hypertext Systems in the Practice of Law 3 (1989) (unpublished manuscript available in the IIT Chicago-Kent Law Library).

[46]*Id.* at 2 (emphasis added).

[47]S. Papert, *supra* note 1, at 172.

of the legal system. Attempts to find a mechanical deductive synthesis of legal domains have foundered because the law is "more similar to the chaos and controversy of competing agents than to the certitude and orderliness of p's implying q's."[48]

This uncertainty and chaos is also one of the most unsettling aspects of law study at the beginning of law school. Law students arrive expecting the law to be a deductive system of coherent rules. Confusion and mental dissonance ensues when they discover that the reality of the law does not match their preconceived ideal.

John Mitchell attempts to explain the cognitive difficulties of the beginning of law school as a version of the difference between novice and expert thinking.[49] He suggests that students in the beginning of law school are novices without the schema of detail that lawyers and law professors take for granted. Law professors, lawyers, and judges, he states,

> possess a vast array of information about law and its processes: legal vocabulary; cases; use of analogies; characteristic "patterns" or "moves" in reasoning; relationships between bodies of doctrine, along with an awareness of general principles and issues that cut across such bodies; the significant questions and historical perspective in each of our areas; procedures for approaching problems; knowledge of the conventions controlling what can and cannot be said. Our "knowledge base" more than any unique cognitive capacity we possess, provides us with an effective framework (i.e., schema) for approaching and analyzing problems. Entering law students ("novices"), however, have no such knowledge base. . . . Accordingly, they are not capable of approaching legal problems in the manner that is second nature to those of us in the "knowledge community" or "domain" of law.[50]

There are at least two types of knowledge in Mitchell's schema: first, information about the law, and second, knowledge about the nature of that information. The enormous capacity and convenience of CD-ROM publishing can give first year law students convenient access to information in large legal knowledge bases. The second type of learning, knowledge about legal knowledge, is a part of the cognitive skill of "thinking like a lawyer" that most students achieve in the first year of law school. It is the type of knowledge that postconservationist children have learned about the quantity of liquids.

Hypertext knowledge bases and annotation tools may help students use the computer as a powerful environment to organize, link, synthesize, identify relationships, and learn legal concepts in law school, in much the same way that Seymour Papert describes his vision of children using the computer to organize, link, and learn mathematical concepts in elementary school. Hypertext may be able to make the computer an "object to think with" to learn the law.

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[48] *Id.*

[49] Mitchell, *Current Theories on Expert and Novice Thinking: A Full Faculty Considers the Implications for Legal Education*, 39 J. LEGAL EDUC. 275, 278–79 (1989).

[50] *Id.* at 278–79.

Hypertext will not read new decisions and automatically fit them within the fabric of an expert system in the artificial intelligence structure. Hypertext will not function as a computer-managed conversation allowing you to "ask a modern Corbin how he sees the issues in your case."[51] But I am sure that Peter Martin expects lawyers and paralegals in the social security area to be able to "browse through [his] computerized work, to use it for orientation in unfamiliar areas and as an entry point to the relevant decisions."[52] Further, David Johnson expects the practicing lawyer or judge to "updat[e] and reorganiz[e] [his] knowledge base as appropriate"[53] when new decisions, documents, or check lists are prepared.

A law student studying with these tools will probably have a disk or two containing all of her "case books." The full text of each case will be available on the disk. Those parts of the cases that the professor does not intend to discuss will be electronically marked. The hypertext linkages will organize the cases in a number of different structures. One structure will be similar to the table of contents of a printed case book. Another structure will look like a course syllabus; it will include assignments and recommended readings and suggested searches of LEXIS and WESTLAW. A third structure will work like a table of cases, and a fourth like an index from the back of the book.

The student will make notes on the computer as she reads the material and she will link and cross reference her notes. Some of these cross references will link to cases on the disk, others will refer to material or ideas that she wrote after attending previous classes. The computer will expand and collapse the structure that she builds so that she can view different levels of detail. The computer will construct some linkages automatically from the language she uses in her notes. For example, every time she uses the word "estoppel" the computer will automatically add the note to a new table. These links will produce lists and tables of related ideas gathered from all the reading and analysis she does in law school.[54]

Whether or not this new medium is artificial intelligence, it captures my imagination. This new medium is an invitation to use the computer to open new vistas of power and creativity. It is the invitation to legal mindstorms.

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[51] A. GARDNER, *supra* note 18, at 191 (describing tasks that AI systems aspire to, but cannot yet attain).

[52] *Id.*

[53] *Id.*

[54] Some of the electronic case books that she uses will contain simulated client documents and evidence to be analyzed and evaluated. Electronic form books and check lists will be stored on the disk or developed by the professor and class to provide problem sets that occur in actual law practice. Elaborate simulations will include full motion video and sound so that the student can see and hear the facts of the case.