Intellectual Property in the Era of the Creative Computer Program: Will the True Creator Please Stand Up?

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Computer scientists, using artificial intelligence techniques such as neural networks, are enabling computers to independently create works that appear to qualify for federal intellectual property protection. In at least one case, the creator of this kind of program has registered its output, a series of musical compositions, under his name as author with the United States Copyright Office. Whether the output of the computer satisfies the statutory and constitutional requisites for protection is questionable, however. The author of this Article argues that the output of an autonomously creative computer program cannot be protected under the current copyright and patent laws. Further, he will assert that the statutory infirmity cannot be cured, as this would violate the Patent and Copyright Clause of the Constitution.

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I. INTRODUCTION

Throughout most of history, the worldly source of creativity has been assumed to be the human being.[1] When contemplating the creative, images of Beethoven, Joyce, and Monet come to mind, not images of machinery. This belief has led the major federal intellectual property laws associated with creative activities—copyrights and patents—to assume that the creator of the work being protected is human.[2]

Recent developments in computer technology, however, challenge the assumption that humans are always the source of creative works. A computer scientist named Stephen Thaler, using a system known as a *neural network*, has enabled a computer to create artistic and inventive works.[3] Importantly, this computer system,

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1. *See The Dhammapada* I:1, *in* BUDDHISM: A RELIGION OF INFINITE COMPASSION 64 (Clarence H. Hamilton ed., F. Max Fuller trans., 1952) ("All that we are is the result of what we have thought: it is founded on our thoughts, it is made up of our thoughts.").

2. For a discussion of copyright, see *infra* Part III.A. For a discussion of patent, see *infra* Part III.B.

3. *See* Philip Yam, *As They Lay Dying*, SCI. AM., May 1995, at 24. *See generally* Imagination Engines, Inc.'s Homepage (visited Feb. 15, 1997), <http://www.imagination-engines.com>. Other computer scientists have used different techniques to enable their computer systems to create. *See* W. Wayt Gibbs, *Artificial Art*, SCI. AM., Dec. 1995, at 34; Paul C. Judge, *Artificial Imagination: Companies Are Trying Out Software Designed to Spur Invention*, BUS. WK., Mar. 18, 1996, at 60; John Schwartz, *Is Aaron's Work Creative Art or Just High-Tech Doodling?*, WASH. POST, Apr. 10, 1995, at A3. *See generally* Simon Penny, *The Pursuit of the Living Machine*, SCI. AM., Sept. 1995, at 216 (describing the future of artificial intelligence and its creative uses).

termed a Creativity Machine by its inventor,[4] is demonstrating skills that Dr. Thaler himself does not possess.[5] Nevertheless, the inventor claims that federal intellectual property law protects the computer's creations and that he is the owner of the rights.[6] If his claim is accepted, this computer invention will challenge the fundamental assumption upon which federal intellectual property laws have been predicated—that humans are the source of creative works. The purpose of this Article, therefore, is to examine whether works created by an autonomously creative computer program qualify for federal intellectual property protection.

The next section will briefly describe the operational characteristics of the Creativity Machine. Part III will analyze the consequences of the invention under current federal intellectual property law. Finally, Part IV will examine both the public policy and constitutional justifications for the law as it exists.

II. A BRIEF DESCRIPTION OF THE CREATIVITY MACHINE[7]

A Creativity Machine is an example of a *neural network*, a "[s]elf-organizing system of simple interconnected processing units that possess a learning rule and are capable of learning."[8] Modeled

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4. *See* Stephen Thaler, *Neural Networks that Create and Discover*, PC AI, May/June 1996, at 16, 18.

5. Telephone Interview with Stephen Thaler, Ph.D., Inventor of the "Creativity Machine" (July 25, 1995) [hereinafter *Thaler Interview*]; *see also* Thaler, *supra* note 4, at 21 ("The Creativity Machine also takes the daring step . . . .").

6. *See* Stephen L. Thaler, *Musical Themes from Creativity Machine*, Copyright Reg. No. PAu1920845 (Oct. 20, 1994).

7. "[S]implification [is] the first step toward mastery of a subject . . . ." THOMAS MANN, THE MAGIC MOUNTAIN 245-46 (H.T. Lowe-Porter trans., Alfred A. Knopf 1961). The Creativity Machine is an example of complex technology. The discussion of it here is not comprehensive by necessity; instead, a simplified summary of its operation is presented so that its primary characteristics can be understood. Dr. Thaler's articles should be consulted for a more detailed presentation of the Creativity Machine. *See* Thaler, *supra* note 4; Stephen L. Thaler, *Death of a Gedanken Creature*, 13 J. NEAR-DEATH STUD. 149 (1995); Stephen L. Thaler, *"Virtual Input" Phenomena Within the Death of a Simple Pattern Associator*, 8 NEURAL NETWORKS 55 (1995). *See generally* JOHN H. HOLLAND ET AL., INDUCTION: PROCESSES OF INFERENCE, LEARNING, AND DISCOVERY (1986) (considering, in depth, the process of learning, both within a computer and without); BRANKO SOUCEK & MARINA SOUCEK, NEURAL AND MASSIVELY PARALLEL COMPUTERS: THE SIXTH GENERATION 213-76, 291-306 (1988) (presenting a more technical description of neural networks including discussions of the various approaches that have been used to program neural networks and how the learning mechanism within a neural network works); JOSEPH WEIZENBAUM, COMPUTER POWER AND HUMAN REASON (1976) (discussing the early, seminal work on artificial intelligence).

8. WEBSTER'S NEW WORLD DICTIONARY OF COMPUTER TERMS 393 (5th ed. 1994).

after the neurons in the biological brain, a neural network comprises multiple computers, each termed a "node," with simple mechanisms for intercommunication among the nodes.[9] Each node is required to make a determination about the factual domain in which the network is working and transmit a result to one or more other nodes within the network.[10] Based on these values, and the importance given to them, the network reaches a conclusion.[11]

A neural network can, to a certain extent, be self-training. Typically, the importance of each node's result initially is established randomly.[12] After a test pattern is presented, if the node participated in a correct decision by making the appropriate determination for that test pattern, the computer increases the importance of that node's result; if the decision was incorrect, the computer decreases the importance of that node's result.[13] The process is then repeated until the network produces correct results.[14]

For example, consider a neural network designed to recognize vehicles. One node could be trained to determine if the input object has wheels.[15] Similarly, other nodes could be prepared to determine if

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9. *See* DAVID H. FREEDMAN, BRAINMAKERS: HOW SCIENTISTS ARE MOVING BEYOND COMPUTERS TO CREATE A RIVAL TO THE HUMAN BRAIN 63-66 (1994).

10. *See id.* at 67. *See generally* EARL B. HUNT, ARTIFICIAL INTELLIGENCE 102-22 (1975) (explaining in detail how each node works).

