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ARTIFICIAL LEGAL INTELLIGENCE

By Pamela N. Gray
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Pamela Gray's *Artificial Legal Intelligence* offers an imaginative, utopian view of the technological implementation of legal reasoning. After surveying a number of programs applying artificial intelligence techniques to legal reasoning, *Artificial Legal Intelligence* offers a vision of the law as a holistic entity on the verge of evolving into a codified computer system of legal services.[1] In this vision, answers to legal questions would be as readily available online as stock quotes, soccer scores, and flight schedules.

Artificial Legal Intelligence presents a thought-provoking approach to both computational models of legal reasoning and the use of evolutionary thinking about the law. Drawing on a prodigious amount of research, Gray looks beyond the rather technical approach common in the field and attempts to place artificial legal intelligence within the broad structure of legal history. This Note first summarizes Gray's vision of a computerized artificial legal intelligence, a vision of developments in both technology and legal history. It next discusses how Gray's concept of the future runs counter to trends in both artificial intelligence and legal theory in some important ways. At the same time, Gray's book, by freeing itself from present technological constraints, provides a wider vision than many more technical discussions of artificial intelligence. In particular, her view of the evolution of law brings in social and cultural factors often ignored by discussions of legal

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1. *See* PAMELA GRAY, ARTIFICIAL LEGAL INTELLIGENCE 305–06 (1997) ("The technology of artificial legal intelligence has the potential to redress the contemporary problems of inaccessibility of the law, through a computer codification of legal services; it also has the potential to transform the system of social power, which incorporates the legal system, by providing, for all people, access to five dimensional legal intelligence."). For a comprehensive list of publications in the field, *see Artificial Intelligence and Law Publications* (last modified Aug. 17, 1998) <http://www.dur.ac.uk/Law/centre/web_ai_a.html>.

reasoning. The last part of this Note considers, more broadly, how evolutionary analysis can provide a fruitful method for analyzing legal reasoning.

The broad scope of *Artificial Legal Intelligence* results in rapid coverage of great amounts of material. As a prelude to the book's ambitious program, the first chapter quickly covers the development of electronic computers, the first endeavors in artificial intelligence to use computers to model human reasoning, and subsequent attempts to apply artificial intelligence to the law (pp. 12–68). As Gray's wide-ranging overview shows, a number of creative research projects have applied artificial intelligence techniques to the domain of legal reasoning.[2] Three fields of artificial intelligence are most relevant to work in the legal area: case-based reasoning, expert systems, and neural networks.[3] Artificial intelligence programs, such as the legal reasoning programs discussed below, can have characteristics of more than one of these fields.[4]

A number of artificial intelligence systems implement various types of case-based reasoning.[5] A case-based reasoning program seeks to solve a problem by relying on solutions to previous, similar problems.[6] Such an approach has an obvious affinity to the use of precedents in legal reasoning. Anne Von der Lieth Gardner's GP program attempted

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2. *See* KEVIN D. ASHLEY, MODELING LEGAL ARGUMENT 223–32 (1990) (discussing a number of projects in artificial intelligence and legal reasoning).

3. In addition to the fields named above, artificial intelligence also encompasses such areas as natural language processing, vision, knowledge-engineering, semantic networks, planning, and problem-solving, among others. *See, e.g.*, STAN FRANKLIN, ARTIFICIAL MINDS (1995); RAYMOND KURZWEIL, THE AGE OF INTELLIGENT MACHINES (1990); STUART S. RUSSELL & PETER NORVIG, ARTIFICIAL INTELLIGENCE: A MODERN APPROACH (1995); PATRICK H. WINSTON, ARTIFICIAL INTELLIGENCE (3d ed. 1992). A good introduction to the field through essays by experts in a number of areas is HAL'S LEGACY: 2001'S COMPUTER AS DREAM AND REALITY (David G. Stork, ed. 1997).

4. For example, the HYPO program discussed *infra* has some characteristics of both a case-based reasoning and expert system. Likewise, the LIRS system discussed *infra*, while not an artificial neural net, has some aspects of a more general "connectionist" approach.

5. I use the term "case-based reasoning" here to refer to systems organized functionally around case-law reasoning. The term is often used in several different ways in the artificial intelligence literature.

6. An excellent source for materials on case-based reasoning, with an emphasis on law related projects, is the CBR Web Server (visited Dec. 9, 1998) <http://cbr-www.cs.umass.edu>, from Professor Edwina Rissland's Case-Based Reasoning Group of the Department of Computer Science at the University of Massachusetts at Amherst. *See also* JOHN ZELEZNIKOW & DAN HUNTER, BUILDING INTELLIGENT LEGAL INFORMATION SYSTEMS: REPRESENTATION AND REASONING IN LAW (1994) (general discussion of research in application of artificial intelligence to law).

to use previous cases to distinguish easy from hard cases in the area of contract law (pp. 59–61).[7] The Norwegian Research Centre for Computers and Law developed SARA, an attempt to model the differing weights given to relevant factors in applying legal norms (p. 33). Kevin Ashley's HYPO system used a database of some thirty cases to compare a case to precedent cases, examining whether similarities existed with respect to given factors (pp. 62–64).

The second category of artificial intelligence is the expert system, which seeks to reproduce the way that a human expert applies her skills to specific types of problems.[8] A notable early project was L.T. McCarty's TAXMAN program, which sought to aid the formulation of arguments in tax cases by developing a formal representation of legal concepts and arguments (p. 39).[9] Alan Tyree's FINDER program sought to automate the analysis of deciding whether a found piece of property belonged to its finder by asking ten key questions and attempting to determine the result of the case from the answers.[10] Carole Hafner's LIRS, an effort toward an intelligent document retrieval system, developed a formal language to represent the legal concepts of negotiable instrument law in order to create a database of cases and statutes linked by those concepts.[11]

A third relevant field of artificial intelligence is the work on artificial neural networks.[12] Neural networks are intended to function in a way analogous to the networks of neurons that comprise the brain.[13] In a neural network, the input points are connected to output points by a

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7. *See* ANNE GARDNER, AN ARTIFICIAL INTELLIGENCE APPROACH TO LEGAL REASONING (1987). Note that the GP program also incorporated a rule-based approach, characteristic of some expert systems.

