Hastings Communications and Entertainment Law Journal

Volume 4 | Number 4 Article 11

1-1-1982

Can a Computer be an Author - Copyright Aspects of Artificial Intelligence

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Can a Computer be an Author? Copyright Aspects of Artificial Intelligence

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> Helene watched John and cogitated: A supper with him? Disgusting! A supper would facilitate a dissertation and a dissertation or tale was what John carefully wanted to have. With what in mind? Wine, otters, beans? No! Electrons! John simply was a quantum logician; his endless dreams were captivating and interesting; at all events Matthew, Helene, and Wendy were assisting him in his infuriated tries to broaden himself. Now legions of dreams itched to punch Wendy's consciousness. Yet John whispered, "Just a minute! Helene's a maid, I'm a quantum logician; can maids know galaxies and even stars or a multitude of galactic systems? . . . Can maids realize electrons?[1]

I
Introduction

Few people would doubt the significance of the computer in modern United States society, but most would doubt a computer "authored" the above quoted excerpt. Perhaps trivial and somewhat nonsensical, it nonetheless evidences a significant trend in computer science towards more powerful, creative and autonomous computer programs. In the computer science field of artificial intelligence (AI), these developments in computer programming pose unique problems in copyright protection of computer software. Computer software capable of automatic programming, inductive analysis and knowledge-based problem solving will soon challenge the legal concepts of authorship and originality central to the common law and statutory basis of copyright. As the threshold between man and machine narrows, courts will have to determine the legal status of the apparently creative work product of a machine, which, if produced by a human, would be afforded copyright protection.

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* Member, Third Year Class; B.A., University of California, Irvine, 1977. A version of this note has been entered in the Nathan Burkan Memorial Competition.

1. RACTER, *Soft Ions*, OMNI, April 1981, at 96, 97.

To evaluate copyright issues presented by artificial intelligence, this note will first examine the field of artificial intelligence and its various themes, current status and indications of future development. Next, this note will briefly discuss the basic structure and function of computer programs. Finally, copyright law will be assessed as it pertains to computer programs, focusing on the originality and authorship aspects of copyright law affected by artificial intelligence to decide if a computer can or should be considered an "author" under the federal copyright laws and the consequences of such protection.

II
Artificial Intelligence

The ultimate goals of AI researchers can roughly be divided into two non-exclusive parts.[2] One group of AI investigators uses computers in attempts to simulate, and thereby understand, human behavior.[3] The other group of researchers uses AI principles to make computers perform tasks unsuited to human capabilities, thus extending the power of man in his environment.[4] Both groups use AI machines[5] as tools to achieve their respective goals.

Although the field of AI has been filled with attempts to create machines which perform human tasks with the speed and efficiency of man, AI machines are still "remote from achieving a level of intelligence comparable in complexity to human thought."[6] In early contemplation of machine intelligence,

2. This analytical framework is a subset of a more complete description of the field of artificial intelligence research dividing research into three parts: (1) understanding human behavior; (2) applications using artificial intelligence techniques; and (3) theoretical research not bound by goals of applications possibilities nor the concept of "human" intelligence per se. *See generally* Waltz, *Artificial Intelligence*, SCI. AM., October 1982, at 118. For a philosophical treatment of issues concerning artificial intelligence, *see generally* D. HOFSTADTER & D. DENNETT, THE MIND'S I (1981).

3. H. Bremmerman, Artificial Intelligence: A Study of Intelligence in Machine, Animal, and Man iii (June 1974) (unpublished manuscript available at U.C. Berkeley).

4. *Id.* at v35.

5. For the purpose of this note, an "AI machine" is composed of a computer, AI software and associated input, output, sensing and environment-manipulating devices like mechanical arms, etc.

6. Firschein, Forecasting and Assessing the Impact of Artificial Intelligence on Society, Third International Joint Conference on Artificial Intelligence: Advance Papers of the Conference (August 20-23, 1973) (Stanford University).

noted British mathematician and logician Alan Turing[7] stated that, "[I]n the last analysis, the question of whether a computer can 'think' or not can be answered in the affirmative if a human being, by asking it questions, could not tell from the answer whether he were interrogating a man or a machine."[8] Prompted by the challenge of the Turing test, programs have been developed which allow a person to engage in a limited "conversation" with a machine. Often found in museum exhibits, these programs allow "hands on" use of a computer by the public in a non-threatening, entertaining manner. However, dialogues resulting from such programs are usually clever incorporations of the user's answers into questions "asked" in a predetermined sequence by the machine, allowing for branching[9] to different patterns of questions upon input of specific answers. Similarly, computers programmed to play chess, checkers, backgammon or other games, also employ AI techniques to simulate human behavior.[10] The user may tend to anthropomorphize the machine, but few persons are fooled into believing the machine is participating as an intellectual entity.

Other researchers in artificial intelligence concern themselves with applying computers to tasks unsuited to the human intellect. Computers make possible "alien intelligence" based on artificial knowledge.[11] This is knowledge of a sort that the human brain can not obtain.[12] Recognizing the immense practical importance of this application of AI, one researcher has remarked that replacing "a human chess player by a machine may have scientific and philosophical interest but it has little immediate practical effect. In contrast, development of capa-

7. For a brief account of Alan Turing's contributions to computer science, see P. MCCORDUCK, MACHINES WHO THINK 50-64 (1979).

8. Milde, *Can a Computer be 'An Author' or an 'Inventor'?*, 51 J. PAT. OFF. SOC'Y. 378 (1969) (citing Turing, *Can a Machine Think?*, 4 WORLD OF MATH. 2099, 2193 (1956)).

9. "Branching" in computer jargon denotes a logical selection or decision to perform a given task when supplied with a given set of data. For example, if a user is asked to input "yes or no" as the answer and he inputs "zzz" instead, the computer might "branch" to an error-handling subroutine to query the user about his answer.

10. *See generally* Berliner, *A Chronology of Computer Chess and its Literature*, 10 ARTIFICIAL INTELLIGENCE 201 (1978).

11. Bremmerman, *supra* note 3, at v35.

12. "Knowledge" in this context means organizing and manipulating facts and information. *See* WEBSTER'S NEW COLLEGIATE DICTIONARY 633 (1981). Large masses of information with complex inter-relationships are not comprehensible and therefore not "obtainable" by the human brain. In this sense, such a body of organized information ("knowledge") is "alien" to humans. *See generally* Bremmerman, *supra* note 3.

bilities that no human being possesses conveys power."[13] Simulation models are a common example of the "power" of such applications. By simultaneously solving complex equations with numerous variables and vast amounts of data, simulation models can generate solutions necessary in corporate planning, economic analysis, operations research, defense preparation and agricultural production.

However, it is unimportant whether one views artificial intelligence as limited to an emulation of human intellect or in a broader sense to include "alien," non-human intelligence. Both views recognize the possibility of machine intelligence, and both assume that "when in a computer knowledge base and deductive capabilities are combined, then artificial intelligence results."[14] Moreover, each view incorporates aspects of behaviorism, mathematics and cybernetics.[15] These major disciplines of AI have focused research and development on language understanding, problem solving, sensory perception, modeling, learning and adaptive systems, robots and games.[16] As a result of such research, automated data retrieval and inquiry systems, industrial robots, medical diagnosticians, weather and economic models, and teaching aids have been created.[17]

Although AI functions are carried out by electromechanical devices such as printers, robot arms, relays, etc., the underlying control of the machine is provided by the computer program loaded into the resident computer. Whether the goal is to duplicate human behavior or to simulate a complex environment, the element of a "computer program" is common to both.[18] Thus, the development and implementation of sophisticated computer programs is the principal means investigators use in attempts to create artificial intelligence. This note focuses upon two types of AI programs which mimic human thinking and intelligent activities in two specific ways: (1) AI

13. Bremmerman, *supra* note 3, at v38.

14. *Id.* at ii2.

15. Behaviorists seek to duplicate goal-seeking behavior. Mathematicians construct devices capable of proving logical and geometric theorems with great speed and accuracy. Cyberneticists try to duplicate and extend human sensory and locomotive functions. *Id.*

16. Firschein, *supra* note 6, at 106.

17. *Id.* at 112.

18. See note 56, *infra*.

programs functioning as software code generators[19] and as "automatic" programmers;[20] and (2) AI programs producing traditional literary works comparable to those of a human author. Although both of these functions are accomplished by an AI program, one outputs a computer program [hereinafter Type I], and the other a story [hereinafter Type II]. The reader must at all times strive to distinguish the AI *program* from its *product*. The product of Type I AI programs is a computer program or a section of program code.[21] The product of Type II AI programs is a story which appears to have been authored by a human. The copyrightability of the *products* of Type I and Type II AI programs is the subject of this note.

A. Code Generators and Automatic Programming

The development and maintenance of applications software is usually the most costly element of a computer system, because software production is labor intensive and requires a skilled labor force.[22] As the use of computers has spread throughout our society, demand has increased for quality programmers and software.[23] Computer users have consequently sought ways to reduce the costs of programming and maintaining their systems. It is not surprising that one of the solutions to the escalating cost of software development has been to let the computer "write the program" itself (Type I AI programs). Money and time can be saved because uniformly written programs result, and man-hours are spent more efficiently. This

19. A code generator is a computer program which translates a program design into an accurate, detailed representation in a language the computer can interpret and execute.

20. "Automatic programming" is a technique using the computer to help plan and code a problem into a programming language. *See* C. MEEK, GLOSSARY OF COMPUTING TERMINOLOGY 14 (1972).

21. "Program code" is the set of instructions for a given computer, each of which when decoded by the computer will cause a predictable change in the state of the machine. *Id.* at 45.

22. Two-year and four-year degree programs in computer science are offered by community colleges and universities respectively. Most employers require a minimum of two years college level education in addition to some outside work experience in a computer-related environment. For insight into the labor-intensive nature of computer programming, *see generally* T. KIDDER, THE SOUL OF A NEW MACHINE (1981).

23. "Software" is a general term denoting programs which can be run on a given computer, whether stored temporarily or permanently within the machine itself or on some portable media like magnetic tape. Though software stored permanently in a computer is usually termed "firmware" because of its relatively immutable nature, both software and firmware are means of storing computer programs. Computer programs, not their medium of storage and expression, are the focus of this note.

trend towards automating the programming process is evident in the development of programming language "code" generators and in AI research into problem-oriented and knowledge-based programming languages.

1. *Code Generators*

A code generator is a computer program which assists the programmer in writing a computer program.[24] At present, code generators are sometimes used to write data entry sections of programs, output report procedures, documentation and tutorial sections, and associated video screen display formats.[25] The programmer interactively answers questions posed by the computer, and the computer automatically generates sections of the program code.[26] In answering questions presented by the computer, the user supplies parameters, variables and labels relevant to the application. The computer supplies the code and tailors the procedure algorithm according to the answers input. The computer then generates and stores the coded instruction. Finally, the programmer modifies the listing[27] to suit his needs and the program is ready for use.

As code generators become more sophisticated, the programmer will function as a mere problem-specifier. His job will be to accurately inform the computer of the problem, wait for the computer to generate the program and then modify it to suit the particular application. The programmer will not concern himself with formulation of the algorithm coded by the computer. He will only have to understand the factors relevant to a concise statement of the problem and to be fluent in the programming language used in the program output by the computer if minor debugging[28] or tailoring is necessary for proper implementation. The economic pressures behind the development of code generators ensure that the computer will become increasingly efficient and effective at this function.[29]

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24. *See generally* Jacobs, *Generating Programs Automatically—Let Your Apple II Do the Programming*, BYTE, Dec. 1981, at 352, and Louden, *The Last One, a program generator from D.J. 'AI'*, INFOWORLD, Jan. 18, 1982, at 18.