11. *See* FREEDMAN, *supra* note 9, at 68-69.

12. *See id.* at 69.

13. *See id.*

> Learning or building the knowledge structure in [a neural network] involves modifying the patterns of interconnectivity. . . .
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> Output from the unit j, O_j, is connected to the input of unit i through the weight w_{ij}. The net input is usually the weighted sum of all inputs to the unit. . . . The useful, frequently used [output] function is the threshold function.

SOUCEK & SOUCEK, *supra* note 7, at 223-24. Many different output functions have been developed. *See id.* at 224-28. This process of feedback—that the result reached by the network affects the operation of each node—is fundamental to the proper operation of the neural network. *See* HUNT, *supra* note 10, at 17.

14. *See* FREEDMAN, *supra* note 9, at 69.

15. Although this sounds simple, the process of determining if there are wheels, or any other determination humans may consider simple, is not computationally easy. Indeed, an entire neural network may be necessary just to make that determination. Thus, the process of building a complicated neural network often consists of building simpler networks in a recursive manner. *See* DOUGLAS R. HOFSTADTER, GÖDEL, ESCHER, BACH: AN ETERNAL GOLDEN BRAID 127-52 (1979) ("WHAT IS *RECURSION*? It is . . . nesting, and variations on nesting. The concept is very general. (Stories inside stories, movies inside movies, paintings inside paintings, Russian dolls inside Russian dolls (even parenthetical comments inside parenthetical comments!)—these are just a few of the charms of recursion." (emphasis added)).

the object has wings, can float, is long, is red, or has other characteristics. All of the nodes make their determination and transmit the information to the next level of the network. At that level, the computer classifies the object. Suppose the object being examined is a red seaplane but the network determined that it was a blue train. The importance of the nodes that are associated with redness and "seaplaneness" would be increased while the importance of the nodes that are not would be decreased. Thus, wings would become more important in the scheme of things while wheels would become less important. After many iterations, the network would correctly determine the object to be a red seaplane. To continue the training, a new object is presented and learned. After the presentation of many images, the system can identify the type of vehicle with a very high success rate.

The Creativity Machine itself consists of two neural networks that work together.[16] The first network, the source machine, is responsible for "produc[ing] a stream of [possibilities],"[17] each of which the second network, the evaluation machine, examines to find if it matches the discovery criteria of interest.[18]

Initialization of the Creativity Machine requires two steps.[19] First, the source machine must be trained in the domain of interest—be it music, dance, automobile design, or other subject matter chosen by the machine's operator.[20] The process of training is represented by its inventor to be fairly simple because the self-learning characteristics of a neural network are used.[21] Many examples from the domain are provided to the network to allow it to extract the patterns contained.[22] Although this training is simple in theory, the choice of which examples from the domain to present is critical—the choice of the wrong examples can result in a failure to train the network properly.[23]

For a discussion of the technical difficulties multilayer neural networks cause, see SOUCEK & SOUCEK, *supra* note 8, at 228-30.

16. *See* Thaler, *supra* note 4, at 18.
17. *Id.*
18. *See id.*
19. *See id.*
20. *See id.* at 16.
21. *See id.*
22. *See id.*
23. *See id.* ("During training, we expose an artificial neural network to a few judiciously chosen data points from a given database. If the training is effective, the network accurately generalizes the relationship among all involved parameters."). The difficulty of training is expressed in Dr. Thaler's specification of a "few judiciously chosen data points." *Id.* The choice of the wrong training examples will result in a network that

The evaluation machine must be trained as well.[24] The process of training the evaluation machine is much the same as that used for the source machine, but the information used also contains a ranking of quality of each input design.[25] This quality ranking can be established by a panel of human judges,[26] by applying a numeric test,[27] or by feeding the evaluation machine successful examples from society.[28]

Once initialized, the Creativity Machine can run. To trigger the source machine to produce new possibilities within the domain, noise[29] is introduced into the system by randomly removing some information provided in the training.[30] Rather than producing a chaotic result, the small pruning of information triggers the output of new patterns that are themselves within the training domain.[31] These new patterns are then fed into the evaluation machine that judges them on the criteria with which it has been provided.[32] The Creativity Machine has been used to create new dance choreographies, songs, and automobile designs, and to propose construction materials that may be ultra-hard.[33]

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does not converge on a correct conclusion. *See* SOUCEK & SOUCEK, *supra* note 7, at 217, 242.

24. *See* Thaler, *supra* note 4, at 18.

25. *See id.*

26. *See* Stephen L. Thaler, *Neural Networks that Autonomously Create and Discover* 4 (prepublication version of Thaler, *supra* note 4, on file with the author). A dance-creation Creativity Machine could be trained by "having a panel of dance aficionados watch, say a hundred performances . . . and offer esthetically driven numerical scores." *Id.*

27. *See* Thaler, *supra* note 4, at 18. A Creativity Machine used to derive new ultra-hard materials could be initialized by having the evaluation machine calculate Knoop hardness values of the materials generated by the source machine and thereafter rank the proposed ultra-hard materials. The Knoop scale is based on how large an indentation would be made in the material being tested by a diamond point. *See* RANDOM HOUSE UNABRIDGED DICTIONARY 1063 (2d ed. 1993).

28. *See* Yam, *supra* note 3, at 25. For example, the "top-ten" songs of the last 30 years were used to initialize the Creativity Machine.

29. "Loosely, any disturbance tending to interfere with the normal operation of a device or system, including interference attributable to equipment components, natural disturbance, or *manual interference*." WEBSTER'S NEW WORLD DICTIONARY OF COMPUTER TERMS, *supra* note 8, at 395 (emphasis added).

30. *See* Thaler, *supra* note 4, at 16-17; Stephen L. Thaler, *4-2-4 Encoder Death*, *in* 2 WCNN '93, PORTLAND: WORLD CONGRESS ON NEURAL NETWORKS 180 (1993) (describing technically how pruning weights results in new examples from the domain).

31. *See* Thaler, *supra* note 4, at 16-17.

32. *See id.* at 18.

33. *See id.*; Yam, *supra* note 3, at 25.

III. WHO CAN CLAIM THE INTELLECTUAL PROPERTY RIGHTS ASSOCIATED WITH WORKS CREATED BY INDEPENDENTLY CREATIVE COMPUTER PROGRAMS?

The Creativity Machine itself, while perhaps a noteworthy invention,[34] is of little direct legal interest. The rights of the inventor, in the output of the Creativity Machine however, present a timely but complex legal question. The Creativity Machine's inventor, Dr. Thaler, considers the output of the Creativity Machine to be his own intellectual property.[35] Serious questions can be raised, however, about whether he is the author or inventor of the works produced by the Creativity Machine as required for federal intellectual property protection. Determining whether Dr. Thaler is an author or inventor requires successive analyses of the copyright and patent laws. As will be seen, the result of each analysis will be the same—the output of the Creativity Machine does not fit within the current paradigm of federal intellectual property law. This result casts a serious question regarding whether the output of the Creativity Machine can or should be protected by federal intellectual property laws.