8. *See generally* RICHARD E. SUSSKIND, EXPERT SYSTEMS IN LAW (1987); KURZWEIL, *supra* note 3, at 283–303. I note that there is not an absolute distinction between case-based reasoning systems and expert systems.

9. *See* L. Thorne McCarty, *Reflections on TAXMAN: An Experiment in Artificial Intelligence and Legal Reasoning*, 90 HARV. L. REV. 837 (1977).

10. *See* Alan L. Tyree, *FINDER: An Expert System* (last modified Dec. 20, 1997) <http://www.law.usyd.edu.au/~alant/aulsa85.html>.

11. *See* CAROLE D. HAFNER, AN INFORMATION RETRIEVAL SYSTEM BASED ON A COMPUTER MODEL OF LEGAL KNOWLEDGE (1981).

12. *See* MOHAMAD H. HASSOUN, FUNDAMENTALS OF ARTIFICIAL NEURAL NETWORKS (1995); FRANKLIN, *supra* note 3, at 121–40; KURZWEIL, *supra* note 3, at 139–42, 547. Neural networks could have a number of applications in law beyond modeling legal reasoning. *See generally* Michael Aikenhead, *The Uses and Abuses of Neural Networks in Law*, 12 COMPUTER & HIGH TECH. L.J. 31 (1996).

13. *See* KURZWEIL, *supra* note 3, at 139–40.

simulated network.[14] The network can be "trained" by adjusting the interconnections or adding new connections in the network, until a given input produces the desired output. Once the network is properly adjusted, it should yield the correct output for future inputs. Because a neural network should learn a rule based on a number of cases, and should be flexible enough to adjust to new cases, the application of the concept to legal reasoning has been readily noted (p. 67). However, there have been few attempts to implement artificial neural networks that perform legal reasoning (perhaps for reasons that will be discussed below). The greatest difficulty is that the "input" of a legal case is much broader and harder to define than in other applications, such as pattern recognition with medical images. In addition, a neural network yields output in a less predictable manner than a case-based program or expert system. Applied to the legal domain, a neural network would give a result without the reasons for it — a "black-box" approach that fits poorly with the need for justifications in the legal world. Nevertheless, there have been steps toward using artificial neural networks to determine the weight given to factors in a set of legal decisions (pp. 66–67).[15]

Thus, there have been a number of projects that claim some progress toward automating legal reasoning. This naturally raises the question, to what extent do the programs actually model the task at issue, or, alternatively, succeed in producing results similar to human decisions? *Artificial Legal Intelligence*, however, gives little attention to these questions. Nor does the book spend much time on the larger philosophical issues that have loomed over the field in recent years: whether it is possible for machines to be intelligent, to understand concepts, or to have consciousness.[16] The debate on such issues has attracted attention from disciplines ranging across philosophy, computer science, neuroscience, and physics.[17] Participants have staked out a

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14. *See id.* at 139–42 (discussing how such connectionist approaches have devised increasingly complex networks, with additional layers and more sophisticated means of adapting).

15. For example, Gray discusses the NEUROLEX project, a "multi-layer perceptron which could learn the weighting involved in a set of legal decisions, and produce all the equivalent rules." GRAY, *supra* note 1, at 66–67.

16. *See, e.g.*, DANIEL C. DENNETT, CONSCIOUSNESS EXPLAINED (1991); MARVIN MINSKY, THE SOCIETY OF MIND (1985); ROGER PENROSE, THE EMPEROR'S NEW MIND: CONCERNING COMPUTERS, MINDS, AND THE LAWS OF PHYSICS (1989); JOHN SEARLE, THE REDISCOVERY OF THE MIND (1992).

17. *See* DENNETT, *supra* note 16, at 253–82 (discussing debate over feasibility of artificial intelligence and consciousness, ranging over neuroscience, cognitive science, philosophy, psychology, computer science, and philosophy).

range of positions, from the idea that people are simply machines that can be emulated, to the opposite extreme, where human consciousness and intelligence are inherently beyond human technological capacity.[18]

Artificial Legal Intelligence steers clear of these deep, muddy, embattled waters. Gray also does not linger over questions of how well existing programs actually perform legal reasoning. Instead, the book makes the questionable assumption that artificial intelligence will be achieved, and turns to a vision of a future, all-encompassing computer system. Gray bases this vision on two interrelated views of the law: "holistic legal intelligence" (pp. 75–114) and "cyclic paradigms of legal intelligence" (pp. 115–36). These concepts make explicit some major assumptions of more modest approaches to computerizing legal reasoning.

The term, "holistic legal intelligence," has a contemporary ring, but the concept captures several widespread assumptions about legal reasoning that have long buttressed the legal profession. In this view, legal reasoning is a unique, autonomous form of reasoning. The advocacy and advising of lawyers, like the decision-making processes of judges, rely on specialized skills that use concepts and rules of inference that could be represented in symbolic form. Accordingly, Gray presents the development of holistic legal intelligence as the progression of a single discipline, in the same way that physics can be described as a series of developments within a single domain (pp. 98–114). Indeed, Gray goes on to associate legal intelligence with the "science of legal choice" (p. 137). Legal reasoning is seen as simply a process of "moving from one unit of legal data to the next to make a selection" (p. 168). This view binds together the idea that law is an autonomous discipline with the notion that the law consists of its formal representations, whether in statutes, cases, or other written embodiments, and that such representations are linked together by a coherent logic of some sort (p. 75–168). Both assumptions — law's autonomy and law's formalizability — would pave the way for the law to be captured in a single computer program as Gray envisions.