25. *Id.*

26. *Id.*

27. A "listing" is a printed list of the program as written by the programmer in a given language (i.e., FORTRAN, COBOL).

28. "Debugging" is the process of systematically locating and correcting problems in program logic or typographical errors which prevent the program from functioning properly.

29. See note 49, *infra*.

2. *Problem-Oriented Languages*

The task of problem specification when using code generators is simplified by using problem-oriented languages. "A problem-oriented language allows one to state and to solve a whole family of problems. . . . The user just has to state his problem in a descriptive manner . . . ."[30] ALICE was the first language of this kind. ALICE has been applied to real-life problems involving operations research and has been more successful than traditional programs.[31] When using ALICE, a purely descriptive statement of the problem is entered using mathematical sets and symbols. No algorithm[32] is supplied by the user. The computer systematically introduces heuristics[33] to derive implications and make appropriate choices.[34] The problem solution is obtained, and the coded algorithm used is available for future use.

3. *Knowledge-Based Systems*

Code generators and problem-oriented languages like ALICE evidence only two approaches towards the AI goal of automating the programming process (Type I AI programs). A third major attempt has focused on the knowledge-based approach to automatic programming.[35] One such project was PECOS, where the researchers summed up their method and rationale as follows:

> [H]uman programmers seem to know a lot about programming. This suggests a way to try to build automatic programming systems: encode this knowledge in some machine readable form. In order to test the validity of this approach, knowledge about elementary symbolic programming has been codified into a set of about four hundred detailed rules, and a system, called PECOS, has been built for applying these rules to the task of implementing abstract algorithms.[36]

30. Lauriere, *A Language and a Program for Stating and Solving Combinatorial Problems*, 10 ARTIFICIAL INTELLIGENCE 29, 123 (1978).

31. *Id.* at 29.

32. An "algorithm" is a fixed step-by-step procedure for accomplishing a given result. *See* C. MEEK, *supra* note 20, at 7.

33. An "heuristic" is a "rule of thumb" for solving a problem. It is a description of a procedure which may solve a given problem but one that cannot be guaranteed to always lead to a solution. *Id.* at 103.

34. Lauriere, *supra* note 30, at 29.

35. Barstow, *An Experiment in Knowledge-Based Automatic Programming*, 12 ARTIFICIAL INTELLIGENCE 73, 116 (1979).

36. *Id.* at 73.

Using this approach, PECOS successfully coded algorithms for sorting data, graph theory and simple number theory.[37] Significantly, "in each case, PECOS' knowledge of different techniques enabled the construction of several alternative implementations."[38] In other words, the program algorithm and resulting code was a product of the data entered, the problem format and the knowledge base present. For any given set of these elements, PECOS could generate one or more alternative coding structures because the problem-specifier had no control over the choice of algorithm. Guaranteed duplication of the given result program could be made impossible by simple changes in the rule-selection procedures embodied in the knowledge base. Consequently, the inputs would not strictly determine the output program contents. The problem-specifier could no longer guarantee the identical program result by inputing the same data on different occasions.

The AI methods used in code generators, ALICE and PECOS offer welcome means to reduce the expensive human element of the program development process. In areas where programs can be formally stated in a descriptive, problem-oriented language, the computer formulates the algorithm, creates the code and solves the problem specified by the "programmer." One might question who or what should be deemed the "author" or "originator" of the resultant program. The need to make this distinction becomes more pressing as the role of the human programmer diminishes and that of the computer increases. PECOS, ALICE and code generators all point in the same direction: a monkey trained to input a problem (e.g., "Get me the banana") into the computer could cause the computer to create a program, execute it and then solve his problem.[39] Has the monkey authored the program? Perhaps. Just as the programmer will become less involved in the *process* of creating a solution algorithm and coding it into a programming language and more concerned with the *result* (a working program or its derivative product), the monkey has little involvement in the *process*, its only concern is to obtain the

37. *Id.* at 75.

38. *Id.* at 73.

39. One commentator describes the "famous" monkey-banana problem: "A monkey sits in a cage. At the top of the cage are bananas, too high for the monkey to reach. How does the monkey get the bananas? He pushes the box so it comes to rest under the bananas. He climbs the box and grasps the bananas. Result: Monkey has the bananas." Bremmerman, *supra* note 3, at ii4.

result (bananas). If the product of an AI program (Type I) initiated by a monkey is a computer program, have the authorship and originality requirements of federal copyright law been met? As Type I AI programs become more powerful, the character and quantity of human input necessary to satisfy traditional copyright notions of authorship and originality will have to be addressed.

B. Simulation of Intelligence

Although devising and writing computer programs is also traditionally a human endeavor now sometimes accomplished wholly or partially by a computer, RACTER is a computer program that simulates the written output of a human author (Type II AI program).[40] Using a vocabulary stored in its memory, RACTER applies grammatical rules to construct semi-coherent stories in English. The author of the program stated that "once the story-writing program is set into motion the output is not only novel and *a priori* unknowable but also cohesive and apparently thoughtful. It is crazy thinking, I grant you, but thinking conducted in perfect English."[41] RACTER

> picks nouns and verbs, adjectives and adverbs, at random from lists that [the author] supplies. Then it tinkers with them and strings them together according to the rules of grammar. RACTER conjugates verbs, keeps track of singular and plural nouns and of male and female characters, and chooses verbs and pronouns to fit.[42]

The source program[43] and the vocabulary are supplied by the original author of RACTER. The products of the machine, simulating the output of a human author, are those of the computer and its software. As programs like RACTER become more sophisticated, the style and coherency of the resulting stories should improve. The human will merely be required to push a button to execute the program. After the human starts the program, the results are not foreseeable or predetermined; the story has possibly not been "conceived" in the sense of original authorship required by the copyright laws.[44] Under

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40. RACTER, *supra* note 1, at 97-98.

41. *Id.*

42. *Id.* at 98.

43. A source program is the coded instruction set usually written in a high level procedural language (FORTRAN, COBOL, etc.) which has been input by the user and represents the human-readable version of the compiled object module.

44. See notes 127, 136 and accompanying text, *infra*.

what circumstances should "authorship" be determined by who pushes the button? Before we answer this question, we must understand a bit more about the workings of the digital computer and computer programs.

III
The Modern Digital Computer and Computer Programs

A. Historical Development

The history of the digital computer has been characterized by a decrease in physical size, a reduction in cost per calculation, an increase in commercial applications and the creation of a mature computer industry and associated support technologies. Although Charles Babbage first formulated the concept of an "Analytical Engine" capable of automatically performing numerous mathematical functions in 1833,[45] the first electronic digital computer with a stored program capability was not operational until over a century later when the EDSAC (Electronic Delay-Storage Automatic Computer) was constructed at Cambridge University in 1949.[46] Since the 1940's, computer technology has passed through several generations. These generations are distinguishable by the technology used, the programming languages employed and by type of function or application sought or achieved.[47]

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45. S. MANDELL, COMPUTERS AND DATA PROCESSING CONCEPTS AND APPLICATIONS 22 (1979).

46. *Id.* at 27.

47. The first generation, (1951-1959), was characterized by vacuum tube components. Data was input by paper tape or punched cards. The languages available to the programmer were restricted to actual binary code and assembly-level symbolic languages. Mainly used for military and scientific applications, these computers were also sometimes employed in the business environment to expedite payroll and billing tasks. Though much faster than the earlier electromechanical computers, these machines generated large amounts of heat and experienced reliability problems because of vacuum tube failure.

During the second generation of computer technology, (1959-64), vacuum tubes were replaced by transistors, magnetic drums replaced magnetic cores and assembly and machine level languages were supplemented by higher-level, procedural languages like FORTRAN. Data was input from or stored on magnetic tapes, paper cards, punched cards or from the keyboard. These machines were less expensive, smaller and more reliable than the previous generation. This generation of computers was primarily built for general business use.

The third generation, (1965-1977), was characterized by use of integrated circuits, sophisticated operating systems, magnetic disk storage and the introduction of a plethora of general and specific programming languages. Though "old" from a technological

In a brief span of 30 years, computer technology has completed nearly four generations of development.[48] Consequently, machine hardware capabilities have far outstripped the availability of user software, creating excess demand for applications programs used in business and entertainment.[49] In an attempt to fill this vacuum, the software industry has

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viewpoint, many of these machines are still in use. They are very fast in calculation, low in cost, small in size and extremely reliable. This generation has formed the data processing infrastructure which currently supports U.S. business, education, government and defense. *See* S. MANDELL, *supra* note 45, at 19-39. *See generally* W. RODGERS, THINK: A BIOGRAPHY OF THE WATSONS AND IBM (1974).

The fourth generation extends from the late 1970's into the present. This generation of computer technology is characterized by very large scale integration (VLSI), increased data storage capacity, a marked reduction in price and an increase in reliability and applications possibilities. This technology is used in very powerful and fast computers like the Cray I, which is capable of close to 100 million calculations per second. The fourth generation has also spawned the "personal" computer. Based on microprocessor technology, these machines are small and inexpensive, and are proliferating rapidly into the world of the small businessman, professional, scientist, educator and hobbyist. *See* Toong and Gupta, *Personal Computers*, 247 SCI. AM. 87 (Dec., 1982), and Matisoo, *The Superconducting Computer*, SCI. AM. May 1980, at 50, 65. *See generally* SCI. AM., MICROELECTRONICS (1977) (collection of 11 articles published in *Scientific American* covering development, technology and applications of microelectronics) and Hogan, *From Zero to a Billion in Five Years*, INFOWORLD, Aug. 31, 1981, at 6. The Japanese feel we're well on our way towards a fifth generation of computer technology. "The previous four generations of computers . . . were categorized according to their elements: the first used the vacuum tube, the second the transistor, the third the integrated circuit, or semiconductor, and the fourth the very large scale integrated circuit, or VLSI. . . . [The Japanese] expect the fifth generation to use, in addition to VLSIs, circuits that work on different physical principles from today's semiconductors. These powerful new circuits, however, are far from the only way in which fifth generation computers will be revolutionary." Lehner, *Japan Starting 10-Year Effort to Create Exotic Computer*, Wall St. J., Sept. 25, 1981, at 29, col. 1. *See also* Uttal, *Here Comes Computer Inc.*, FORTUNE, Oct. 4, 1982, at 82.