A. Copyright Law

For a copyright to exist, a work of authorship must be created and fixed in a tangible medium of expression.[36] Fixation is not a problem with the Creativity Machine, as it can be made to produce its output on paper or other tangible media.[37] For a work of authorship to exist, there must be a legally recognized author who has created the work.[38] For the Creativity Machine, it is implausible that these requirements can be satisfied.

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34. Its inventor has applied for a patent. *See* Thaler *Interview*, *supra* note 5.

35. *See* Thaler, *supra* note 6; Yam, *supra* note 3, at 25. The Creativity Machine has triggered a copyright controversy, as yet unaddressed, sooner than some had expected. *See* Arthur R. Miller, *Copyright Protection for Computer Programs, Databases and Computer-Generated Works: Is Anything New Since CONTU?*, 106 HARV. L. REV. 977, 1037-38 (1993) ("Thus, because the state of the art is bound to change dramatically before a genuine copyright controversy involving a neural network arises, any discussion today of the copyright implications of neural networks would be speculative . . . .").

36. *See* 17 U.S.C. § 102(a) (1994).

37. *See* Thaler, *supra* note 26, fig. 2B. "A work is 'fixed' in a tangible medium of expression when its embodiment in a copy . . . is sufficiently permanent or stable to permit it to be perceived, reproduced, or otherwise communicated for a period of more than transitory duration." 17 U.S.C. § 101.

38. *Cf.* Andrien v. Southern Ocean County Chamber of Commerce, 927 F.2d 132, 134-35 (3d Cir. 1991) (noting that creation of a work can not entail every step in the process from creation to fixation in a tangible medium).

1. The Current Legal Requirements to Be an Author of a Work under the Copyright Law

The Copyright Act establishes that the copyright vests ownership "in the author . . . of the work."[39] The term "author" is not specifically defined within the Copyright Code, however.[40] To determine the word's precise meaning requires that several sources be analyzed, starting with the statute itself and any legislative history that clarifies the word's meaning.[41] If the primary means of statutory interpretation fail or are inconclusive, then other techniques are employed[42]—determining the meaning given the word in other federal statutes,[43] reviewing definitions adopted in regulations issued pursuant to the particular statute,[44] and assessing whether the word has a generally understood meaning[45] or is a term-of-art.[46]

Although not specifically defined, the use of the term "author" in the Copyright Act implies that Congress meant a human author. For

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39. 17 U.S.C. § 201(a).

40. *See id.* § 101; Pamela Samuelson, *Allocating Ownership Rights in Computer-Generated Works*, 47 U. PITT. L. REV. 1185, 1197 (1986) (noting that the term "original works of authorship" is not defined within the Copyright Act).

41. *See, e.g.*, Middlesex County Sewerage Auth. v. National Sea Clammers Ass'n, 453 U.S. 1, 13 (1981) ("We look first, of course, to the statutory language . . . . Then we review the legislative history . . . ."). *See generally* 2A NORMAN J. SINGER, STATUTES AND STATUTORY CONSTRUCTION § 45.01 (5th ed. 1992) ("[T]he particular language of the [statute] is always the starting point on any question concerning the application of the law."); *id.* § 48.04 ("[T]he history of events during the process of enactment . . . has generally been the first extrinsic aid to which courts have turned in attempting to construe an ambiguous act.").

42. *See Middlesex County Sewerage Auth.*, 453 U.S. at 13 ("[O]ther traditional aids of statutory interpretation [are used second] to determine congressional intent.").

43. *See* Cleveland Inst. of Elec., Inc. v. United States, 787 F. Supp. 741, 745 (N.D. Ohio 1992). *See generally* 2B SINGER, *supra* note 41, § 53.01 ("Construing statutes by reference to others advances [harmony and consistency within the statutes]. In fact, courts have been said to be under a duty to construe statutes harmoniously where that can reasonably be done." (footnote omitted)).

44. *See Cleveland Inst. of Elec.*, 787 F. Supp. at 745. *See generally* 2B SINGER, *supra* note 41, § 49.03 ("[I]nterpretation of a statute by the executive officers charged with its administration and enforcement . . . constitutes an invaluable aid in determining the meaning of a doubtful statute.").

45. *See* Escondido Mutual Water Co. v. La Jolla Band of Mission Indians, 466 U.S. 765, 772 (1984) ("[I]t should be generally assumed that Congress expresses its purposes through the ordinary meaning of the words it uses . . . ."). *See generally* 2A SINGER, *supra* note 41, § 47.28 ("[W]hen common terms are used they should be given their common meaning.").

46. *Cf.* Gustafson v. Alloyd Co., Inc., 115 S. Ct. 1061, 1063 (1995) (defining "prospectus" as being a term of art within security law rather than as having any ordinary meaning). *See generally* 2A SINGER, *supra* note 41, § 47.30 ("[L]egal terms in a statute are presumed to have been used in their legal sense.").

example, the duration of a copyright is defined as "the life of the author and fifty years after the author's death."[47] This usage implies that an author is something capable of dying—a human rather than an artificial entity. Likewise, the statute defines an author's widow or widower,[48] which definition clearly eliminates nonhuman entities. Indeed, for a nonhuman entity such as a corporate employer to claim a copyright in a work, the work must be a work-made-for-hire.[49] "In the case of a work made for hire, the employer . . . is *considered* the author for the purposes of this title."[50] But even here Congress was careful to indicate that the employer is not the author-in-fact, but is only "considered" to be the author by law.

The primary legislative history for the Copyright Act is in the House Report to the bill.[51] As with the statute itself, Congress did not define the term "author" in the Report,[52] but used the term in a way which strongly implies that humans were the intended group.[53] This meaning in the legislative history is reinforced by the work and report of the National Commission on New Technological Uses of Copyrighted Works,[54] commonly known as CONTU. Among the

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47. 17 U.S.C. § 302(a) (1994).

48. *See id.* § 101.

49. *See id.* § 201(b). A "work made for hire" is defined as "a work prepared by an employee within the scope of his or her employment; or . . . a work specially ordered or commissioned for use as [nine specific uses] if the parties expressly agree in a written instrument signed by them that the work shall be considered a work made for hire." *Id.* § 101.

50. *Id.* § 201(b) (emphasis added).