The other principal reason Gray offers for the likely computerization of the legal process is a theory about the historical development of legal systems, termed "cyclic paradigms of legal intelligence" (p. 115). In this view, each legal system evolves through successive life cycles, and each

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18. *Compare* MINSKY, *supra* note 16 (suggesting that artificial intelligence could be achieved by combining a range of simpler programs called agents that accomplish various discrete tasks), *with* SEARLE, *supra* note 16 (suggesting artificial intelligence and consciousness are not feasible on philosophical grounds).

life cycle in turn is comprised of five stages: "ritual, common law, theory, casuistry, and codification" (p. 115). Gray accordingly describes the history of the Roman and English legal systems as respectively divided into these five stages. In the ritual stage of Roman law, blood feuds between clans were supplanted as dispute mechanisms by the decision-making of patrician priests, who performed the tasks of the legal system through formalized rituals and invocation of memorized rules (p. 116). The formation of the Roman republic saw a transition to the common law stage, where the principles of written civil law and specialization of administrative and judicial officials replaced the arbitrary decision-making of priests (pp. 118–19). The stage of theory began when Roman jurists developed Roman natural law, influenced by theoretical approaches adopted from Greek philosophy and rhetoric (pp. 121–23). In the succeeding stage of casuistry, the spread of Roman law across the empire to peoples unfamiliar with Roman legal theory opened the way to judicial proceedings geared more to particularized, fact-based reasoning than application of the abstractions of the theory stage (pp. 127–28). The final stage, codification, came with the Theodosian Code and the Justinian Code which succeeded earlier, less comprehensive efforts (pp. 132–35).

The Roman legal system, in Gray's view, was succeeded in evolutionary fashion by the English legal system, likewise divided into five stages. The ritual stage, in the ninth to eleventh centuries, saw efficient, if arbitrary, trials by ordeal — determining guilt or innocence by whether the accused would heal after being burned by a hot iron or a cauldron of boiling water, or by whether the accused floated when dropped in a stream (p. 117). Less violent was the ritual of oath, where success of a claim depended simply on how many "oath-helpers" a party could recruit in support (pp. 116–17). The common law stage, running from the twelfth to fourteenth centuries in Gray's model, replaced trials by ordeal or oath with advocacy in verbal form before itinerant royal justices, or in more vigorous form with trial by battle (pp. 119–21). Courts developed and sought governance from customary law rather than divine intervention (pp. 121–22). The theory stage coincided with an increase of the powers of Parliament during the fifteenth through seventeenth centuries (pp. 123–26). Rather than adhering strictly and literally to customary law, courts took a more abstract approach, with two important developments: analogical reasoning from precedents permitted broader application of legal principles, and the institution of courts of Chancery permitted equitable considerations to override mechanical legal results (pp. 124–26). Gray sees the stage of casuistry in English law as extending from the eighteenth century to the present. Systematic reporting of judicial decisions, together with the tomes of

Blackstone and others, permitted the construction of a comprehensive body of law resting on legal principles defined through particular cases (pp. 128–30).

The English legal system, in Gray's view, now stands on the brink of the codification stage. Gray notes that some areas of English law have been reduced to consolidated legislation or to systematically organized judicial precedent (p. 135). Gray argues that the sheer volume and complexity of English law means the system will be unworkable without computer codification. Fortunately, conscious choice rather than historical forces will determine which route the English system takes: "There is now an opportunity to review legal intelligence, and consciously determine any evolutionary leap in the form of codification" (p. 135). Such a codification would go well beyond making legal materials accessible online; rather, artificial intelligence would provide the equivalent of a lawyer or judge, in computer form (pp. 135–36). Such a development, Gray suggests, is necessary not only to preserve the functioning of the English legal system but also to preserve the autonomy of the legal system. Extending her analogy from Roman history, Gray warns that unless "designer programs" preserve the vitality of the English legal system, political authority will be overrun by forces from the East, as was the case with Rome, with the European Union bureaucrats of Brussels playing the role of the Huns and Visigoths (pp. 135–36).

The latter third of *Artificial Legal Intelligence* is devoted to Gray's vision of an artificial intelligence program that would function to automate the "collective legal intelligence" (pp. 197–314). Such a system, Gray suggests, could be SURMET (SURvival METasystem), a "legal information system containing both the knowledge and processes of human intelligence" (p. 204). SURMET would have subsystems for evolutionary ethics and principles, for knowledge, and for the law itself (p. 203). Evolutionary principles and ethics would be included to foster the survival of humans and culture, on the theory that the law is "a method by which people survive" (p. 209). Such a system, a "Leviathan computer codification of English legal expertise," could provide enormous social benefits. All people, not just clients able to retain lawyers, would have ready access to legal expertise at all times. Making the legal system thus universally accessible, Gray suggests, would strengthen the social contract among people by spreading the benefits of the law (p. 313). There would be a "new, rationalised social cohesion through the legal system" (p. 10). The social security afforded by such universal legal aid would in turn foster other advances in human

endeavor (p. 134).[19] Such benefits would not be restricted to the English legal system. On the theory that the underlying forms of legal intelligence in various jurisdictions are similar, a single form of intelligent program could process the laws of various countries (p. 2).

Gray wisely makes little effort to describe how such programs would be built from existing technologies or their foreseeable successors. Indeed, the feasibility of such an enterprise receives little discussion in the book. One of the few discussions of actual implementation comes in her characterization of legal intelligence as "four dimensional" (p. 223). The four dimensions are, first, the concepts of law; second and third, the arrangements of such legal concepts to suit the plaintiff and defendant respectively; and fourth, the resulting legal outcome or strategy (pp. 222–23). So characterized, Gray argues the law is made more readily amenable to computerization. Even if that novel and ambitious claim holds (and the book offers little specific guidance on how particular cases would actually fit into such a paradigm), it would be only one step toward bridging the vast gulf between present computer legal systems and what Gray envisions.