48. See note 47, *supra*.

49. *See* Toong and Gupta, *supra* note 47, at 100-104. The 42 members of the Computer and Business Equipment Manufacturer's Association in 1976 predicted an expenditure of 17 billion dollars on software alone during 1976-79. Gemgnani, *Legal Protection for Computer Software: The View from '79*, 7 RUTGERS J. COMPUTERS TECH. & L. 269, 274 (1979). An estimated seven million Americans spent their work days in front of video display terminals in 1981. Markoff & Freiberger, *VDT's Can Cause Stress and Other Health Hazards in the Office*, INFOWORLD, Oct. 26, 1981, at 21. "When electronic computers became commercial, just after World War II, forecasters predicted that no more than a dozen machines ever would be needed. IBM even decided not to sell computers because the market seemed so small. Yet this year, for the first time, computers on the planet will outnumber people. According to market researchers Dataquest, Inc. and International Data Corp., by the end of 1982, more than five billion computers of all sizes, from microprocessors to mainframes, will be in use." Shaffer, *Computing Industry is Finding That It's Vulnerable to Slump*, Wall St. J., April 16, 1982, at 27, col. 1. "So many tiny computers are working under the hood of today's automobile to increase mileage and lower pollution that a single car maker, General Motors, actually manufactures more computers every year, albeit smaller ones, than

evolved rapidly. Though a relatively esoteric profession in the late 1960's, over 300,000 programmers presently ply their trade within a large and complex computer manufacturing, data processing, "information" industry.[50]

The rapid growth rate and economic significance of the computer industry are important when discussing legal issues involving a "leading edge" area of research and development like artificial intelligence because what is presently considered futuristic may become commonplace as the next generation of computer hardware and software evolves and disseminates. Equally important is at least a cursory understanding of the concept of a computer "program."

B. Computer Programs

A modern digital computer functions as a vast array of electrical switches, whose values ("on" or "off") can be manipulated to represent and modify information.[51] This manipulation of information is controlled within the machine by a set of instructions known as a "program."[52]

The "program" most people are familiar with is the actual "coded" instruction set entered at the computer keyboard (or on punched cards or paper tape, etc.).[53] The program is a representation of an algorithm prepared initially as a flow chart[54] or step-wise procedure[55] written in standard English to solve a particular problem or to perform a specific task.[56]

International Business Machines Corp., Digital Equipment Corp., Burroughs Corp. and all other computer-system manufacturers combined." *Id.*

50. *See* Gemgnani, *supra* note 49, at 273-276.

51. In large scale integration, a single chip can hold approximately 64,000 bytes. A byte of information in most microprocessors consists of eight bits capable of either "1" or "0" values. For background information concerning the components of modern digital computers, see generally S. MANDELL, *supra* note 45 and H. KATZAN, OPERATING SYSTEMS, A PRAGMATIC APPROACH 12-64 (1973).

52. See note 56, *supra*.

53. Two kinds of programs should be distinguished. First, system programs such as the operating system, input-output routines and user-interface programs allow the user to communicate with the machine while executing a program. Second, user programs are entered into the computer by the user to perform a given user-defined task. This note focuses on user programs.

54. A "flow-chart" is a graphic representation of the operation and flow of information through a computer program. Special symbols are used to represent specific operations (input, output, memory storage, etc.). *See* C. MEEK, *supra* note 20, at 94.

55. A "step-wise" procedure is the English-language version of an algorithm to be later translated into a specific programming language.

56. 17 U.S.C. app. § 101 (1976) states that "A 'computer program' is a set of statements or instructions to be used directly or indirectly in a computer in order to bring

From initial formulation of an algorithm to final execution, the program changes dramatically in form and structure. On the outermost level of computer programming and operation, the program is entered into the computer via the keyboard or some other input device. Here, the program is represented within the computer as a direct translation of the characters entered.[57]

Next, the program must be compiled or translated into machine readable form. This is done by the "compiler." The compiler is a sophisticated set of programs which checks the user program for logical, syntactical and typographical errors.[58] These errors are flagged on an output listing for the user to correct. A compiler performs a rigid mapping function; a given element of code is translated into a corresponding element of machine language.[59] A programmer writes the coded instructions; a compiler translates them. Thus, in the normal programming environment, the programmer can exercise a large degree of originality and creativity in formulation of the algorithm and in the expression of this idea in a coded program instruction set.

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about a certain result." *See* Gemgnani, *supra* note 49, at 280-281, for further discussion of definitions of "computer programs." *See also* Nycum, *Legal Protection for Computer Programs*, 1 COMPUTER/LAW J. 1, 11-12 (1978).

57. *See generally* S. MANDELL, *supra* note 45, at 53-54.

58. "Compilers are necessarily dependent upon the language being processed; however, the following steps are usually involved:

1. The source program is read and analyzed on a statement by statement basis.
2. A *lexical analysis* routine scans each source statement and identifies reserved words, variables, operator symbols, constants, etc.
3. A *syntactical analysis* routine identifies the type of statements and verifies that the structure of that statement is admissible.
4. Tables and lists of symbols, expressions, and statements are maintained so that an inter-statement analysis can be made.
5. Analysis is made of logical flow of the source program and a global error analysis is made.
6. Machine language instructions, in an intermediate symbolic form internal to the compiler are generated and optimization is performed, as required.
7. An object module is generated from the intermediate language and a program listing is produced.

H. KATZAN, *supra* note 51, at 22-23. After the compilation state, the output module contains not only the translated code, it also contains various system routines, or instructions invoking these routines to assist in execution and uses of system resources. Some compilers "optimize" the module by modifying it in even more drastic fashion to allow for more efficient execution. *See id.* at 24-36 for an introduction to loading, linking and editing.

59. But this correspondence is not necessarily in a 1:1 ratio.

However, AI developments like code generators,[60] ALICE[61] and PECOS[62] threaten to alter this normal method of program creation. Code generators remove the programmer from the authorship process to the extent the machine self-generates the high level source code, and in some cases supplies the solution algorithm[63] as well. Programs like ALICE and PECOS require only a problem statement. The computer then develops a solution algorithm, creates a code listing, compiles it and executes the program. The element of human input into the program-creating process is minimal. Furthermore, if the product of the program, as in RACTER, is designed to simulate a human-authored manuscript, and the output is *a priori* unknowable to the operator who executes the program, then arguably neither the programmer nor the operator is the author of the finished product.

IV
Artificial Intelligence and Federal Copyright Law: 1982

The computer industry has sought to protect its ideas, techniques, designs and products from misappropriation, infringement and unauthorized use. The industry has traditionally relied upon the use of trademarks, copyrights, trade secrets, patents and licensing agreements to protect its property interests.[64] However, the recent growth of the market in videogames, home or "personal" computers and small business systems has created problems in protecting and enforcing legal interests in computer software.[65] Low cost, ease of copying,

60. See note 24, *supra*.

61. See note 30, *supra*.

62. See note 35, *supra*.

63. See note 32, *supra*.

64. *See generally* Nycum, *supra* note 56, at 1-81; Gemgnani, *supra* note 49, at 269-313; Comment, *Copyright Protection for Computer Programs*, 47 TENN. L. REV. 787 (1980); Schmidt, *Legal Proprietary Interests in Computer Programs: The American Experience*, 21 JURIMETRICS J. 345 (1981).

65. "The case of [MICROCHESS] shows how severely amateur copying can damage software sales. Before the International PET Users' Group published a method of copying [MICROCHESS], the game program had sold more than 100,000 copies. After publication of the copy method, sales dried up. By contrast, the semiprofessional program [WORDCRAFT] enjoyed a dramatic increase in sales when the protection routine known as the 'Dongle' was incorporated." Hayman, *Software Protection in the United Kingdom*, BYTE, Oct. 1981, at 132. *See generally* Freiberger, *Software Piracy*, INFOWORLD, Mar. 22, 1982, at 31.

portability and often immense commercial value and popularity all serve to motivate the illicit copying, use and sale of computer software. Searching for a viable means of protection, software suppliers have now turned to licensing agreements,[66] sale of "read only" non-copyable programs[67] and copyright registration.[68] Licensing agreements usually rely on self-submitted forms included in a software package at the point of sale.[69] To the would-be pirate and the hobbyist, such agreements are seen as ridiculously unenforceable.[70] "Copy-protected" programs have caused such concern among users in need of back-up copies that a thriving market has developed for programs specifically designed to copy any program stored on any given disk.[71] Because of such problems with copy-protection and licensing, and because of the large amounts of money involved, companies have increasingly sought protection under the federal copyright laws.[72]

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66. *See generally* D. REMER, LEGAL CARE FOR YOUR SOFTWARE (1982).

67. *See, e.g.*, Teiser, *Locksmith Version 4.0 from Omega Micro-Ware*, INFOWORLD, Feb. 1, 1982, at 22 (review of a popular program used to defeat copy-protection schemes). One commentator highlighted the problems of copy-protection: "[A]mateurs confront software publishers with a dilemma: if publishers take no steps to protect their programs, making a copy becomes the easiest thing in the world. On the other hand, if publishers use protection routines, making a copy is for many amateurs the most enjoyable thing in the world. Unlike semiprofessional users of software, amateurs have both the time and the enthusiasm needed to defeat protective measures." Hayman, *supra* note 65, at 132. Peter Laurie, editor of *Practical Computing*, confirmed this view by saying "Any intelligent teenager will make it [overcoming copy-protection measures] his first task of the day." *Id. See generally* Freiberger, *Software Piracy*, INFOWORLD, Mar. 22, 1982, at 31.

68. See text section IV and accompanying notes, *infra*.

69. A program is usually sold imbedded on a "floppy disk" (a magnetic recording medium about the size of a 45 rpm record) enclosed within some form of packaging. The licensing agreement, warranty, etc. is often sealed within the package and is unavailable for review prior to purchase of the program. The user is supposed to fill out the enclosed forms, mail them to the manufacturer and then abide by the terms stated therein. *See generally* D. REMER, *supra* note 66.

70. *Id.*

71. A single-disk user is in great need of a backup copy, especially where his data and program are still on the same disk. Some users take this privilege too far, causing problems for all users. *See generally* Freiberger, *Software Piracy*, INFOWORLD, Mar. 22, 1982, at 31. One commentator has said, "amateur piracy will have five consequences for the average software buyer. It will reduce the range of software available, raise prices, and make companies reluctant to invest in software development. . . . [P]iracy also leads to lack of support and maintenance, and discourages development of software by cottage industries which cannot afford to go to court to protect their interests." Hayman, *supra* note 65, at 133.

72. "[D]ramatic change in the law and the growing trend toward mass-marketed programs mean that copyright is likely to be increasingly important in protecting com-

Statutory federal copyright protection for computer programs is relatively new. In its final report issued July 31, 1978, the National Commission on New Technological Uses of Copyrighted Works (CONTU) recognized that "[c]omputer programs are the product of great intellectual effort and their utility is unquestionable."[73] To afford protection "necessary to encourage the creation and broad distribution of computer programs in a competitive market,"[74] CONTU recommended that the Copyright Act of 1976[75] [hereinafter the Act] be amended:

> (1) to make it explicit that computer programs, to the extent that they embody an author's original creation, are proper subject matter of copyright; (2) to apply to all computer uses of copyrighted programs by the deletion of the present section 117; and (3) to ensure that rightful possessors of copies of computer programs may use or adapt these copies for their use.[76]

These recommendations were incorporated in an amendment to the Act enacted under the Carter administration on July 12, 1980.[77] The amended Act expressly placed computer programs within the realm of literature and written works. It extended protection to programs that are the original expression of an idea, by an author, fixed in a tangible medium of expression capable of being directly or indirectly viewed with or without the aid of a device.[78] A systematic enumeration of the provisions of the Act, relevant case law and their impact upon AI software developments like code generators, ALICE, PECOS and RACTER delimits the present boundaries of fed-

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puter programs, particularly those of small entrepreneurs who create their works for individual consumers and who can neither afford nor properly use other forms of protection." FINAL REPORT OF THE NATIONAL COMMISSION ON NEW TECHNOLOGICAL USES OF COPYRIGHTED WORKS, July 31, 1978, at 15. [hereinafter CONTU]. *See also* Remer, *Legal expert on software theft: the piranahas versus true pirates*, INFOWORLD, Mar. 22, 1982, at 40; Lawlor, *A Proposal for Strong Protection for Computer Programs Under the Copyright Law*, 20 JURIMETRICS J. 18 (1979) (broad support within business community for copyright protection for computer software); Freiberger, *Sony Case Scares Micro Makers*, INFOWORLD, Nov. 16, 1981, at 1 (discusses Universal Studios v. Sony Corp. of America, 659 F.2d 963 (9th Cir. 1981) as it affects possible copyright infringement by makers of anti-copy protection devices specifically designed and marketed to defeat copyright owner's attempts to protect source code from unauthorized copying).