51. *See* H.R. REP. NO. 94-1476 (1976), *reprinted in* 1976 U.S.C.C.A.N. 5659; Russ VerSteeg, *Sparks in the Tinderbox: Feist, "Creativity," and the Legislative History of the 1976 Copyright Act*, 56 U. PITT. L. REV. 549, 561-62 (1995); *cf.* Feist Publications, Inc. v. Rural Tel. Serv. Co., 499 U.S. 340, 355 (1991). *Compare* H.R. REP. No. 94-1476 (1976), *reprinted in* 1976 U.S.C.C.A.N. 5659, *with* H.R. CONF. REP. NO. 94-1733, at 69 (1976), *reprinted in* 1976 U.S.C.C.A.N. 5810. *See also* 2A SINGER, *supra* note 41, § 48.06.

52. *See* H.R. REP. NO. 94-1476 (1976), *reprinted in* 1976 U.S.C.C.A.N. 5810.

53. *See, e.g., id.* at 137 ("Computing the term from the *author's death* . . . ." (emphasis added)); *id.* at 120 ("If each of the authors prepared *his or her* contribution . . . ." (emphasis added)). Once again, the House Report requires that a nonhuman entity be an employer under the work-made-for-hire doctrine to claim rights. *See id.* at 137.

54. *See* NATIONAL COMMISSION ON NEW TECHNOLOGICAL USES OF COPYRIGHTED WORKS, FINAL REPORT 1 (1979) [hereinafter CONTU REPORT]. CONTU was established by Congress to study various problems associated with the impact of new technologies, computers and photocopiers foremost, on copyrights. *See id.* at 4-5. The recommendations of CONTU were enacted by Congress. *Compare* Computer Software Protection Act, 17 U.S.C. § 117, *with* CONTU REPORT, *supra*, at 1, *and* RAYMOND T. NIMMER, THE LAW OF COMPUTER TECHNOLOGY ¶ 1.03[2] (2d ed. 1992).

issues CONTU studied was "the creation of new works by the application or intervention of computers."[55] CONTU concluded that

> [I]t may be seen that although the quantum of originality needed to support a claim of authorship in a work is small, it must nevertheless be present.... The eligibility of any work for protection by copyright depends not upon the device or devices used in its creation, but rather upon the presence of at least minimal *human* creative effort at the time the work is produced.[56]

No other provision in the United States Code defines "author," although several sections use the term.[57] In none of them does Congress indicate that a nonhuman entity can be an author except in § 290(e) of Title 15 where Congress authorizes the Secretary of Commerce to obtain a copyright "on behalf of the United States as author."[58] Rather than being interpreted as a statement of congressional intent recognizing nonhuman authors, however, this section can best be interpreted as providing an exception to the normal prohibition on U.S. Government copyrights for works created by government employees.[59] Thus, the general use of the term "author" in the U.S. Code reinforces the conclusion that Congress intended the term to mean humans.

Similarly, the regulations promulgated by the Copyright Office do not define "author."[60] The use of the word in the regulations is consistent with that of the statute, however, giving rise to the implication that the Copyright Office understands the word "author" to apply either to a human or to an employer under the work-made-for-hire doctrine.[61]

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55. CONTU REPORT, *supra* note 54, at 44.

56. *Id.* at 45 (emphasis added).

57. *See, e.g.*, 15 U.S.C. § 290e(a); 21 U.S.C. § 343-2(a); 38 U.S.C. § 1704(2)(B).

58. 15 U.S.C. § 290e(a).

59. *See* 17 U.S.C. § 105 ("Copyright protection ... is not available for any work of the United States Government...."). "[W]orks produced for the U.S. Government by its officers and employees should not be subject to copyright." H.R. REP. NO. 94-1476, at 58, *reprinted in* 1976 U.S.C.C.A.N. 5659, 5671.

60. *See* 37 C.F.R. §§ 201.1-259.6 (1996).

61. *See* 37 C.F.R. § 202.3(b)(9)(ii) n.5 ("An 'author' includes an employer or other person for whom a work is 'made for hire' under 17 U.S.C. § 101. This paragraph does not permit an employee or other person working 'for hire' under that section to make a later registration in his or her own name.").

Without a doubt, the word "author" in the Copyright Act is a term of art,[62] having been used in prior versions of the Copyright Act[63] and owing its origin to the Constitution.[64] As a term of art, the courts have used "author" to mean the actual individual who was responsible for creating the work.[65] The author is "the *person* who effectively is, as near as he can be, the cause of the [work] which is produced, that is, the *person* who has superintended the arrangement, who has actually formed the [work]."[66] Moving beyond this definition of author would alter significantly the meaning that has been used for at least the last one-hundred years.

The conclusion that computers can be authors under the Copyright Act would have massive ramifications throughout the law. If allowed, the computer would presumably have to be given the other rights granted under the Copyright Code such as the right to transfer the copyright[67] and to bring suit for infringement.[68] To transfer a copyright that requires an "instrument of conveyance . . . in writing

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62. *See* H.R. REP No. 94-1476, at 51, *reprinted in* 1976 U.S.C.C.A.N., at 5664 (stating that "original works of authorship" is used to mean the standard established by the courts under the Copyright Act of 1909).

63. *See, e.g.*, Copyright Act of 1909, § 4, 61 Stat. 652 (codifying the 1909 Act as amended), *as amended by* Act of Apr. 27, 1948, Pub. L. No. 80-501, ch. 236, 62 Stat. 202; Act of June 25, 1948, Pub. L. No. 80-773, ch. 646, § 39, 62 Stat. 992; Act of June 3, 1949, Pub. L. No. 81-84, ch. 171, 63 Stat. 153; Act of Oct. 31, 1951, § 16, 65 Stat. 716; Act of July 17, 1952, Pub. L. No. 82-575, ch. 923, 66 Stat. 752; Act of Apr. 13, 1954, Pub. L. No. 83-331, ch. 137, § 2, 68 Stat. 52; Act of Aug. 31, 1954, ch. 1161, 68 Stat. 1030; Act of Mar. 29, 1956, Pub. L. No. 84-542, ch. 109, 70 Stat. 63; Act of Sept. 7, 1957, Pub. L. No. 85-313, 71 Stat. 633; Act of Sept. 7, 1962, § 21, Pub. L. No. 87-646, 76 Stat. 446; Act of Oct. 27, 1965, Pub. L. No. 89-297, 79 Stat. 1072; Act of Aug. 12, 1970, § 6(i), Pub. L. No. 91-375, 84 Stat. 777; Act of Oct. 15, 1971, Pub. L. No. 92-140, 85 Stat. 391; Act of June 6, 1972, Title XVII, § 204, Pub. L. No. 92-310, 86 Stat. 203; Act of Dec. 31, 1974, Title I, §§ 102 & 104, Pub. L. No. 93573, 88 Stat. 1873 [hereinafter Copyright Act of 1909] ("The works for which copyright may be secured . . . shall include all the writings of an *author*." (emphasis added)), *repealed by* Copyright Act of 1976, Pub. L. No. 94-553, 90 Stat. 2541.