Gray's vision is so futuristic as to defy specific argument. The capabilities of computers in the distant future is pure speculation at this time. Indeed, Gray's picture of a fully computerized legal process runs counter to trends in the study of both artificial intelligence and legal reasoning. With respect to artificial intelligence, Gray speaks as though the first projects in artificial legal intelligence have shown the way toward computer implementation of legal reasoning. But, as with artificial intelligence research generally, the picture is more complex. As many researchers have noted in recent years, the prospects that artificial intelligence programs will replicate human cognition have paradoxically diminished with research.[20] The more work that is done in the area, the more difficult the problem seems to be. Several decades ago, when electronic computers were new and rapidly assuming tasks that had previously taken great amounts of human work, many confident predictions were made that the time of true machine intelligence was not far off.[21] Indeed, in succeeding years, computer programs were created

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19. Gray broaches the possibility that "users of virtual metaphysical universes may evolve as a species suited to space travel." GRAY, *supra* note 1, at 134.

20. *See generally* HAL'S LEGACY, *supra* note 3.

21. *See* STEVEN LEVY, ARTIFICIAL LIFE: THE QUEST FOR A NEW CREATION 115 (1992) (discussing the failure of early predictions of artificial intelligence); *see also* KURZWEIL, *supra* note 3 (discussing "the enthusiasm, romanticism, and immodesty of the early AI field"). Perhaps the best known example of the early optimism about artificial intelligence is NORBERT WIENER, CYBERNETICS, OR CONTROL AND

that could accomplish difficult tasks — proving mathematical theorems, making calculations, even suggesting diagnosis of illness based on symptoms.[22]

What has gradually proved to be the most resistant to computerization, however, are the things that people do easily: natural language communication, common sense reasoning, interpreting facts in context, and devising explanations. The general trend in artificial intelligence is mirrored in the legal arena. Ambitious early statements have been replaced by more limited projects. However, the relatively limited success in implementing legal reasoning in artificial intelligence does not mean that efforts in the field have not been fruitful. Such projects constitute some of the most interesting work on legal reasoning. In trying to fit legal reasoning to the rigid constraints of computer programming, researchers have achieved a number of detailed and disciplined descriptions of how lawyers approach legal problems.

To give a sense of the state of the art of artificial legal intelligence, I will briefly describe the HYPO program discussed by Kevin Ashley in his book, *Modeling Legal Argument*.[23] HYPO seeks to evaluate disputes about trade secrets law using some thirty cases.[24] HYPO does not actually use the judicial opinions in the cases. Rather, a person reads each case and decides, for each of a list of factors relevant to trade secret cases, whether the factor, such as whether plaintiff and defendant make competing products, whether defendant was formerly an employee of plaintiff, whether defendant paid an employee with knowledge of plaintiff's product to leave plaintiff, or whether plaintiff disclosed the alleged trade secret to any one, is present in the case. Accordingly, if there were sixteen factors,[25] the actual data input for a case might be: 0010 0110 1110 1001. To use the program to select relevant precedents for a fact setting, the person similarly determines if each factor is present in the set of facts to be tested.[26] In other words, a person would run through the set of facts using the list of factors, and input something like 1100 1010 1011 1111. HYPO then compares the input to the thirty cases in the data base and returns the cases it selects as closest to the fact setting, indicating whether defendant or plaintiff was successful in each

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COMMUNICATION IN THE ANIMAL AND THE MACHINE (1961).

22. *See* KURZWEIL, *supra* note 3, at 135, 331–32, 401.

23. *See* ASHLEY, *supra* note 2.

24. *See id.*

25. HYPO appears to use thirty-one factors, which would fit conveniently in a binary system of storage. *See id.* at 261–63.

26. *See* ASHLEY, *supra* note 2.

case.[27] To determine which cases are most relevant, the program checks for the presence of certain factors in both the input pattern and the case in the database.[28] To determine which cases are most helpful to defendant or plaintiff's position, HYPO looks for similar clusters of factors in cases in the database that were decided for each party.[29]

Ashley makes no claim that HYPO automates the analysis of trade secrets cases. In such a mechanical framework, most of the reasoning is still done by the human involved, in deciding whether each factor appears in each case. Rather, the project has considerable value because it shows what remains to be done before fully automated legal reasoning can even be considered. HYPO omits all consideration of the policies behind trade secret law and ignores the ambiguity and vagueness inherent in the application of legal concepts to factual settings. The HYPO approach also assumes that a complete list of factors can be constructed. Of practical necessity, potentially determinative factors, such as whether the information was already public, whether defendant reverse-engineered the product, or whether a release had been signed, are not even considered.[30] No matter how long a list of factors one devises, a good lawyer can always think of one more. Likewise, analysis of an actual case could hardly be restricted to a given set of precedents in trade secret law, nor could a lawyer ignore the possibility of a cause of action under some other theory, such as tort or patent law.

Even after restricting the analysis to the given cases, the mathematical tracking of the factors hardly conforms, as Ashley notes, to how they would influence a court. For example, Ashley includes an extended discussion of why factors relevant to a case could not be simply assigned numerical weights or even a particular hierarchy.[31] Rather, the role that a factor plays in case analysis is "highly contextual and depends on individual problem situations."[32] Ashley discusses other considerations that make case law reasoning difficult to fit into artificial intelligence paradigms: cases are not consistently "positive or negative exemplars of concepts,"[33] applying simple legal terms often requires reaching more complex legal conclusions,[34] vague legal rules resist

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27. *See id.* at 57–62.
28. *See id.* at 58–61.
29. *See id.* at 174–77.
30. *See id.* at 261–63.
31. *See id.* at 174–76 .
32. *Id.* at 175.
33. *Id.* at 225.
34. *See id.* at 224–25.

attempts to make them precise,[35] and the relationship between legal principles and analogical reasoning has yet to be described in a satisfactory way.[36]

Indeed, Gray is perhaps a little too generous in referring to existing programs as models of legal analysis, where they actually perform much more mechanical tasks. Despite the occasional exaggerated description of a system's capabilities or what it represents for future developments, none of the developers claims that his program can accomplish the most basic task of a lawyer: to read and understand a case or a statute. Indeed, in legal artificial intelligence, as in artificial intelligence generally, the last few decades have shown that the cognitive tasks that are easy for humans prove most difficult for computers.[37] Common sense interpretation of ordinary verbal communications are well beyond the capabilities of any computerized system to date[38] (although of course computers can do many things well beyond human mental capability, such as "remember" verbatim any number of judicial opinions, even if they cannot understand them).