73. CONTU, *supra* note 72, at 11.

74. *Id.*

75. 17 U.S.C. app. §§ 101-810 (1976 & Supp. IV 1980).

76. CONTU, *supra* note 72, at 1.

77. Boorstyn & Fliesler, *Copyrights, Computers, and Confusion*, 56 CAL. ST. B.J., 148 (1981).

78. *Id. See also* Wehringer, *Copyright in Brief*, PRAC. LAW., July 15, 1979, at 77 (brief discussion of filing procedures for copyright protection).

eral copyright laws applicable to the products of Type I and Type II AI software.

A. Requirements for Copyright Protection

1. *Computer Programs are "Literature, Written Works"*

Under the Constitution, Congress is empowered to "promote the Progress of Science and useful Arts, by securing for Times, to Authors . . . the exclusive Right to their respective Writings . . . ."[79] The term "writings" in the Constitution has been broadly interpreted by Congress and the courts to protect new forms of expression created by technological advances. In 1884, the Supreme Court recognized photographs as writings.[80] Motion pictures were recognized as writings in 1911,[81] sound recordings in 1973.[82] Although the U.S. Copyright Office began to register computer programs in 1964,[83] the express subject matter provision under the "writings" interpretation was not provided until the 1980 amendment to the Act.[84]

By placing computer programs and data bases under the term "literary works," the Act does not "connote any criterion of literary merit or qualitative value; it includes catalogs, directories, and similar factual, reference, or instructional works and compilations of data. It also includes computer data bases and computer programs . . . ."[85] Thus, within the provisions of the Act, products of Type I AI software are clearly copyrightable subject matter as computer programs or data bases under the rubric of "literature or written works." Products of Type II AI programs, like stories written by RACTER, also fit within the "literature" subject matter category.

2. *The Program Must Be Fixed in a Tangible Medium of Expression*

Although computer programs are copyrightable subject matter, they are not copyrightable until they are "fixed." The Act as amended in 1980 provides that copyright protection is available to original works of authorship "fixed in any tangible me-

79. U.S. CONST. art. I, § 8, cl. 8.
80. Burrow-Giles Lithographic Co. v. Sarony, 111 U.S. 53 (1884).
81. Kalem Co. v. Harper Bros., 222 U.S. 55 (1911).
82. Goldstein v. California, 412 U.S. 546 (1973).
83. Boorstyn, *supra* note 77, at 148.
84. N. BOORSTYN, COPYRIGHT LAW. 68 (1981).
85. CONTU, *supra* note 72, at 16.

dium of expression, now known or later developed, from which they can be perceived, reproduced, or otherwise communicated, either directly or with the aid of a machine or device."[86]

Fixation in a tangible medium of expression occurs when "its embodiment in a copy or phonorecord, by or under the authority of the author, is sufficiently permanent or stable to permit it to be perceived, reproduced, or otherwise communicated for a period of more than transitory duration."[87] In ruling for the copyrightability of a program stored in Read Only Memory [hereinafter ROM], the courts have found that the "Act contains no restrictions on the type of material objects suitable for fixation."[88] Thus, computer "chips"[89] have been considered copies of copyrighted programs.[90] Programs stored on other media, capable of being perceived, reproduced, or otherwise communicated by or from the copy directly or indirectly are also "fixed" within the meaning of the Act.[91]

Technology employed in the fixation of AI software is no different from that used for any other computer program.[92] AI-produced software can be stored in RAM,[93] ROM, "chips," tapes, cards, etc. It can be "perceived, reproduced, or otherwise communicated" in the same way as ordinary software.[94] Thus, programs produced by Type I AI programs meet this requirement to the same extent as would a program produced in a normal manner.[95] Computer written stories, (products of

86. 17 U.S.C. app. § 102(a) (1976).

87. 17 U.S.C. app. § 101 (1976 & Supp. IV 1982).

88. Midway Mfg. Co. v. Dirkschneider, 214 U.S.P.Q. (BNA) 417, 427 (D. Neb. 1981). In microprocessor computers, the primary memory is usually "hardwired" into the system. In these computers, the Read Only Memory (ROM) cannot be modified by the user and generally contains the main system programs. The Random Access Memory (RAM) portion is available for use by the programmer and is where the user program is loaded and executed. The contents of ROM are permanently hardwired into the computer in much the same way as an electronic circuit. Thus, ROM contents are not destroyed when electrical power to the machine is shut off. The RAM is volitile and is only stable while power is supplied; the contents are destroyed when electrical power ceases.

89. *See generally* SCI. AM., MICROELECTRONICS, *supra* note 47.

90. Tandy Corp. v. Personal Micro Computers, Inc., 524 F. Supp. 171 (N.D. Cal. 1981).

91. *Id.*

92. Like any other computer software, AI code is amenable to fixation and storage in all normal media (e.g., tape, disk, cards, RAM, ROM).

93. See note 88, *supra*.

94. 17 U.S.C. app. § 102(a) (1976).

95. *Midway Mfg. Co. v. Dirkschneider*, 214 U.S.P.Q. (B.N.A.) 417, 427 (D. Neb. 1981), held that audiovisual displays are entitled to copyright protection even though the un-

Type II AI programs), would also be deemed "fixed" either within the memory of the computer (stored as a data base), in video-display form or in tangible paper printout.

3. *Registration and Notice Requirements*

Under the Act as amended in 1980, the "concept of eye-readability, for the purpose of copyright eligibility, has been abandoned."[96] The Act only requires registration of program copies which can be visually perceived directly or indirectly with or without the aid of a device.[97] AI-produced software (products of Type I AI programs) would meet this requirement to the same extent as ordinary software because its manner of fixation, storage and display are not unique and can be accomplished "with or without" the aid of a device. Type II AI products would meet the notice requirements in the same manner as ordinary literary works stored, displayed or printed by a computer.

CONTU has stated that if the program is copyrighted, then the notice should be displayed prominently on any source listing. "Those programs that may be read only with the aid of a machine or device should contain notice in the medium of fixa-

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derlying computer program was not copyrighted. *But see In re* Certain Coin-Operated Audio-Visual Games and Components Thereof, 537 PAT. TRADEMARK & COPYRIGHT J. (BNA) No. 337-TA-87, at A-5 (July 16, 1981) where the International Trade Commission distinguished between the "attract mode" and the "play mode" when assessing copyrightability of commercial audiovisual displays. Midway had asked the ITC to exclude importation of video games appearing to infringe on copyrights it held on its Galaxian video game. The Commission held the attract mode was copyrightable because it always replayed the same identical sequence. Similarly, it held the first few seconds of the play mode also copyrightable, because this sequence is also repeated identically in every game. However, the Commission refused to decide whether performance of the game could possibly infringe upon a valid copyright of the play mode:

> First, for statistical reasons, it is virtually impossible for a performance of Galaxian ever to duplicate that performance fixed in the video tape. If we were to hold that such performances could infringe a copyright in the play mode, we might be protecting the game itself or its mode of play, items which are specifically not subject to copyright protection. Second, each performance of the Galaxian play mode depends, in part, on the player. It is therefore possible that the player may be considered a "coauthor" of each performance of the play mode. Our research has indicated no legislative history or case law on whether coauthored works of this sort are subject of copyright, and we decline to rule on this issue. Third, in view of the remedy we are granting in this investigation, a ruling on either copyrightability or infringement of the play mode is unnecessary.

Id. at A-6.

96. Boorstyn, *supra* note 77, at 148.

97. 17 U.S.C. app. § 102(a) (1976).

tion so that the contents of the program cannot be listed without reproducing the notice in the position just described."[98] Indeed, in *Midway Manufacturing v. Dirkschneider*, a federal district court applied this concept to audiovisual displays produced by a computer program, even though the underlying program was not copyrighted.[99] Finding the audiovisual output was itself copyrightable subject matter, the court discussed notice requirements of the Act, stating that:

> [t]he [A]ct apparently requires fixation on the copies of the works, the proposed regulations for this section provide that the copyright notice is satisfied, for works embodied in printed circuit boards, by including the notice within the visual display of the work or by affixing the notice to the terminal where the work is displayed.[100]

Thus, copies of computer programs or their audiovisual products must contain notice of copyright protection so that if the copy or product becomes "visually perceived," then the notice becomes conspicuous. Like other computer programs, products of AI software can easily be tailored to meet this need.

4. *The Expression, Not the Idea Itself, Is Protected*

Under the provisions of the Act, the expression of the idea, not the idea itself, is the object of protection.[101] This rule is consistent with case law. In 1879, the Supreme Court in *Baker v. Selden* drew a "clear distinction" between Mr. Selden's book and the "art which it is intended to illustrate."[102] Selden had sued Baker for alleged copyright infringement on a book of blank accounting forms with accompanying text explaining a particular system of bookkeeping.[103] The court held that copyright would extend to the particular explanation or expression of the bookkeeping method, but would not grant "to the author an exclusive right to the methods . . . he propounds, or to the diagrams which he employs to explain them."[104] Similarly, in *Mazer v. Stein* the Supreme Court found "protection is given only to the expression of the idea—not the idea itself."[105]

98. CONTU, *supra* note 72, at 14.
99. Midway Mfg. Co. v. Dirkschneider, 214 U.S.P.Q. (BNA) at 428.
100. *Id.* at 428.
101. 17 U.S.C. app. § 102(b) (1976).
102. Baker v. Selden, 101 U.S. 99, 102 (1879).
103. *Id.* at 100.
104. *Id.* at 103.
105. Mazer v. Stein, 347 U.S. 201, 217 (1954).

However, when the number of ways to express an idea is limited, courts generally will not allow copyright of the expression, because this would lead to a virtual monopoly on the underlying idea. Although this rationale has been employed in a recent case to disallow copyright protection to data input formats for structural analysis software,[106] once courts become aware of the vast choice available to the programmer in coding a given algorithm, this argument will no longer be persuasive. As one commentator stated, "[o]nce the ability to vary the labeling of variables and the sequence of commands is widely recognized, computer programs should not fall prey to the doctrine that infringement does not occur when an idea can be expressed in only a limited fashion."[107]

The Act clearly intends to continue the historical division between an idea and its expression. CONTU manifests this intention in its interpretation of section 102(b) of the Act. CONTU stated that section 102(b) "is intended, among other things, to make clear that the expression adopted by the programmer is the copyrightable element in a computer program, and that the actual processes or methods embodied in the program are not within the scope of the copyright law."[108]

Satisfying this idea/expression dichotomy required under the Act presents a major obstacle to copyright protection for products of both Type I and Type II AI software. In copyright, the "expression" to be protected necessarily presumes the existence of an underlying idea to be expressed.[109] As previously noted, the trend in code generation, automatic programming and automatic storywriting is towards a minimization of human input into the production of an apparently creative result. Although the resulting program may embody an intricate, unique algorithm or the story a seemingly coherent plot, these "expressions" produced by AI software cannot be said to be expressions of ideas "adopted by the programmer" as intended by the Act.[110] The computer software, not the programmer, selectively "adopts" the particular form of expression evidenced

106. Synercom Technology, Inc. v. University Computing Co., 199 U.S.P.Q. (BNA) 537 (N.D. Tex. 1978).

107. Comment, *Copyright Protection for Computer Programs*, 47 TENN. L. REV. 787, 788 (1980).

108. CONTU, *supra* note 72, at 19 (emphasis omitted).

109. *Id.* See also notes 114, 115 and accompanying text, *infra*.