64. *See* U.S. CONST. art. I, § 8, cl. 8 ("The Congress shall have Power . . . To promote the Progress of . . . useful Arts, by securing for limited Times to *Authors* . . . the exclusive Right to [his or her] . . . Writings . . . ." (emphasis added)).

65. *See* Community for Creative Non-Violence v. Reid, 490 U.S. 730, 737 (1989); Burrow-Giles Lithographic Co. v. Sarony, 111 U.S. 53, 61 (1884). *See generally* MICHAEL A. EPSTEIN, MODERN INTELLECTUAL PROPERTY § 4.01[A][1] (3d ed. 1995).

66. *Burrow-Giles Lithographic Co.*, 111 U.S. at 61 (emphasis added). This use of "author" as a term-of-art is consistent with ordinary definitions of the word. "[A] *person* who writes a novel, poem, essay, etc.; the composer of a literary work, as distinguished from a compiler, translator, editor, or copyist." RANDOM HOUSE UNABRIDGED DICTIONARY 139 (2d ed. 1993) (emphasis added).

67. *See* 17 U.S.C. § 201(d) (1994).

68. *See id.* § 501(b).

and signed by the owner of the rights conveyed,"[69] the computer would need the power to engage in voluntary and knowing behavior[70]—something that is well beyond the current power of any computer and may never be achieved.[71] Furthermore, it would be granting "personhood" to the computer. For example, if the computer has the right to own a copyright and therefore to bring a suit to redress copyright violations, it would be entitled to the same Due Process rights under the Fifth and Fourteenth Amendments as would any other property owner and litigant. How this can be achieved—how the computer would be served with notice or how it could be given a meaningful hearing,[72] for example, is problematic at best. For now, therefore, it is appropriate to assume that, if there is an author, it must be one of the humans involved and cannot be the computer.[73]

2. The Current Legal Requirements that the Work Originate from an Author under the Copyright Law

That a work owes its origin to an author has been a long-standing interpretation of the Copyright Act.[74] Recently, this requisite was strongly reinforced by the Supreme Court in *Feist Publications, Inc. v. Rural Telephone Service Co.*[75] In *Feist*, the Court held:

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69. *Id.* § 204(a).

70. *See* Playboy Enters., Inc., v. Dumas, 831 F. Supp. 295, 309 (S.D.N.Y. 1993) (stating that § 204 requires the writing to be the agreement or to memorialize an orally reached agreement), *aff'd in part, rev'd in part*, 53 F.3d 549 (2d Cir. 1995); *see also* U.C.C. § 2-204(1) ("A contract for sale of goods may be made in any manner sufficient to show agreement, including conduct by both parties which recognizes the existence of such a contract.").

71. *See* FREEDMAN, *supra* note 9, at 177-89.

72. *See* Mullane v. Central Hanover Bank & Trust Co., 339 U.S. 306, 314 (1950).

73. Whether this assumption will be long sustained is something that only the future of artificial intelligence research will reveal. *See* DOUGLAS R. HOFSTADTER, METAMAGICAL THEMAS: QUESTING FOR THE ESSENCE OF MIND AND PATTERN 526-46 (1985). While it may not be possible to predict if truly autonomous and self-aware artificial intelligence will ever be created, it is possible to predict that the challenges placed before the legal system will be immense if such artificial intelligence is achieved. *See* Lawrence B. Solum, *Legal Personhood for Artificial Intelligences*, 70 N.C. L. REV. 1231, 1284-87 (1992). The difficult legal and philosophical questions about what constitutes a person under the law will have to be faced. For example, will the legal system allow the autonomous and self-aware artificial intelligence to be treated as property subject to the whims of its owner, including the right to deactivate the intelligence, or will the legal system cloak the intelligence with personhood and treat attempts to deactivate it as murder or attempted murder? Answering this type of question, if it becomes necessary, will be a revolutionary challenge to the common-law system.

74. *See* Gray v. Russell, 10 F. Cas. 1035, 1037-38 (C.C.D. Mass. 1839) (No. 5,728).

75. 499 U.S. 340 (1991).

> The *sine qua non* of copyright is originality. To qualify for copyright protection, a work must be original to the author. Original, as the term is used in copyright, means only that the work was independently created by the author (as opposed to copied from other works), and that it possesses at least some minimal degree of creativity. To be sure, the requisite level of creativity is extremely low; even a slight amount will suffice. The vast majority of works make the grade quite easily, as they possess some creative spark, "no matter how crude, humble or obvious" it might be. Originality does not signify novelty; a work may be original even though it closely resembles other works so long as the similarity is fortuitous, not the result of copying.[76]

The *Feist* case serves as a solid reminder that a work must be the result of some creative effort on the part of its author in order to qualify for a copyright. Without this creative effort, copyright protection is not available. How this applies to the Creativity Machine requires an appreciation of the continuum of works that can exist, with one work produced solely by a human at one end of the human-computer continuum, to one produced solely by a computer at the other end.

For a work produced solely by a human, there can be little debate that the work owes its origin to that person even though the human uses "dumb" technology.[77] As the technology used becomes more capable, the question of origin becomes increasingly more ambiguous.[78] Three examples from the human-computer continuum demonstrate how more capable computer technology leads to a more difficult origin analysis: a compiler, Scott French's book-writing assistant and, finally, the Creativity Machine. In each successive example, computer technology is responsible for an ever-increasing proportion of the expression contained in the work until establishing the associated intellectual property rights becomes intractable.

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76. *Id.* at 345 (citations omitted).

77. *See* WEBSTER'S NEW WORLD DICTIONARY OF COMPUTER TERMS, *supra* note 8, at 193 (stating that a "dumb terminal" has "minimal I/O capabilities and no processing capability"). When used more generally, "dumb" technology is that which does not use any computer processing capabilities. Examples of dumb technology would include pen and paper, dictation equipment, and typewriters.

The Copyright Act presumes that authors will use technology to record their works. "Copyright protection subsists ... in original works of authorship fixed in any tangible medium of expression ... from which they can be perceived, reproduced, or otherwise communicated, either directly or *with the aid of a machine or device.*" 17 U.S.C. § 102(a) (1994) (emphasis added).

78. *Cf.* OFFICE OF TECHNOLOGY ASSESSMENT, INTELLECTUAL PROPERTY RIGHTS IN AN AGE OF ELECTRONICS AND INFORMATION 132-37, 271-72 (1986).

a. Does the Use of a Compiler Affect Who Has the Right to Claim Copyright Protection in the Object Code?

An early example of technology in the human-computer continuum is the compiler. A compiler is "a computer program whose purpose is that of translating high-level language statements into a form that can directly activate the computer hardware."[79] The high-level language, often termed source code, is written by the programmer.[80] With very little further human interaction, the compiler processes the source code and, assuming it is well formed,[81] translates it into the equivalent object-code program.[82] The object-code

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79. WEBSTER'S NEW WORLD DICTIONARY OF COMPUTER TERMS, *supra* note 8, at 105. *See generally* DAVID GRIES, COMPILER CONSTRUCTION FOR DIGITAL COMPUTERS 3 (1971).