The obstacles that have prevented automation of the verbal and reasoning skills that humans take for granted include a need for contextual knowledge,[39] an inability to deal with language's ambiguity and uncertainty,[40] and an inability to plan for all contingencies.[41] All of

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35. *See id.* at 227.

36. *See id.* at 231–32.

37. *See* KURZWEIL, *supra* note 3, at 299, 302–07 (describing the difficulty artificial intelligence programs have in dealing with broad domains of knowledge, with ambiguous language, and with contextual communication); M. MITCHELL WALDROP, MAN-MADE MINDS: THE PROMISE OF ARTIFICIAL INTELLIGENCE 44–48 (1987) (discussing how artificial intelligence programs have limitations that would be easily overcome by common sense).

38. *See* Roger C. Shank, *I'm Sorry, Dave, I'm Afraid I Can't Do That: How Could HAL Use Language*, *in* HAL'S LEGACY, *supra* note 3, at 171 (discussing how artificial programs to date have fallen far short of human standards in understanding natural language); WALDROP, *supra* note 37, at 77–84 (detailing limitations caused by the need for contextual knowledge in interpreting sentences).

39. *See* Shank, *supra* note 38, at 182–86 (discussing how understanding communication in context requires a great deal of previous experiences to provide relevant knowledge).

40. *See* KURZWEIL, *supra* note 3, at 303–06 (describing how ambiguity inherent in natural language communication poses great difficulties for program design). For example, the sentence, "time flies like an arrow" could be interpreted in at least four completely different ways. *Id.*

41. *See* David E. Wilkins, *That's Something I Could Not Allow to Happen*, *in* HAL'S LEGACY, *supra* note 3, at 305 (describing how the enormous number of possibilities in a series of events has made automated planning one of the most problematic fields of artificial intelligence).

these apply to the area of legal reasoning, for the law is a very generalized activity, dependent on verbal communication and full of ambiguity, contradiction, and amorphous reasoning. Reasoning by analogy, the type of reasoning most often seen as characteristic of legal reasoning, is likewise extremely resistant to effective computerization. Indeed, there is still no generally accepted description of legal reasoning.[42]

The rather mechanical nature of existing artificial intelligence programs generally is reflected in the programs built to model legal reasoning tasks. The most interesting thing about these projects is not what they do but rather what they do not do. The greatest value in attempts to automate legal reasoning may lie in showing just how difficult the project really is.[43] Thus, the author of the HYPO program, in attempting to automate the analogical reasoning process, identified which aspects of analogical reasoning could be readily modeled and which aspects require a deeper theory than presently available.[44] Likewise, the process of designing the Legal Information Retrieval System led to "several insights about semantics and modeling," as well as showing the need for broader databases, increased semantic power, and a natural language interface.[45]

Moreover, a comparison of those computer projects with existing legal practice undercuts Gray's suggestion that artificial legal intelligence appeared with the computer and is on the verge of taking over the law. Rather, most forms of computerized artificial intelligence have long-established counterparts in the more mundane world that one might call paper legal intelligence. Indeed, these counterparts, with the advantage of much more time and resources spent in development, still far outdistance the computer projects in scope and achievement. For example, computerized case-based reasoning systems echo the well-known West Key Number system, which organizes the law into subject

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42. Some notable theories of legal reasoning appear in STEVEN J. BURTON, AN INTRODUCTION TO LAW AND LEGAL REASONING (1987); EDWARD H. LEVI, AN INTRODUCTION TO LEGAL REASONING (1949); Scott Brewer, *Exemplary Reasoning: Semantics, Pragmatics, and the Rational Force of Legal Argument by Analogy*, 109 HARV. L. REV. 925 (1996) (proposing theory of legal reasoning by analogy based on C. S. Pierce's theories of inference); Cass R. Sunstein, *On Analogical Reasoning*, 106 HARV. L. REV. 741 (1993) (proposing that legal reasoning by analogy permits reasoning in specific cases where relevant general principles are not completely theorized).

43. *See generally* Edwina L. Rissland, *Artificial Intelligence and Law: Stepping Stones to a Model of Legal Reasoning*, 99 YALE L. J. 1957 (1990) (a broad survey of the area, detailing difficulties in implementing AI and lessons learned).

44. *See* ASHLEY, *supra* note 2, at 230–32.

45. *Id.*

matter areas, then divides each area into dozens of categories and sub-categories. The Key Number system, of course, is a blunt instrument, but certainly no less accurate than any of the computer systems and far greater in scope. Likewise, expert systems are nothing new to the lawyer, who has always relied on a simple but effective expert system: the legal form. A well-designed legal form — be it for a real estate closing, a motion to dismiss for lack of personal jurisdiction, or a software contract — does what an expert system does: it attempts to reproduce the steps that a human expert would follow in addressing a problem. But like computerized expert systems, forms are also subject to mistakes if misused. Using the wrong form for a jurisdiction can easily lead to dire consequences.