110. CONTU, *supra* note 72, at 19.

in its product.[111] To the extent the programmer has less and less control over the expression ultimately "adopted," the programmer loses possible copyright protection.[112] If the expression is no longer the programmer's, is it the computer software's?[113]

As courts attempt to investigate the copyright potential of AI products, the goal of affording protection to the expression of ideas, as set forth in the case law and in the 1976 Act, will be very difficult to achieve because it will be a herculean task to determine if the expression is one of an underlying idea (and thus of human origin and therefore possibly copyrightable) or is only "apparently" an expression of an idea (the existence of which is anthropomorphically read into the expression by the viewer) and thus not within the contemplation of copyright law.[114] If courts strictly maintain the idea/expression dichotomy as a central pillar of copyright law, AI produced "expressions" will lead into a metaphysical quagmire as things get "curiouser and curiouser" per poor Alice.[115]

5. *The Program Must Be an Author's Original Work*

The "author" of a work seeking copyright protection is "he to

111. The programmer who uses the software has no control over the exact code or story that is produced by the AI software. The programmer who created the AI software itself might have an idea of what the program will do when faced with a given set of data, but, as in RACTER, if the program randomly selects nouns and verbs then places them in grammatically correct relationships consistent with the rules given it by the original programmer, even he would be unable to foresee or influence the content of the story output.

112. The federal copyright laws require a work to be that of an author and that it evidence a non-trivial amount of "intellectual labor." See notes 116-118 and accompanying text, *infra*.

113. *See generally* Milde, *supra* note 8.

114. See notes 116-118, 127 and accompanying text, *infra*. *See also* Apple Computer, Inc. v. Franklin Computer Corp., 545 F. Supp. 812 (E.D. Penn. 1982) (slip opinion, July 30, 1982) (in denying copyrightability of a series of programs stored in ROM on a chip, the court discussed the authorship requirements of copyright law). *But see* Williams Electronics, Inc. v. Artic International, Inc., 685 F.2d 870 (3rd Cir. 1982) (slip opinion, August 2, 1982) (on similar facts, court held programs stored in ROM to be works of authorship, fixed in tangible medium of expression, etc., meeting all requirements of copyright law). *See also* Midway Mfg. Co. v. Artic International, — F. Supp. — (E.D. Ill. 1982) (slip opinion, March 10, 1982) (programs stored in ROM copyrightable).

115. Apple Computer, Inc. v. Franklin Computer Corp., 545 F. Supp. at 825. "If the concept of 'language' means anything, it means an ability to create human interaction. It is the fixed expression of this that the copyright law protects, and only this. To go beyond the bounds of this protection would be ultimately to provide copyright protection to the programs created by a computer to run other computers. With that, we step into the world of Gulliver . . . ."

whom anything owes its origin; originator; maker; one who completes a work of science or literature."[116] The art of authorship requires some independent reproduction or independent contrivance.[117] Thus, the "author" of a program is the one who originates it.

The work must be original. The test of copyright originality is "one with low threshold, in that [a]ll that is needed . . . is that 'author' contributed something more than 'merely trivial' variation, something recognizably 'his own.' "[118] Thus, the nontrivial alteration of a prior work will "constitute sufficient originality to support a copyright if such variation . . . is the product of the author's independent efforts . . . ."[119] Though the requirement of "substantial as opposed to trivial variations" from the original is met with a low threshold, courts continue to interpret copyright protection as requiring *some* degree of "originality" in authorship.[120]

While investigating the status of computer technology in forming its recommendations, CONTU found the state of artificial intelligence did not yet pose problems relating to copyright requirements of original authorship.[121] The report noted that:

> [t]his discussion may have stemmed from a concern that computers either had or were likely to soon achieve powers that would enable them independently to create works that, although similar to other copyrightable works, would not or should not be copyrightable because they had no human author. The development of this capacity for "artificial intelligence" has not yet come to pass, and, indeed, it has been suggested that . . . such development is too speculative to consider at this time.[122]

What the commission found "too speculative" is rapidly becoming commonplace only five years later.[123] Code generators

116. Burrow-Giles Lithographic Co. v. Sarony, 111 U.S. 53, 57-58 (1884).

117. Alfred Bell & Co. v. Catalda Fine Arts, Inc., 191 F.2d 99, 103 (2d Cir. 1951).

118. L. Batlin & Sons, Inc. v. Snyder, 536 F.2d 486, 487 (2d Cir. 1976) (quoting Alfred Bell & Co. v. Catalda Fine Arts, Inc., 191 F.2d 99, 103 (2d Cir. 1951)).

119. *Id.* at 492 (Meskill, J., dissenting) (quoting 1 M. NIMMER, NIMMER ON COPYRIGHT § 10.1).

120. *Id.* at 490.

121. CONTU, *supra* note 72, at 44.

122. *Id.* at 42.

123. CONTU's apparent lack of insight regarding the direction and pace of computer industry development can be understood when one notes that: (1) CONTU relied upon testimony of experts in computer science as the basis for its conclusions that AI was too primitive to present copyright issues; (2) most of the data used by the commission was from the mid-1970's, thus not focusing on the revolutionary impact of

are being mass-marketed for home computers,[124] industry is clamoring for devices using automatic programming techniques[125] and a computer-generated story has been published in a national magazine.[126] As AI software and its products become increasingly sophisticated, courts will soon be forced to grapple with the unstated assumption underlying the copyright concepts of authorship and originality: an author is a human.[127]

In the vast majority of programming situations the legal requirements of human authorship can be easily satisfied. The programmer expresses his solution algorithm in the form of a coded instruction set or a high-level language. This program is then compiled and executed, causing the computer to manipulate data to produce the results desired. The results can all be found to originate from, or be copies or translations of, the work of a human author within the meaning of the Act as amended in 1980.[128]

In primitive code generation systems (Type I AI programs) the level of participation of the programmers is still quite high.[129] By interactively answering questions posed by the

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microprocessor technology; and (3) it was probably in the best interest of the commission to follow the conservative lead of its experts to avoid political repercussions and needless controversy. *See generally* CONTU, *supra* note 72.

124. *See* Jacobs, *supra* note 24, at 352. The 1981 and 1982 issues of BYTE, INFOWORLD, PERSONAL COMPUTING and other computer-oriented periodicals all carry advertisements for code generators to ease the task of program development.

125. Industrial robots, Computer Alded Design and Manufacturing (CAD/CAM) and medical diagnostic programs all use AI principles.

126. RACTER, *supra* note 1, at 96.

127. Under the U.S. CONST. art. I, § 8, cl. 8, Congress is authorized to legislate for the protection of authors whose writings are the result of intellectual labor. The copyright is intended to protect original writing founded in the "creative powers of the mind . . . fruits of intellectual labor . . . .", the Trade-mark Cases, 103 U.S. 82, 94 (1879). The original writing must evidence the skill, labor and judgment of the author. Dorsey v. Old Surety Life Ins. Co., 98 F.2d 872, 873 (10th Cir. 1938). However, even though the author need only contribute "something more than a 'merely trivial variation' something recognizably his own," L. Batlin & Son, Inc. v. Snyder, 536 F.2d 486, 487 (2d Cir. 1976) (quoting *Alfred Bell*, 191 F.2d at 103), this low threshold of originality "does not prevent the court from concluding . . . that works may lack even the modicum of originality required for a valid copyright . . . ." Gardenia Flowers, Inc. v. Joseph Markovits, Inc., 280 F. Supp. 776, 782 (S.D.N.Y. 1968). Thus, Congress has allowed copyright protection for writing resulting from intellectual labor. The courts have provided an interpretation requiring a minimal amount of original contribution by the author. By implication, the use of "him" and "his," as well as the concepts of "intellectual labor" and "creative powers of the mind" all rest on the assumption that the "author" of the work at issue is a human. *See Apple Computer, Inc.*, 543 F. Supp. at 824-825.

128. 17 U.S.C. app. §§ 101-810 (1976 & Supp. IV 1982).

129. See note 24, *supra*.

machine, the user formulates and expresses a vague algorithm and specifically decides output format. Although not involved in the specific coding of the parameters[130] and functions[131] needed to express this vague algorithm or the desired output form, the variable names,[132] field labels[133] and array dimensions[134] provided by the programmer will tailor the resultant coding into a unique, copyrightable program. But, as code generators become more specialized in given applications, the amount of user input will probably decrease.[135] At some point, courts will be confronted by extremely sophisticated programs produced by code generators aided by very minimal human input, forcing them to determine if the human effort involved is "non-trivial" or "substantial" in the copyright sense.

Problem-oriented language systems like ALICE present even more difficult human/machine threshold questions because the user merely states the problem in a descriptive form for the computer to solve. The user does not formulate the algorithm or influence its expression in coded form. He is concerned with the results, not the process developed by the computer to obtain them. Although the problem-specifier would probably be able to copyright the problem statement, he would have a difficult time convincing a court of the copyrightability of the code created by the computer and its software.[136] The author originates the expression of the idea;

130. A parameter is a piece of information such as date or time, which functions as a constant, boundary or reference value for internal use within the program.

131. *E.g.*, mathematical equations and logical relationships (less than, greater than, etc.).

132. A variable name is a symbol which represents a certain value which can be operated upon by the program (e.g., in the equation a = 4, "a" is a variable).

133. A field label is a name given part of a record of information. For example, in an "address record" field labels might be assigned for those portions which comprise the street number, street name, city, state and zipcode.

134. An array can have one or more dimensions. A one-dimensional array can be expressed as a linear arrangement of data. A two-dimensional array has an x-axis and a y-axis. A three-dimensional array has an x-axis, y-axis and z-axis. If one were to write out a multiplication table through the 10's, then he would have a 10x10 two-dimension array with the values 10,10 representing its maximum size.

135. This conclusion follows logically from an assumption that commercial dissemination of code generators reflects labor saving economies created by their use.