> A compiler must perform an *analysis* of the source program and then a *synthesis* of the object program. First decompose the source program into its basic parts; then build equivalent object program parts from them. In order to do this, the compiler builds several tables during the analysis phase which are used during both analysis and synthesis. . . .
>
> As a program is analyzed, information is obtained from [the source code] and saved for later use. . . . For example, it is necessary to know with each use of an identifier how that identifier was [defined] and used elsewhere. . . . [E]very compiler uses a *symbol table* . . . [to store this information].

Id.

80. *See* WEBSTER'S NEW WORLD DICTIONARY OF COMPUTER TERMS, *supra* note 8, at 539. For example, a simple program, written in a high-level language known as "PL/I," to reverse the letters in a sentence would be:

```
example: procedure options (main);
    declare data_string  character (127) varying;
    declare index        fixed binary;
    get list (data_string);
    do index = length (data_string) to 1 by -1;
      put list (substr (data_string, index, 1));
    end;
  end example;
```

If the sentence "See Spot run." is provided as input, the program will produce ".nur topS eeS" as its output.

81. Source-code programs may contain several types of errors, but the ones relevant to the process of generating object code are source statements that are improperly written. *See* GRIES, *supra* note 79, at 315. If, for example, the programmer has created an identifier named "*index*" but types the name as *indox* in a statement, the compiler will probably not be able to correctly produce object code. *See id.* at 316-20. Similarly, rather than misspelling a word, a syntactical mistake could be made in a statement that would also prevent the compiler from producing object code. *See id.* at 320-26.

82. *See id.* at 202. This process is highly deterministic. Given the same source code and compiler version, the same object code will be produced. *See id.* at 2-3. For example, the object code produced by compiling the source code given in note 94, *infra*, with the Digital Research PL/I compiler would be: "10000101 10010001 01010110 00010000

program, also known as a machine-language program, is capable of operating on the computer to produce the result desired by the programmer.[83] When a program is distributed, it is the machine-language object code that is normally provided rather than the source code.[84] Thus, for most distributed programs, copyright protection is as critical for the object code as it is for the part of the program actually written by the programmer, the source code.

After many years of litigation,[85] it is fully accepted now that the object code produced by a compiler is protected by the copyright on the computer program.[86] As the court held in *Apple Computer, Inc. v. Franklin Computer Corp.*, "a computer program, whether in object code or source code, is a 'literary work' and is protected from unauthorized copying, whether from its object or source code version."[87] In reaching this defensible holding, however, the court did not address correctly why the object code should be protected under the Copyright Act; it also failed to appreciate the problems associated with the object code being a computer-generated work.[88] The court incorrectly assumed that the object code represented a copy of the original source code, presuming the ability to "perceive[], reproduce[], or otherwise communicate"[89] the source code from the object code.[90] When the object code is produced, however, much of the original expression in the source code is lost.[91] The portion that is lost is the part that most nearly fits within the Copyright Act's philosophy of protecting the expression of an idea rather than the idea itself.[92] Many of the words chosen by the programmer are irretrievably lost,[93] as are

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01010011 01010100.... 01101010 10001001 11101010 00001011 00010011 01010110 00100000 00001001 11001000 00000000 00000000."

83. *See* WEBSTER'S NEW WORLD DICTIONARY OF COMPUTER TERMS, *supra* note 8, at 347.

84. *See* EPSTEIN, *supra* note 65, § 10.01[A][4][c].

85. *See* NIMMER, *supra* note 54, ¶ 1.03[2].

86. *See, e.g.*, Apple Computer, Inc. v. Franklin Computer Corp., 714 F.2d 1240, 1246-49 (3d Cir. 1983); NIMMER, *supra* note 54, ¶ 1.02 ("[T]his issue ... is no longer seriously debated: copyright protects most computer programs.").

87. *Apple Computer, Inc.*, 714 F.2d at 1249.

88. *See id.* at 1248.

89. 17 U.S.C. § 102(a) (1994).

90. *See Apple Computer, Inc.*, 714 F.2d at 1248 (quoting 17 U.S.C. § 102(a)).

91. *See* GRIES, *supra* note 79, at 376, 457.

92. *See* 17 U.S.C. § 102(b).

93. *See* GRIES, *supra* note 79, at 457 (noting that a compiler discards the symbol table and data area maps).

many of the syntactical structures chosen by him or her.[94] Thus, as it is not possible to retrieve the original source code from the object code, the court's reliance on § 102(a) of the Copyright Act was misplaced.

Similarly, the object code cannot be considered a derivative of the source code under § 103(a) of the Copyright Act. In order to be a derivative, the derived work must fully qualify for a copyright on its own.[95] Thus, the § 102(a) requirements of originality must be met.[96] To be original, a work must be the result of human labor and creativity.[97] Applying this test to a compiled program leaves the object code in a questionable status—all that is necessary to produce an object-code version of the program, in most systems, is to invoke the compiler and indicate where the source code is located.[98]

Thus, a compiler introduces the human-computer continuum that will culminate in the Creativity Machine. A compiler results in a creation, the object code, for which copyright protection is claimed. The terms of the statute, however, suggest that the object code is not qualified for protection because it is not a copy of the source code, as the source code cannot be "perceived, reproduced or otherwise communicated"[99] from it; and it is not a derivative of the source code, as no human creativity was involved in its production. This is the fundamental problem faced whenever a computer-generated work is

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94. *See id.* at 376. Typical optimization techniques, for example, perform some operations that the programmer specified to occur when the program is run or when it is compiled, eliminate operations that are redundant, move operations from where the programmer placed them to a more efficient location, and change some expensive operations, such as multiplication, into a cheaper addition. For instance, it is more efficient on most computers to add a number to itself rather than multiplying the number by two. *See id.*

When these optimization operations are done, it may be impossible to reconstruct what the programmer actually coded. Consider the following short program:

```
for index := 1 to 2;
        print (2*2*index);
next index;
```

In an optimizing compiler, the object code, retranslated to source, would likely read as follows:

```
print ("4", "8");
```

All indications that the programmer had used a loop and a variable called "*index*," would disappear as would the code used to multiply two by itself and "*index*."

95. *See* 17 U.S.C. § 103(b); EPSTEIN, *supra* note 65, § 4.01[G].

96. *See* 17 U.S.C. § 103(b); Past Pluto Prods. Corp. v. Dana, 627 F. Supp. 1435, 1441 (S.D.N.Y. 1986).

97. *See supra* Part III.A.1; *see also* Feist Publications, Inc. v. Rural Tel. Serv. Co., 499 U.S. 340, 345 (1991); M.M. Bus. Forms Corp. v. Uarco, Inc., 472 F.2d 1137, 1139 (6th Cir. 1973).