Richard Susskind's thoughtful writings on legal expert systems reflect the shift in artificial intelligence from early optimism to measured skepticism, even as attempts to create artificial intelligence have greatly increased knowledge of human reasoning. In his 1987 work, *Expert Systems in Law*,[46] Susskind surveyed work in the field and suggested that, although none of the existing systems came close to duplicating the work of human experts, a deeper approach, incorporating jurisprudential theory, could yield legal expert systems that would rival or surpass lawyers in many core tasks. By 1996, Susskind recognized in *The Future of Law* that although certain well-defined tasks could be automated, a more useful approach would be to look to how information technology could be incorporated into the practice of law, rather than replace it.[47] Thus, rather than automating the reasoning of a lawyer, information technology at present is better suited to augmenting the lawyer's ability to retrieve and organize information and to communicate with others.[48]

Accordingly, artificial intelligence projects in law, as in other fields, have become more modest in their aspirations. Rather than seeking to emulate the entire process of legal reasoning, developers devise programs that perform specific, well-defined tasks. Case-based reasoning projects seek to provide retrieval of relevant documents. Expert system projects take the users through the preliminary steps of common types of cases. More ambitious projects like neural networks are few in number, very likely because researchers have not identified many promising possibilities. This general trend runs counter to Gray's view that a huge program could automate all aspects of legal reasoning,

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46. SUSSKIND, *supra* note 8.
47. RICHARD E. SUSSKIND, THE FUTURE OF LAW (1996).
48. *See id.* at 120–25.

indeed the entire legal process. Such a program may or may not prove feasible in the distant future, but is too remote from the present state and direction of the art.

As noted above, however, *Artificial Legal Intelligence* looks beyond issues of technological feasibility. The book's proposal that artificial intelligence will be the next step in law ultimately rests not on technological grounds but rather on a historical theory. English law is on the verge of the stage of codification, the argument runs, and the complexity and volume of law require that such codification take the form of computer systems that can perform the tasks of lawyers and judges. Just as the Roman legal system was inevitably codified, so must the English legal system inevitably become computerized in its final stage.[49]

Gray offers a very useful framework for thinking about the history of a legal system, but her position lacks a deterministic force. She offers no reason why a legal system would not follow a different path. A system could react to the overflowing of casuistry by retreating to theory rather than progressing to codification. Indeed, a broader look at legal history raises similar questions. The English legal system (rather than the continental systems, which certainly use more explicit Roman concepts in both legal education and the legal system[50]) seems a counterintuitive choice as the successor to the Roman legal system. On a broader level, why should succeeding systems pass through all the stages from the starting point instead of building on one another? If the English system is indeed the successor to the Roman, why would it start again at the stage of ritual, which seems more like a reversion than an evolution?

Another possible objection to using the theory to predict the computerization of the legal process is that the need for a development does not necessarily make the development itself feasible. Even if one assumes that a stage of codification is now imminent, Gray offers little support for the argument that the law has become so voluminous and complicated that only computerization can maintain the viability of the system. Such a claim requires some way of measuring the complexity of such a system and a way of showing where it would exceed the limits

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49. *See generally* KARL MARX, DAS KAPITAL VOLS. I–III (1867, 1885, 1894); OSWALD SPENGLER, THE DECLINE OF THE WEST (rev. ed. 1928).

50. *See* NORBERT HORN, HEIN KÖTZ & HANS G. LESER, GERMAN PRIVATE AND COMMERCIAL LAW 12 (Tony Weir, trans., Oxford University Press, 1982) ("[T]he legacy of Roman law has conduced to a greater clarity in the language used in laws and contracts on the Continent, whereas the common lawyer's approach to a problem is often more practical.").

of present methods. More important, however, is the non sequitur between the argument that the legal system will overload unless it is computerized, and the claim that such computerization is therefore feasible. Just because people need to do something does not imply that it can be done.

Gray's vision of a computerized legal system thus depends on the success of the strongest claims both for legal reasoning and for artificial intelligence, coming at a time when proving such claims seems increasingly difficult. The book has the fault of being too generous. *Artificial Legal Intelligence* views "legal intelligence" as the accumulated legal knowledge and expertise of centuries, viewed as an upward progression toward ever more exact application of legal principles (p. 75).[51] Accordingly, the book takes an uncritical stance toward the numerous, and sometimes contradictory, claims about legal reasoning. Gray suggests incorporating as many views of legal reasoning as possible into the future computerized legal Leviathan. Legal reasoning has been characterized in many ways, and Gray's model seeks to include all of them. According to this view, "theoretical choice," "dialectic choice," "relative choice," "list choice," "spectrum choice," "paradoxical circular choice," "inductive choice," "deductive choice," "hierarchical choice," "granular choice," "temporal choice," "procedural choice," "combinatorial choice," and "boundary choice," all have a place in the program (pp. 140–50). In this approach, Gray simply reflects a difficulty that legal artificial intelligence has long faced. In order to attempt to model legal reasoning, one needs to start with a description of what legal reasoning is. Yet, there are many theories of legal reasoning, none with any greater claim to validity than the rest. But before envisioning a world run according to such theories, one should first consider the substantial grounds for skepticism about the claims made for legal reasoning. In other words, all the competing theories about legal reasoning cannot simultaneously be correct, so there would be no need for such a program to incorporate them all. Indeed, a program that incorporated all theories of the law would presumably yield some very strange results.

A recent book that incisively criticizes some of the grander claims made for legal reasoning, and in so doing illustrates the risks of taking such theories as given, is Paul Campos's *Jurismania*.[52] Campos suggests

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51. *See* GRAY, *supra* note 1, at 75 ("[C]ollective intelligence . . . consists of the paradigms which legal experts have, create, use, and pass down through legal practice, education and training. Since time immemorial, legal experts have contributed to legal intelligence, according to their understanding of what it is, and how it is evolving.").