136. Ascertaining the "flow" of originality or idea expression and creation through the process of problem specification, algorithm development, program coding, compilation and execution is best illustrated by a series of examples of increasing technical complexity. Consider first the author who uses a computer as a word-processor. The author formulates the plot, characters and dialogue while at the terminal or types in a previously written rough draft of his manuscript. The characters input at the keyboard

this expression, not the idea itself, is afforded copyright protection.[137] If one grants authorship and copyright protection to programs written by programs like ALICE, which arguably fall below the "non-trivial" test of copyright authorship and originality, then one might conclude either: (1) computers can have ideas, because a computer program is generally recognized as an expression of an idea-algorithm or solution method; or (2) "expressions" can be copyrighted even though they do not embody an underlying idea.[138]

Finally, Type II AI programs accurately simulating human behavior, like story-writing programs (e.g., RACTER), also present problems regarding authorship and originality requirements of the Act. As noted earlier, the program outputs a story outwardly meeting all criteria needed for copyright, yet the

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are represented within the computer as their electronic equivalents. The author then executes certain word-processor editing programs to manipulate this data as desired and then directs the computer to print the final product. Here, the ideas concerning the story have originated in the mind of the author. This set of ideas is expressed through the display on the video screen, within the computer memory and in the final output version of the story. The word-processor has functioned merely as a tool to help the author express his ideas. Next, consider a participant in a sophisticated interactive fantasy game played on a computer modified to print out a narrative summary of the game as it is being played. Here, the player/author initiates the game by starting the program. His idea is to play the game. He may have ideas regarding strategy and select the level of complexity at which he desires to play, but he will not be able to determine the specifics of his "plot" with any degree of certainty. As the player selects the general traits of his characters (certain powers, skills, etc.), the computer program fills in the other character attributes using preprogrammed (random) values unknown to the player. The actual course of events and the outcome of the game are determined jointly through the interaction between the values input at the keyboard by the user and those supplied by the computer as a programmed, sometimes random, response. Although the software-generated portion of the game dialogue is apparently idea expressive, the ideas expressed by the software are not those of the human player. The flow and amount of the author's originality has been intermixed with the product of the machine. Finally, if one were to replace the human game participant with a computer program which randomly selected allowable answers to the game software queries, the amount of human input attributable to the game player would be reduced to nil because the human would merely initiate the game dialogue-producing program, yet would not contribute at all to its idea-expressive content. *See generally Word Processing*, INFOWORLD, Jan. 11, 1982, at 17 (special section on word-processing technology) and *Supergames*, INFOWORLD, Apr. 12, 1982, at 14 (special section on computer video-games).

137. Mazer v. Stein, 347 U.S. at 217.

138. Presently, machines are not deemed able to formulate ideas capable of being expressed in a copyrightable manner and cannot be said to be authors of original expressions within the meaning of the Act. Allowing copyright protection for expressions not evidencing an underlying human-originated idea would raise significant problems. *See* Apple Computer, Inc. v. Franklin Computer Corp. 545 F. Supp. at 824-825.

"author" might be deemed the software and the computer. Except for pushing the button on the console of the computer, no human creative process is involved in writing the story.[139] Although the person initiating the program execution may desire or have the idea of producing a story, the program supplies the specific words, plot, characters and apparent "expression" of an idea.[140] The story has no human "author" within the bounds of common usage of the term and, within the meaning of the Act,[141] is possibly not copyrightable material under present law. But, as programs like RACTER inevitably become more sophisticated in mimicking human literary output,[142] the increasing economic value of the works produced will heighten the need for copyright protection.

V

Authorship, Originality and Artificial Intelligence: Coping with the Man/Machine Threshold

We have seen that developments in AI challenge the application of present copyright laws to computer generated software and literature. Both the "original expression by an author" requirement and the goal of affording copyright protection to expressions of ideas rest on a fundamental assumption that "authors" are human beings.[143] As AI progresses, this assumption will be tested in a legal sense as valuable and apparently

139. One might argue the ideas "expressed" in the story or program produced by an AI machine are "derived" from the ideas of the original human programmer or the AI software. This approach misconstrues the definition of a "derived work" as used in the Act. See note 173 and accompanying text, *infra*. Also, one might question how far removed the human can be from the process of expression and still maintain a claim for authorship. For example, if a programmer designs an AI machine which produces other AI machines which produce other AI machines, etc.—each of which randomly produces stories, can the ideas of the original software programmer be effectively linked or traced to the *n*th story written? What about a program which summarizes news stories as they appear on the UPI wire service? *See* Waltz, SCI. AM. Oct. 1982, at 118, 132.

140. See note 136, *supra*.

141. An author is "one that originates or gives existence," WEBSTER'S NEW COLLEGIATE DICTIONARY 75 (1981). This colloquial meaning is given more definite meaning under copyright law. See note 127, *supra*. Also, CONTU's refusal to even speculate upon the copyright issues presented by computer-authored literary works seems to indicate an explicit presumption that the Act is meant to deal with human (or at least non-computer) authors. *See* CONTU, *supra* note 72, at 44.

142. Language understanding and synthesis is an area of great interest to AI researchers. *See* Waltz, SCI. AM. Oct. 1982, at 118, 132.

143. See note 138, *supra*.

idea-expressive computer generated software and literature are produced. If not found the product of a human author, these works will not be afforded copyright protection under the Act.[144]

To prevent a gap in legal protection offered by copyright, courts have several alternatives at their disposal. Specifically, when a court determines that a given *product* of AI software is "authored" by machine rather than a person, it may choose to: (1) disallow copyright completely; (2) give authorship and copyright to the computer and its software or find authorship "shared" between the AI software and a human; (3) settle copyright upon the owner of the underlying AI software or the machine owner; or (4) create a fictional human author and assign its copyright to the AI software copyright owner, the problem-specifier or the computer owner either individually, jointly or in part. The following is an examination of the advantages and disadvantages of these alternatives. Number four, proposing a fictional human author and implicitly assigning its economic rights, offers the best protection within a slightly modified traditional framework of federal copyright law.

1. *Disallow Copyright Protection Completely*

Consistent with the traditionally implied assumption that authors contemplated by the Act are necessarily human, courts might choose to deny copyright protection for AI produced materials whenever they determine the human input into the creation of such products not legally sufficient. Besides having the advantage of consistency with the traditional, anthropocentric approach to legal matters, this alternative would spare courts from possibly having to implicitly credit inanimate objects or machines with a capability of formulating and expressing ideas.[145] The test of the quantum of human input, if failed, would immediately preclude all associated copyright issues.[146] It could be argued that any harm resulting from denial of copyright protection would be adequately offset by use of other available means of protection like trade secrets,

144. See notes 126, 127 and accompanying text, *supra*.

145. See note 136 and accompanying text, *supra*.

146. All requirements for copyright must be met for copyrightability to be found. 17 U.S.C. app. §§ 101-810 (1976 & Supp. IV 1982). *See generally* N. BOORSTYN, *supra* note 84, at 22-29.

licensing agreements or patent law.[147]

However, the benefits of eliminating copyright protection for machine authored works are significantly outweighed by the advantages gained by allowing *some* form of copyright protection. Though consistent with the traditional concept of an author as a person, denying protection is inconsistent with the historically flexible interpretation and application of copyright laws as technology has developed.[148] AI products are the result of technological development and should be deemed within the historically flexible scope of copyright laws.[149]

Also, one must recognize the social policy behind providing copyright protection of human authored expressions is equally applicable to works produced by AI software. Traditional copyright policy aims at maintaining an economic incentive for expression of valuable ideas,[150] promoting scientific and literary development[151] and preventing monopolization of the market for ideas and their derivative products.[152] Expressions produced by AI software fit neatly into the same policy structure. Copyright availability for AI generated works would provide an incentive for their development and dissemination because the proprietary interests of investors and inventors would be guaranteed a degree of legal security not otherwise available.[153] Scientists, artists, programmers and educators would be free to produce and use AI materials just as they would any other copyrighted written work. A competitive market for AI products would also be encouraged by availability of copyright protection.[154] These important policy considerations are not served well by the elimination of copyright protection for AI products.

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147. See text and accompanying notes, *infra*.

148. *See generally*, L. PATTERSON, COPYRIGHT IN HISTORICAL PERSPECTIVE (1968).

149. At the very least, products of AI software should not be denied consideration under copyright laws because of their technological "newness" or novelty. See notes 79-84 and accompanying text, *supra*.

150. *See* L. PATTERSON, *supra* note 148, at 190.

151. *Id.* at 183, 191.

152. *Id.* at 224-225.

153. As will be seen, *infra*, copyright protection offers an inexpensive and workable means of affording protection relative to the alternatives of patent registration, trade secrecy and licensing.

154. Once AI programmers are assured of copyright protection for the products of the AI programs they produce, economic incentive will induce production of AI programs just as copyright availability has become important to producers of normal software. *See generally* CONTU, *supra* note 72.

Furthermore, the available alternatives of patent registration, licensing agreements and trade secrets do not promote the same policy goals as copyright, are more costly and more time consuming to create and enforce and are also victims of the same fundamental assumption of a necessarily human element in the creation of ideas and their expression.

(a) Patent Registration

Patent registration focuses on protection of the idea itself, not its expression.[155] In a sense it creates a limited monopoly on a given idea to provide incentive for the development of such ideas and to allow society to benefit from their commercial dissemination.[156] Copyright focuses on the expression, not the idea, and seeks a much less restricted, more competitive market.[157] Patent registration procedures, verification and enforcement are much more costly in dollars and in time than for copyright.[158] Furthermore, patent protection of AI generated ideas would create difficulties because courts would have to credit machines with a capacity for thought. Protection of the idea is the central element of patent law; to hold for patentability, the court would have to find that the idea at issue satisfied criteria equally applicable to ideas formed by persons.[159] Thus, if the court found the "idea" produced by the AI machine patentable, a strong implication would be made that, at least for purposes of patentability of AI products, machines can think. Another problem tending to preclude the patentability of AI products is that computer programs and stories are not of

155. 35 U.S.C. § 101 (1970) provides: "Whoever invents or discovers any new and useful process, machine, manufacture, or composition of matter, or any new and useful improvement thereof, may obtain a patent therefore . . . ." The word "process" means "process, art or method, and includes a new use of a known process, machine, manufacture, composition of matter, or material." 35 U.S.C. § 100(b) (1975). *See also* Nycum, *supra* note 56, at 4-5 and Schmidt, *supra* note 64, at 355-57.

156. A patent is valid for a period of seventeen years from date of issuance. The holder has the right to "exclude others from making, using, or selling the invention throughout the United States . . . ." 35 U.S.C. § 154 (1970).

157. For instance, in copyright multiple expressions of a similar idea are permitted, but in patent multiple use of the idea itself is prohibited without authorization from the patent holder.

158. The costs of litigation in patent enforcement can be prohibitive. In 1967, a study found costs of litigation for patent enforcement/infringement to range from $25,000 to over $1,000,000. *See* Harris & Chuppe, *Cost of Enforcement of Industrial Property Rights*, 14 IDEA 77, 81 (conf. issue, 1970). *See also* Nycum, *supra* note 56, at 72-73.

159. To do otherwise would distort the meaning of "idea" under patent law. See note 160, *infra*.

themselves patentable.[160] To make a computer program (Type I AI product), or a story (Type II AI product), patentable standing alone, the courts would have to extend patent to cover an expression, not an idea or process.[161] Stretching the scope of patent law to such an extreme would open the proverbial "floodgates" of litigation as persons sought to patent their literary works.[162] As a result, traditional policy goals of patent and copyright law would be hindered as the "marketplace of ideas" became enmeshed in a complicated legal environment. One must conclude the availability of patent protection for AI software produced algorithms is uncertain at best and should not help form the basis for denying copyright protection.