98. *See, e.g.*, MICROSOFT CORP., C COMPILER USER'S GUIDE 52 (1986).

99. 17 U.S.C. § 102(a).

involved—that of identifying the author and establishing that individual as the originator of the work.

Congress has resolved the confusion in the case of the object-code version of a computer program by defining it in § 101.[100] Without this definition, the express congressional intent that object code be included within a copyright,[101] and the close interrelationship between the source—and object-code versions of a program,[102] the interpretation of the Copyright Act would require a very expansive reading to include the object code. For other computer-generated works, however, particularly those based on artificial intelligence programming, these three essential factors are lacking, thus complicating the analysis.

b. Does the Use of Scott French's Rule-Based, Artificially Intelligent Book-Writing Computer Program Affect Who Has the Right to Claim Copyright Protection?

In 1993, Scott French produced and published a book entitled *Just This Once*,[103] a novel written in the style of Jacqueline Susann, author of *Valley of the Dolls*.[104] The importance of this novel was not in its literary merit,[105] but in the way it was written. Mr. Scott

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100. *See id.* § 101 ("A 'computer program' is a set of statements or instructions to be used directly or indirectly in a computer in order to bring about a certain result.").

101. Congress indicated clearly that computer programs should be protected when the Copyright Act of 1976 was adopted. *See* H.R. REP. NO. 94-1476, at 116 (1976), *reprinted in* 1976 U.S.C.C.A.N. 5659, 5731. This intent was further clarified to expressly include the object code of a computer program by the 1980 amendments to § 101 of the Copyright Act which defined a computer program to include its operational characteristics. *See* 17 U.S.C. § 101. As a general rule, in order to include the operational characteristics of a computer program within a copyright, the object code must be included. *See* GRIES, *supra* note 79, at 6-7. Thus, by defining "computer program" in the way it did, Congress left little doubt that the unified computer program, including both its source and object codes, is protected by the Copyright Act.

102. It may not be possible to retrieve the source code from the object code, but it is possible to reproduce deterministically the object code if given the source code. *Cf.* GRIES, *supra* note 80, at 2 ("A [compiler] is a program which translates a [high level language program] into an *equivalent* [machine level language program]." (emphasis added)). Further, while little or no creative effort is required by the programmer to produce the object code from the source code, no more creativity is expressed by the compiler. If a compiler produces a result that cannot be predicted by the programmer, it is likely to be treated as an error within the compiler.

103. Scott French, Just This Once (1993).

104. *See* Steve Lohr, *Potboiler Springs from Computer's Loins*, N.Y. TIMES, July 2, 1993, at A1. *See generally* JACQUELINE SUSANN, VALLEY OF THE DOLLS (1966).

105. *See* Lohr, *supra* note 104, at A1 ("'If you do like this stuff, you'd be much, much better off with the one written by the computer.'" (quoting novelist Thomas Gifford)); Patricia Holt, *Sunday Review*, S.F. CHRON., Aug. 15, 1993, at B4 ("The result is a mitigated

programmed a computer to be a heuristically based expert system[106] on the writing style of Ms. Susann.[107] Mr. French then used the computer to help him write the book.[108] According to Mr. French, "he wrote about a quarter of the prose, the computer cranked out about the same amount and the remainder can only be described as a collaboration of man and machine."[109] Mr. French has claimed a copyright in *Just This Once*.[110] Leaving aside any issue of whether Mr. French's book is a derivation of Ms. Susann's works,[111] Mr. French's copyright claim is clearly a step farther down the human-computer continuum than a compiler.

With a compiler, there is a very close, deterministic relationship between the source and object codes.[112] Given the same source code and compiler version, identical object code will be produced each

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disaster ...."); Jocelyn McClurg, *From Edith Wharton to Howard Stern*, PORTLAND OREGONIAN, Dec. 31, 1993, at B4 ("A specially programmed computer churned out a novel that may well have been the worst book published in 1993.").

106. *See* Lohr, *supra* note 104 (noting that Mr. French programmed the computer with thousands of rules derived by Mr. French from the writings of Ms. Susann); *see also* WEBSTER'S NEW WORLD DICTIONARY OF COMPUTER TERMS, *supra* note 8, at 271 (stating that heuristic rules are "[a] set of practical rules used by experts to make decisions").

An artificial intelligence based on heuristics differs from a neural network such as that used in the Creativity Machine. In an heuristic machine, often known as an expert system, the computer is given a set of logical "if-then" rules which cause the algorithm to reach a conclusion. *See* FREEDMAN, *supra* note 9, at 42. For example, to implement the vehicle identification system discussed, *supra* Part II, rules would be specified such as, "if the object has wings, it is a airplane," "if the object floats, it is a boat," for example. By processing all of the rules, the system can typically determine where, within its domain, the subject object fits.

Heuristic systems suffer from a major disabling weakness. If the rules are improperly coded or are incomplete, incorrect results will be reached. *See id.* In the example above, for example, seaplanes float but are not boats. Since, for any complex system, the set of rules are mathematically certain to be inconsistent or incomplete because of Gödel's Incompleteness Theorem, any heuristic system likewise will be incorrect in its conclusions or will be unable to reach one. *See* HOFSTADTER, *supra* note 15, at 17-19. As a consequence, although heuristic algorithms are still used in some expert systems, they have lost favor with the scientists attempting to create artificial intelligence. *See* FREEDMAN, *supra* note 9, at 42-43. *See generally* SOUCEK & SOUCEK, *supra* note 7, at 277-89 (discussing adaptive rule-based expert and goal directed systems).

107. *See* Lohr, *supra* note 104.

108. *See id.*

109. *Id.*

110. *See* Scott R. French, *Just This Once*, Copyright Reg. No. TX3633395 (June 21, 1993). The Copyright Office limited ownership to "original & computer-aided text."

111. Mr. French did apparently "work out" something with Ms. Susann's estate. *See* Lohr, *supra* note 104. For a student comment discussing the derivation issue, see Tal Vigderson, Comment, *Hamlet II: The Sequel? The Rights of Authors vs. Computer-Generated "Read-Alike" Works*, 28 LOY. L.A. L. REV. 401, 426-28 (1994).

112. *See supra* notes 79-82, 102.

time. While this could be true for a book produced using Mr. French's computer, the extra complexity incorporated into Mr. French's process[113] and the interactive development of the book between Mr. French and the computer[114] virtually insure that a subsequent book would differ from an earlier one. Likewise, by reprogramming even one of the heuristic rules, a completely different book would be produced, even one in a different author's style.[115]

Thus, while it is possible to analogize the heuristic rules developed by Mr. French with source code and the resulting novel with object code, the analogy is not particularly sound. Unlike the situation with a compiler, there will be variations each time French's computer system is used. Further, some of the resulting expressions in the novel will be effectively unpredictable, causing an observer to conclude that "the computer wrote it" where, with object code, its contents can be predicted fully in advance.