52. PAUL F. CAMPOS, JURISMANIA: THE MADNESS OF AMERICAN LAW (1998).

that it is useful to think of the present American legal system as showing signs similar to symptoms of mental illness: obsessively perfectionist and abnormally attentive to minor details.[53] The root cause, Campos suggests, is that the legal system regularly attempts to do the impossible. Cases are frequently disputes within a "social and legal equilibrium zone," meaning that neither legal rules nor social norms dictate the outcome.[54] Legal rules and social policies are so numerous, contradictory, and vague that it is impossible to determine a single outcome. Rather than recognizing reality, however, the American legal system permits the parties and a succession of courts to sink as many resources as possible into trying to do the impossible and uncover the "right" result. Thus, a faith in rationality drives the system to irrational efforts. One need not accept every part of this view to see its potential implications for a fully computerized legal system. Such a program might take a single case and happily hum along forever, perhaps pausing periodically to issue interlocutory rulings. Even if legal reasoning is not as quixotic as Campos suggests, one clearly would not want simply to transfer all theories of legal reasoning without reservation into a program that would then govern human disputes.

The proliferation of theories of legal reasoning is not the only fundamental obstacle to a program automating legal reasoning. The very idea that legal reasoning exists as a distinct form of reasoning is also increasingly less accepted. Rather, trends in legal theory run more toward showing how legal reasoning borrows freely from other types of reasoning. Scholars and lawyers once generally assumed that legal reasoning was a specialized type of thinking that could be practiced exclusively with the traditional tools of the lawyer: cases, statutes, and analogical reasoning.[55] Recent attempts to analyze legal reasoning, however, borrow widely from other fields in order to describe how lawyers reason. In addition, law has become widely multi-disciplinary in nature. Economics, critical theory, political science, and other disciplines are increasingly integrated into legal theory and the law itself. These developments make construction of a program to automate legal reasoning even more elusive, for they would require such a program to incorporate ever wider fields of human endeavor.

With an eye toward considering the role of artificial intelligence in studying legal reasoning, the remainder of this Note turns to a different

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53. *See id.* at 88–92.

54. *Id.*

55. *See generally* Richard A. Posner, *The Decline of Law as an Autonomous Discipline 1962–1987*, 100 HARV. L. REV. 761 (1987).

approach to the study of legal reasoning, one that nevertheless shares two of Gray's central concerns. Gray's vision of legal reasoning is both computational and evolutionary. But digital computer science is not the only approach to computational thinking, and a cyclic paradigm of legal history is not the only way to think of the law in evolutionary terms. Another way of thinking about the law and legal reasoning is the model of evolution by natural selection, both evolutionary psychology and the evolution of the law itself.[56] Here, I will briefly survey how thinking about legal reasoning in evolutionary terms provides several useful insights.

Evolutionary psychology attempts to analyze mental processes by considering how the forces of natural selection shape our cognitive abilities.[57] It is thus computational in a different sense from computer science.[58] While artificial intelligence compares thinking to algorithmic processes, evolutionary psychology seeks to explain psychological faculties by their adaptive value.[59] This approach to thinking proceeds on the useful assumption that "[t]he mind is a system of organs of computation, designed by natural selection to solve the kinds of problems our ancestors faced in their foraging way of life, in particular, understanding and outmaneuvering objects, animals, plants and other people."[60] Evolutionary psychology (although it has its own intellectual hazards) offers a useful model for thinking about legal reasoning that does not rely on legal scholars' models.

The work in evolutionary psychology that bears most directly on the law is the study of what has been called the "moral sense."[61] Moral issues evoke not just intellectual interest but visceral reaction. People have a very strong sense of what they consider to be right and wrong, and much of the legal system is devoted to rationalizing those sentiments. Evolutionary psychology offers a number of interesting, though highly speculative, explanations. These observations are less a guide to the logic of legal reasoning than a way to uncover possible

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56. For a broad survey of cognitive science, reflecting considerable influence of evolutionary theory, see STEVEN PINKER, HOW THE MIND WORKS (1997). For a book that addresses more generally how Darwin's idea of evolution by natural selection has broadly influenced a number of scientific fields, see DANIEL C. DENNETT, DARWIN'S DANGEROUS IDEA (1995).

57. *See* PINKER, *supra* note 56, at 22–23.

58. *See id.* at 26.

59. *See id.* at 36–39.

60. *Id.* at 21.

61. ROBERT WRIGHT, THE MORAL ANIMAL: THE NEW SCIENCE OF EVOLUTIONARY PSYCHOLOGY (1994); Amy L. Wax, *Against Nature: On Robert Wright's The Moral Animal*, 63 U. CHI. L. REV. 307 (1996).

biases in reasoning that purports to be following legal principles. Analysis shows that moral feelings, although honestly expressed, may often be self-serving, even self-deceptive.[62] In short, evolutionary pressures would favor a "moral instinct" that serves the individual, rather than society at large. This calls into question the many aspects of the legal process that rely on unbiased or neutral actions of judges, jurors, and witnesses. In particular, it counsels some skepticism about the ability of judges to engage in pure legal reasoning unmindful of the collateral effects.

Another area of study in evolutionary psychology with great relevance to legal reasoning is the apparent human faculty for devising explanations. Just as people have an innate ability to learn languages, so too people appear to have an innate ability to devise explanations for their experiences.[63] The evolutionary argument for such a faculty is straightforward. There would have been considerable adaptive value for primates able to come up with fruitful hypotheses about their environment and about the other primates that competed with them for resources. Over time, then, forces of natural selection would favor those who inherited such a capacity. Empirical research, as well as common experience, seems to support the existence of such a faculty.[64] As with other ideas in evolutionary psychology, the idea of such an innate ability is hardly novel. In the nineteenth century, Charles Sanders Pierce, whose pragmatic philosophy has deeply influenced recent legal scholarship, proposed that the human mind must in part be configured to make sense of the world.[65] Such an important cognitive ability must surely play a role in legal reasoning. Many analyses of legal reasoning do contain references to how legal rules can act as hypotheses, to explain disparate cases or give the reason behind certain rules.[66]

Evolutionary thinking allows us to compare the development of an explanatory faculty as a survival mechanism, and the use of such a faculty in legal reasoning. If it is a product of evolution, then early humans used it to do things like categorize animals and plants, predict

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62. *See id.*

63. *See* PINKER, *supra* note 56, at 323.