(b) Licensing and Trade Secrecy

Licensing and trade secret contracts present less costly[163] and more expedient protection methods than patent registra-

160. A mathematical formula as such is not afforded protection under the patent laws. Gottschalk v. Benson, 409 U.S. 63 (1972). The court must look to see if the mathematical formula at issue is itself the primary object of patent protection or, if it is implemented or applied in "a structure or process which, when considered as a whole, is performing a function which the patent laws were designed to protect [e.g. transforming or reducing an article to a different state or thing] . . . ." Diamond v. Diehr, 450 U.S. 175, 192 (1981). Thus, if a computer program is used in a process for curing rubber which, considered as a whole, is "performing a function which the patent laws were designed to protect," then the process containing the program and its formula is patentable subject matter. *Id.* at 191-193. However, a mathematical formula or computer program not sufficiently part of a process is not of itself patentable subject matter (standing alone). *Id.* at 186-88. *See also* Gottschalk v. Benson and Parker v. Flook, 437 U.S. 584 (1978). *See generally* Nycum, *supra* note 56, at 16-28 and Schmidt, *supra* note 64, at 355-58.

161. "Excluded from . . . patent protection are laws of nature, natural phenomena, and abstract ideas." Diamond v. Diehr, 450 U.S. at 185. The abstract ideas contained within the algorithm or the story are not patentable subject matter. "An idea of itself is not patentable. . . ." Rubber-Tip Pencil Co. v. Howard, 68 U.S. (1 Wall.) 498, 507 (1874). *See also* Funk Bros. Seed Co. v. Kalo Inoculant Co., 333 U.S. 127, 130 (1940).

162. A guiding consideration in drawing the line between the "idea" not protected by copyright and the "expression" which is protected is the preservation of the balance between competition and protection. Herbert Rosenthal Jewelry Corp. v. Kalpakian, 446 F.2d 738 (9th Cir. 1971). By allowing protection for literary works under the patent laws, this balance between protection and the promotion of competition would be destroyed. Although the litigation and time "costs" associated with patent far exceed those associated with copyright, patent protection can be used to suppress dissemination and commercial development of an idea, whereas copyright is unlikely to result in such suppression because only the expression, not the idea itself, is protected. See note 158 and accompanying text, *supra*. *See also* Nycum, *supra* note 56. (American Telephone and Telegraph, among other large corporations, has been accused of obtaining patents on technical innovations and then "sitting" on them until the corporation recoups capital invested in older technologies).

163. The cost of printing a standard non-disclosure or licensing contract is minimal.

tion,[164] but their applicability to AI produced expressions is made uncertain by fundamental assumptions of contract law regarding the subject matter of the contract itself, mutual assent and the identity and nature of the parties involved. In the software industry, licensing and trade secret contracts are made to limit access to a particular program algorithm, source code or its use while at the same time allowing for a profit by the supplier.[165] Although the contract itself may be valid because few limitations exist concerning the subject matter of contracts,[166] the implication of contracting to protect legal property interests a party claims to have in the apparently thoughtful expressions formed by a machine is rather thought provoking, to say the least. However, whenever the subject matter of the contract is disputed by the parties, the courts might not be able to avoid considering such issues. Also, federal copyright protection would afford a more uniform, consistently applied body of law for protection of expressions produced by AI machines and would foster a less restrictive environment for the production and dissemination of such expressions than would licensing or trade secret agreements. The policy goals of trade secrecy and, to a lesser extent, of licensing laws are not identical to those of copyright, and the laws themselves are not uniform throughout the different states.[167] For these reasons, contractual licensing and trade secret agreements are not good substitutes for copyright protection.

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164. Patent registration and approval are time-consuming, costly mechanisms when compared with the immediate contract arrived at through use of trade secret or licensing agreements made with employees or co-authors.

165. A trade secret is "any formula, pattern, device or compilation which is used in one's business, and which gives him an opportunity to obtain an advantage over competitors who do not know or use it." RESTATEMENT OF TORTS § 757 comment b (1939). *See generally* Raysman, *Protection of Proprietary Software in the Computer Industry: Trade Secrets as an Effective Method*, 18 JURIMETRICS J. 335 (1978) and Schmidt, *supra* note 64, at 386-99.

166. Exceptions to subject matter not valid as objects of services contracted for include "illegal bargains." *See generally* 1 A. CORBIN, CORBIN ON CONTRACTS §§ 1373-78 (17th printing 1975).

167. 17 U.S.C. app. § 301 effectively preempts state and local governments from exercising jurisdiction over copyright in works "fixed" after January, 1978. At present, states may exercise authority over works fixed prior to Jan. 1978, "unfixed" works and certain other narrow areas not yet covered by federal statute. *See generally* N. BOORSTYN, *supra* note 84, at 10-20. At present, there is no uniform, national statutory basis for enforcing rights granted under trade secrecy and licensing agreements.

2. *Computer or Man-Machine Hybrid as the "Author"*

At the other extreme from denial of copyright to AI software products is an alternative endowing the AI software creating the materials in need of protection either exclusive copyright ownership or one shared in some manner with one or more humans. The disadvantages inherent in granting exclusive copyright ownership to the computer and its software are manifest. First, by doing away with the traditionally implied requisite of human authorship, this alternative concedes that a machine can formulate ideas and express them.[168] Although the time may come when truly intelligent, sentient machines are created, thereby causing a revolutionary change in the corpus of traditional law, it presently seems unnecessary and extreme. Second, even if courts did recognize machines as authors, enforcement, ownership and assignment of rights would not be easy. How could a machine be a real party in interest in a lawsuit? Would a human be allowed to "own" a thinking machine? Would the human act as trustee for revenues received for products created and sold by the AI device? Who is the master? Who is the servant? Third, although legal interests have been recognized in trusts and corporations, these interests are based on the essentially human nature of the endeavor (evidenced by shareholder participation).[169] Public policy considerations support the existence of trusts and corporations,[170] but the problems caused by endowing machines with copy-

168. If one grants copyright to "expressions" not purported to be the result of underlying intellectual labor, the concept of authorship becomes meaningless. Natural phenomena as well as animals would thereby become likely candidates for authorship if, by accident, an "expression" is produced. (e.g., a cat walks on an ink pad and then onto a piece of paper, leaving an "expressive pattern" in his trail. One cannot distinguish this expression from one intentionally done by a human for some unknown reason. If one doesn't look to the expression of an underlying idea or some evidence of intellectual effort having been expended as the basis for copyright, then the accidental markings of the cat would be equated with the works of famous artists: both would be copyrightable or neither would be. Critics of modern art might cheer this interpretation but the damage done to the goals and the availability of copyright is significant). *See* Apple Computer, Inc. v. Franklin Computer Corp., 545 F. Supp. 812 (E.D. Penn. 1982) and *Alfred Bell & Co.*, 191 F.2d 99 (2d Cir. 1976) (inadvertent expressions can be "adopted" by a human and thus meet authorship requirements under copyright).

169. In other words, the "legal person" status of a corporation reflects a need for society to recognize and facilitate a method for efficiently organizing human physical and intellectual effort to achieve maximum return on monetary and human capital investment. *See* P. DRUCKER, CONCEPT OF THE CORPORATION 30-45 (rev. ed. 9th printing 1975).

170. *Id.* at 174-215.

right ownership outweigh any advantages of this alternative by a wide margin.[171]

Alternatives creating a legal relationship between the man and the AI software, granting copyright to man and machine as joint authors, as works made for hire or through assignment of copyrights held by the machine to the human, are also not viable options. In these alternatives, the human would be granted copyright protection with or through his "co-author," "employee" or "assignor": the AI machine. Less drastic than total ownership of copyright by the machine, this approach still has several fatal drawbacks. Importantly, to the extent these alternatives grant authorship to the AI machine, the implication can be safely drawn that it can form and express ideas.[172]

In normal joint authorship situations, each co-author has legally enforceable rights and duties.[173] Economic gains can be split according to prior agreement; liabilities can be assessed and shared. In the man-machine joint author situation, the concept of an "agreement" has little meaning and the notion of a machine having legal rights and duties is absurd.[174] Allowing the machine "authorship" rights would appear as a mere gesture as the human exercised complete control over "their" joint work. Also, the normal joint authorship concept as expressed in the case law, in the Act and by CONTU assumes the parties involved in the agreement are humans.[175] The law does

171. One of the fundamental goals of copyright protection is to give the author incentive to express his ideas. However, if the "author" is an AI machine, the availability of copyright protection would be of no consequence because the AI machine, being non-sentient, would be unable to perceive the "incentive" or reap the economic benefits of such protection. Thus, one must turn towards finding authorship in humans—who are capable of recognizing and responding to such incentives—thereby promoting broad policy goals of economic development and dissemination of valuable ideas.

172. See note 168, *supra*.

173. 17 U.S.C. app. § 101 defines a "joint work" as work prepared by two or more authors "with the intention that their contributions be merged into inseparable or interdependent parts of a unitary whole." It is doubtful that a computer can have "intentions" in a legal sense. *See generally* A. CORBIN, *supra* note 166, at §§ 2, 3, 9, 15. But, one commentator argues for this approach when he states "[P]resumably both the original programmer for the machine and the person whose problem the machine is designed to handle are both contributing to the formulation of the final problem. But, since neither of these human beings need have full knowledge of the steps the computer will perform to create a program, can it not be said that the machine is also at least co-author of the program?" Milde, *supra* note 8, at 395.

174. *See generally* A. CORBIN, *supra* note 166, at §§ 3, 9, 622-26, 923.

175. See notes 72, 127, *supra*.

not contemplate a man/machine "joint author."[176] Neither a typewriter, nor a trained animal has ever been accorded joint authorship status under the copyright laws.[177]

Under the provisions of the Act, an employer can obtain ownership of the copyright to a work authored by an employee while acting in his job function or by an agent contracted for hire.[178] One could argue that the computer and its software is the "agent" or "employee" of its owner or user, and that any works produced by its software is thus a "work made for hire" under the Act and is therefore copyrightable. But, it is difficult to define a legal, contractual employment or agency relationship between a human and a machine. Furthermore, the human employee or agent has legal rights and duties by agreement with his or her employer. The computer "employee" cannot be said to enter an agreement for employment, nor can the computer assert its legal rights or be cognizant of its legal duties. Also, this approach is a misapplication of the statutory meaning of "work made for hire." The Act clearly contemplates that the author of the "work made for hire" is a human.[179] This factor is emphasized in CONTU's refusal to even "speculate" upon the possibilities of computer-authored written works.[180]

In the broad view, if one were to extend the Act to cover man-AI "work for hire" situations, this distortion would also imply recognition of other man/machine and man/animal agreements. The idea of a person "hiring" his trained parrot to "author" a soundtrack or literary work distorts the scope of copyright protection far beyond its meaningful, legally-enforceable boundaries.[181] On the other hand, if one takes a narrow view and limits man/machine "work for hire" agreements to cases involving AI software, we are still faced with the prob-

176. *See In re* Certain Coin-Operated Audio-Visual Games and Components Thereof, *supra* note 95, and CONTU, *supra* note 72, at 44.

177. Although the products of such items or creatures may be copyrighted when the expression results from human intellectual effort, copyright "authorship" has never been extended to inanimate "tools" of the human.

178. 17 U.S.C. app. § 201(b) (1976) points out that a work prepared by an employee within the scope of employment is a "work made for hire."

179. One does not speak of "scope of employment" when discussing machines used in production or manufacture of a product at issue in copyright. It is questionable whether a computer is an employee or a programmer/owner is an employer of a computer within the meaning of the Act. *Id.*

180. *See* CONTU, *supra* note 72, at 42.