64. *See id.*

65. *See* RICHARD A. POSNER, THE PROBLEMS OF JURISPRUDENCE 26–28 & n.41 (1990) (discussing of the effect of Pierce's philosophy of pragmatism on legal theory, in a leading jurisprudence book itself relying extensively on Pierce); *see also* Jeremy Paul, *The Politics of Legal Semiotics*, 69 TEX. L. REV. 1779 (1991) (discussing application to law of semiotics, which originated with Pierce); Steven D. Smith, *The Pursuit of Pragmatism*, 100 YALE L. J. 409 (1990).

66. *See, e.g.*, Brewer, *supra* note 42; LEVI, *supra* note 42; Sunstein, *supra* note 42.

their properties, and make use of them.[67] In such an environment, false hypotheses might be readily recognized, rejected, and abandoned. In the context of legal reasoning, however, a legal explanation is less likely to be subject to testing. Accordingly, we should learn to exercise a certain skepticism about theories and other conclusions that we make.

Combining the two areas above leads to some cautionary thinking about legal reasoning. Moral reasoning may sometimes be self-serving. Explanatory reasoning, in legal domains, may provide useful hypotheses that are not subject to testing against facts. Accordingly, we might suppose that there is a particular risk of legal reasoning developing explanations that are appealing, but are actually self-serving.

One might also note that although there is widespread agreement that people are good at formulating hypotheses to explain their experiences, there is little knowledge of just how we do it. Until that mental process is understood (and there are no indications that this will happen soon) it seems unlikely that anyone will be able to write computer programs to do the same thing. For this reason, areas of reasoning, such as legal reasoning, that rely on explanatory inferences, are likely to remain difficult to model with computers.

Evolutionary psychology might also supply food for thought not just about legal reasoning, but about the reasoning of those affected by the law. Legal theory makes a number of assumptions about how the law affects the decisions of individuals. Evolutionary psychology might help question those assumptions. A timely example is the role of status in affecting behavior, and how that could affect the law and economics approach to legal theory. Economic analysis of law centers on how law affects the incentives for people to make decisions. Economics traditionally assumes that people take actions that they see as being in their best interest, characterized in rather materialistic terms. Evolutionary psychology asserts, however, that people are motivated not just by materialistic desires but also by concerns of status. Accordingly, economic analysis of law should pay more attention to the effect of status considerations.[68]

Beyond evolutionary psychology, one can apply evolutionary thinking to the development of the law itself, as some recent scholarship illustrates. Legal rules and institutions develop over time, and may be influenced by forces analogous to natural selection. Rules "compete" in the sense that individuals and groups choose which rules to adopt. Thus,

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67. *See* PINKER, *supra* note 56, at 323.

68. Some law and economics scholarship has paid heed to the effect of status concerns. *See* Richard H. McAdams, *Relative Preferences*, 102 YALE L.J. 1 (1992).

recent scholarship has analyzed the forces that might influence how norms originate[69] and spread among populations.[70] Similarly, some have analyzed how early society could select from competing legal structures.[71]

Another way that evolutionary thinking could be used in analyzing legal reasoning is to ask how the law has adapted to human capabilities. Terrence Deacon, building on the work of Noam Chomsky, has argued that the development of language must have been influenced in part by human cognitive capabilities.[72] The law can hardly be equated with language, which plays a central role in human interaction and cognition. But the law, or some system of rules, has likely accompanied culture throughout recent stages of evolution. Accordingly, it might be fruitful to consider how the law has adapted to human cognitive capabilities. For example, the most basic form of legal argument is argument from cases.[73] With or without legal training, people seem to take naturally to the use of precedent as argument. Even children quickly show the ability to rely on previous "cases" to support their arguments.[74] It would be interesting to see if such skills could be linked to evolutionary developments, and likewise to see if other forms of argument are less adaptable to human cognitive abilities.

Evolutionary thinking offers a lot to the study of legal reasoning, but it also contains many intellectual hazards. In particular, one risks justifying existing rules or institutions on the basis that some selection process must have culled them as superior. Though evolutionary analysis can help to generate useful hypotheses about law and legal reasoning, such hypotheses should be measured carefully against empirical facts.

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69. *See* Richard H. McAdams, *The Origin, Development and Regulation of Norms*, 96 MICH. L. REV. 338 (1997).

70. *See* Randal C. Picker, *Simple Games in a Complex World: A Generative Approach to the Adoption of Norms*, 64 U. CHI. L. REV. 1225 (1997).

71. *See* Mark F. Grady & Michael T. McGuire, *A Theory of the Origin of Natural Law*, 8 J. CONTEMP. LEGAL ISSUES 87 (1997).

72. *See* TERRENCE W. DEACON, THE SYMBOLIC SPECIES: THE CO-EVOLUTION OF LANGUAGE AND THE BRAIN (1997). For a very clear introduction to Chomsky's theory of language and its implication for cognitive science see STEVEN PINKER, THE LANGUAGE INSTINCT (1994).

73. *See* LEVI, *supra* note 42.

74. *See* ASHLEY, *supra* note 2, at 196–201.

CONCLUSION

Artificial Legal Intelligence has a powerful vision of the benefits of a perfectly informed, unbiased, and capable legal system. But such an optimistic view of the evolution of law undercuts a greater contribution of artificial intelligence techniques to the study of legal reasoning — the identification of a need for close and skeptical examination of the legal reasoning process.[75] *Artificial Legal Intelligence* proceeds on the assumption that law will steadily evolve toward the ideal system portrayed. But evolutionary forces simply cause adaptations, which can be for better or for worse. Accordingly, a broader evolutionary model should look not just to the potential of law, but to its limitations.

75. *See* Rissland, *supra* note 43, at 1959–60.