181. *See generally* A. CORBIN, *supra* note 166, at §§ 8, 9, 99, 100, 624.

lem of according contractual rights to a machine.[182]

Another alternative is the possibility of allowing the AI machine to obtain the copyright and then "assigning" the economic rights attending this copyright to the owner of either the AI software or the computer.[183] But, before a property can be assigned, it must be owned or controlled by the assignor. How can a machine "own" something?[184] Assignment is a contractual concept which entails all elements necessary in a normal contract: mutuality, consideration, performance, etc. It is hard to see how these elements could be satisfied by the AI machine without doing severe damage to the traditional ambit of contract law.[185] Also, for an assignable copyright to be found in the first place, the question of authorship would have to be already settled.[186] Thus, a machine would be found the author of expressions worthy of copyright protection, implying such expressions reflect underlying ideas. Once again, courts would be faced with the problem of machines having ideas and expressing them or, in the alternative, of expressions which do not "express" anything being given copyright protection.

3. *Copyright to the Owner of the Underlying AI Software or to the Computer Owner*

At first blush, these alternatives present logical answers to the problems of authorship and originality posed to copyright law by AI produced works. The copyright owner of the underlying AI software used to produce the expressions may assert he is the author because the expressions are a derivative work product of his copyrighted program.[187] Similarly, when the

182. See notes 127, 138, 178, 179 and accompanying text, *supra*.

183. Provisions for copyright protection for derivative works include "works consisting of editorial revisions, annotations, elaborations, or other modifications which, as a whole, represent an original work of authorship." 17 U.S.C. app. § 101 (1976). However, it is apparent that the "author" contemplated by the Act is a person, not a machine. *See* CONTU, *supra* note 72, at 44.

184. "Ownership" of a property implied rights and duties which can be ascertained and enforced in a court of law. To date machines have not been recognized as a "real party in interest" and, as such, would not be able to protect "their" ownership rights. Furthermore, ownership is sometimes spoken of in terms of dominion and control over property. It is difficult to see how an AI machine could exercise control over its product.

185. *See generally* A. CORBIN, *supra* note 166.

186. Before a copyright interest can be assigned, it must be awarded to the original assignor/owner by the copyright office. Therefore, the question of authorship must already have been settled.

187. See note 183, *supra*.

computer owner also owns the copyright to the AI software, one might consider allowing him to copyright the expressions produced by it. Under these alternatives, products of AI software would be deemed "derived" from the original, copyrighted source.[188] Thus, the holder of the original AI software copyright or the computer owner could be allowed to assign, license, sell or divide his legal interest in any literary products produced.

However, these approaches misconstrue the meaning of "derivative" used by the Act and interpreted in the case law. By its very nature, a derivative work is wholly or significantly based upon the work of another.[189] The amount of the second person's creative input is found to be insufficient to adequately distinguish the second work from the first. But, in AI produced works, the resulting literature or program is not "based upon" or derived from the underlying, copyrighted AI software: it is "created" by it. The similarity between the expression created by a program and that of the actual program itself is usually nonexistent except when the sole function of the program is to produce a listing of its code.[190] In AI software applications, the work product bears little or no resemblance to the underlying program code which created it.[191] Thus, it is not "derivative" in a copyright sense. AI software performs a creative function, lacking as a matter of fact when a work is found to be derivative from another. The owner of the copyright in the original

188. The products of the AI software would not be in existence but for the prior original expression of a human programmer. This expression is embodied in the AI software. Because the original programmer can own the copyright to such software if he meets the requirements of the Act, one could argue that ownership of the copyright to the products of this software should be traced back to this original programmer because the products are "derived" from his copyrighted work. See note 183 and accompanying text, *supra*.

189. WEBSTER'S NEW COLLEGIATE DICTIONARY 303 (1981) speaks of "source" or "origin" when attempting to define the meaning of "derived." The Act defines a derivative work as a "work based upon one or more pre-existing works, such as a translation, musical arrangement, dramatization, fictionalization, motion picture version, sound recording, art reproduction, abridgement, condensation, or any other form in which a work may be recast, transformed, or adapted." 17 U.S.C. app. § 101 (1976).

190. For instance, in Type I AI programs, the code generator source program remains unaffected by the creation of the product program. Similarly, in Type II situations, the output story bears no resemblance as a whole to the source code of RACTER or to the contents of the various vocabulary data files used by RACTER to write the story. Thus, in a copyright sense, the product of Type I and Type II AI program are not "derived" from the underlying AI program because they bear no resemblance to it. The AI program creates a product distinct from its own expression format.

191. See note 190, *supra*.

AI software or the owner of the computer can enforce their rights against others who choose to derive programs from theirs,[192] but they cannot claim derivative copyright protection over the *product* of the AI software because this is not within the contemplated meaning of "derivative" used in the Act.[193] AI software functions as a tool. Although legal ownership of this tool may be held by a person other than the one who uses it to create a product of value, for this product to be deemed a "derivative work" of the original in a copyright sense, it must significantly resemble it.[194] The creative function of AI software virtually precludes this possibility and effectively blocks application of the copyright concept of "derivative work." Also, if the computer owner or the owner of the underlying AI software rights claims he is directly involved in the authorship of the resulting expressions, he must be able to prove his input in the creation of the finished work was substantial. Ownership per se of the right to the AI software or the computer has little to do with the originality or the derivative nature of the expression produced by the machine. When the human contribution is found insufficient, the court cannot grant copyright in the traditional sense. Without completely eliminating the requirement of human originality and authorship, the AI machine owner or the owner of the underlying AI software rights would rarely be able to obtain copyright protection for works substantially created by the machine.

4. *Conservation of Ideas: The Fictional Human Author*

The alternatives discussed thus far either misconstrue the basic tenents of copyright law, do not adequately serve traditional policy goals or require drastic revision of basic copyright assumptions to achieve limited availability of copyright protection for products of AI software. Careful thought reveals an alternative which avoids these pitfalls. When a court finds a given product of AI software is "authored" by machine rather than a person, the court should presume the existence of a fictional human author and assign the appropriate fractions of the copyright rights to the owner of the AI software copyrights, the problem-specifier or the computer owner, either individu-

192. *Id.*

193. See notes 189 and 190, *supra*.

194. *Id.*

ally, jointly or in part.[195]

Founded on the assumption that expressions "express" ideas and that ideas must spring from a human mind, this approach has several advantages. First, by presuming the existence of a human author, a court makes no implication that ideas can be formed or expressed by non-humans. It maintains the traditional approach of law viewing creation as an uniquely human endeavor and that authorship, originality and creativity are human qualities not to be usurped by machines.[196] Second, contractual problems associated with several of the other alternatives are avoided because the party assigning rights is "human," and all other possible copyright contenders are also human.[197] Third, this approach would exhibit the traditional flexibility of copyright law as it expands and changes in the face of new technologies.[198] Fourth, copyright protection would be available under this alternative and would thus serve the important policy goals cited earlier.[199] Economic incentives would be provided for creation of AI software, scientific and literary interests would be furthered as products of AI software were commercially disseminated, and monopolization of the expressions produced by AI programs would be limited to a degree consistent with traditional copyright policy. Finally, courts would not have to cope with philosophical questions revolving around the idea/expression dichotomy and the concept of "thinking machines" and their legal rights and duties. The main structure of traditional copyright law would remain untouched, its basic requirements merely extended to yet another form of technological development.

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195. Courts often have to determine which contending party owns how much, if any, of a given copyright. The question is usually one for the fact-finder to determine the quantity and quality of the contribution of each "author" to the given work. The court will also look at all contracts, agreements, customs and other facts and circumstances when determining the distribution of "ownership" of the copyright. Under this proposed solution, the "authorship" requirement under the Act would be presumed met in Type I and Type II AI product situations whenever human contribution is found to be trivial. The court would then look to the other requirements under the Act to allow or disallow copyright in a given case. If copyright were found to exist, the court would be able to "assign" the rights of ownership to the humans who, given all the facts, are most deserving.

196. See notes 114, 115, 127, 136 and accompanying text, *supra*.

197. *Id.*

198. *See generally* L. PATTERSON, *supra* note 148.

199. *Id.*

VI
Solution: A Proposed Interpretation of Section 102 of the Copyright Act

To assist the courts in creating a presumption of a fictional human author whenever a product of Type I or Type II AI programs evidences insufficient human contribution to satisfy copyright requirements of "originality" and "authorship," section 102 of the Act[200] should be interpreted by the court as if it incorporates the following passage:

> In determining the copyrightability of expressions wholly or partly produced by computer software and which are apparently thoughtful or indistinguishable from those produced by a human author, human authorship will be *presumed* and "authorship" and "originality" requirements of this Act will be deemed satisfied.[201]

This interpretation would enable courts to presume authorship in AI product situations and allow time for analyzing the other requirements of the Act to determine copyright availability in a given situation. If all copyright requirements were met, then the policy goals of copyright would adequately be served because protection would be granted. The court would have to determine the correct apportionment of copyright ownership rights among the owner of the underlying AI software, the owner of the machine and the problem-specifier.[202] Assessing the economic interests of human parties, the court would be on familiar ground. The traditional integrity of the idea/expression dichotomy would be maintained in copyright law, and the human focus of jurisprudence would remain inviolate.

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200. *See, e.g.*, discussion in *Apple Computer, Inc. v. Franklin Computer Corp.*, *supra* note 114 (the court developed a "Seldon-Taylor" doctrine of copyright wherein expressions to be given protection must have an underlying explanatory purpose or be attempting to communicate in some way. Finding the expressions fixed in ROM to be, at most, communication from a man to a machine, the court found programs stored in ROM to be non-copyrightable expressions). *See also* Alfred Bell & Co. v. Catalda Fine Arts, Inc., 191 F.2d 99 (2d Cir. 1976) (concept of inadvertent expressions (i.e. natural effects of lightning strike caught in nature photograph) which are not planned for nor created by the human, yet are copyrightable if the human "adopts" such expressions as his own. Note, however, that in adopting the expression as his own work, the human puts forth the minimal degree of "intellectual effort" needed to satisfy the Act).

201. See notes 195 and 200, *supra*. This "interpretation" could also be statutorily enacted.

202. See note 195, *supra*.

VII
Conclusion

Throughout its history, federal copyright law has flexed under the pressures of technological advancement. Developments in artificial intelligence will soon place even more tension on the scope and application of its traditional requirements. Code generators, problem solving languages and story-writing programs all act as harbingers of more powerful, creative and economically important innovations soon to come. Although dealing with many issues germane to the advent of computer technology, CONTU did not adequately address the looming onslaught of AI based products and creations. Finding that extension of copyright protection to AI software work products is advantageous for the same reasons copyright is extended to normal, human produced literary works, this note has analyzed the threat AI developments pose to copyright concepts of authorship and originality and has discussed several alternative solutions to afford copyright protection. The solution least destructive to traditional copyright concepts *presumes* a fictional human author and then "assigns" copyright to the creator of the AI software, the problem-specifier or the computer owner, as the court sees fit.

It should be emphasized that the solution proposed in this note is a stop-gap measure. As AI develops more fully, the ability to sidestep the tremendous impact such advances will have on the legal system will diminish significantly. Man will confront "thinking machines," and the impact will be unprecedented. The technical feasibility of artificial intelligence has been shown at a relatively primitive level, but "[o]nce artificial intelligences start getting smart, they're going to be very smart very fast. What's taken humans and their society tens of thousands of years is going to be a matter of hours with artificial intelligences."[203] We must prepare for "the possibility that we may have to undergo still another redefinition of ourselves as a species, another Copernican revolution that will move us further yet from the center of the universe."[204]

203. P. McCorduck, Machines Who Think 351 (1979).
204. *Id.* at 328.