These differences place Mr. French's computer program at a mid-point in the human-computer continuum. Unlike a compiler, the computer was "creative"[116] as it produced some expressions independently from any direct human control. At the same time, however, a substantial portion of the creative effort resulting in *Just This Once* was clearly Mr. French's. He analyzed Ms. Susann's works to derive the tens of thousands of heuristic rules needed before the computer could generate its first sentence.[117] Even after these rules were provided, only a maximum of twenty-five percent of the completed expression is attributed to the computer exclusively; the rest was developed by Mr. French, alone or with the assistance of the computer.[118] It is these limitations that separate Mr. French's computer from the Creativity Machine. Allowing Mr. French to claim a copyright in *Just This Once* expands, but does not radically alter, the operation of the Copyright Act, as Mr. French's computer can easily be

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113. *See* Lohr, *supra* note 104 (noting that it took eight years to produce the book).

114. *See id.* ("The writing of a scene amounted to a dialogue between Mr. French and his computer software.").

115. "I like Tom Clancy a lot. Maybe he and my computer can do lunch." *Perspective Quotables*, CHI. TRIB., Oct. 11, 1993, at 13 (quoting Scott French); *accord* Anita Bartholomew, *When Computers Copy Style: The Case Against HAL and the Future of Copyright*, OMNI, Jan. 1, 1995, at 29 (noting that this "author of spy novels" threatened suit if a book was produced in his style).

116. "[R]esulting from originality of ... expression ...." RANDOM HOUSE UNABRIDGED DICTIONARY, *supra* note 66, at 472.

117. *See* Bartholomew, *supra* note 115.

118. *See* Lohr, *supra* note 104.

considered an adjunct to his creative efforts rather than an autonomously creative entity.[119]

c. Does the Use of the Self-Taught, Artificially Intelligent Creativity Machine Affect Who Has the Right to Claim Copyright Protection?

Thus far, two points have been examined in the human-computer continuum of computer-produced expression, the compiler and Mr. French's heuristic program. The first point, the compiler, had the computer producing an expression without the need of any substantial human involvement, but the expression produced was deterministically established by the source code created by the human. The second point, Mr. French's program, likewise had the computer producing an expression, but this expression was no longer deterministically established by the human; instead, it resulted from the human-dominated interaction between the human and the computer.

The Creativity Machine, however, is clearly different from Mr. French's computer. Mr. French derived the rules used in creating *Just This Once*.[120] As he freely admits, "'If I'd written it myself, this book would have been done seven or eight years [before the computer finished it].'"[121] It seems clear that Mr. French could have written *Just This Once* without the aid of the computer. This is not true for the Creativity Machine.

With the Creativity Machine, no one derives rules for the computer to control its creativity; rather, using its learning algorithm and based on the training examples it is given, it develops rules on its own.[122] This learning is done independently of its user.[123] Indeed, it is probable that Dr. Thaler would not be able to produce some of the results conceived by the Creativity Machine, as he is untrained in some of the domains explored by it.[124] Thus, the Creativity Machine represents at least the first step at the end of the human-computer

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119. *See* Miller, *supra* note 35, at 1047-49.

120. *See* Lohr, *supra* note 104.

121. *Id.* (quoting Scott French).

122. *See* Thaler, *supra* note 4, at 16; *see also supra* Part II.

123. *See supra* notes 12-14.

124. *See Thaler Interview*, *supra* note 5 (indicating that Dr. Thaler played in a high school band, but had not composed music, for example); *see also* Yam, *supra* note 3, at 25 ("Photographs of Thaler's own body movements [were used to] generate dances."); Thaler, *supra* note 26, fig. 1.

continuum where computers possess the independent ability to create expressions.

This, then, presents the ultimate question—who can claim a copyright in the expressive works fixed by the Creativity Machine? The claim of the user of the machine seems highly dubious. The user was not the originator of these expressions as no specific creative effort was exerted by the user.[125] Consequently, a claim of authorship by the user is unsustainable. Similarly, the Creativity Machine itself is not able to claim the copyright because such claims are limited to humans.[126] The answer to the ultimate question, therefore, is "no one." Without a claimant, the work presumably enters the public domain.[127]

B. Patent Law

Not all of the materials produced by the Creativity Machine are works of authorship that qualify for copyright protection. Among other things, the Creativity Machine has formulated chemical formulas for new ultra-hard materials.[128] While copyright protection is inappropriate for these new compounds, assuming the other requisites of the Patent Act are met,[129] a patent could be sought for them as a composition of matter.[130] Of course, merely creating a formula for a chemical is not enough—the inventor must also be able to make the chemical.[131] Currently, this ability has not been claimed for the Creativity Machine,[132] but this does not eliminate the applicability of the patent law to the output of the Creativity Machine for two reasons. First, the requisite ability to make a chemical can be provided through the general chemical arts:

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125. *See supra* Part II.

126. *See supra* Part III.

127. *See* EPSTEIN, *supra* note 65, § 12.02[A][3][c] ("For works not falling within the 1976 Act's scope, such as works which are 'unoriginal' within the meaning of the 1976 Act, . . . [an] author is free to use such works without legal worry.").

128. *See* Thaler, *supra* note 4, at 18.

129. *See* 1 DONALD S. CHISUM, PATENTS, at OV-1 (1995) ("Patent law protects new, unobvious, and useful inventions such as machines, devices, chemical compositions, and manufacturing processes.").

130. *See* 35 U.S.C. § 101 (1994). A composition of matter can be a chemical compound or molecule, a mixture of ingredients, or, potentially, an atom. *See* CHISUM, *supra* note 129, § 1.02[2].

131. *See* Amgen, Inc. v. Chugai Pharm. Co., 927 F.2d 1200, 1206 (Fed. Cir. 1991) ("Conception [of a patentable chemical] requires both the idea of the invention's structure and possession of an operative method of making it."). The ability to make the chemical is termed its "reduction to practice." CHISUM, *supra* note 129, at Gl-20.

132. *See* Thaler, *supra* note 4.

> When, as is often the case, a method of making a compound with conventional techniques is a matter of routine knowledge among those skilled in the art, a compound has been deemed to have been conceived when it was described, and the question of whether the conceiver was in possession of a method of making it is simply not raised.[133]

Second, just as it is possible to train the Creativity Machine to propose chemicals, it may also be possible to program it to apply known methods of making chemicals to derive a means of making the chemicals it "discovered." For the discussion in this Article, therefore, it will be assumed that an invention created by the Creativity Machine will be capable of being reduced to practice without substantial assistance from any person,[134] and it further will be assumed that the other requisites of the patent law are met by the invention.[135] Just as with copyright law, however, one requirement of the patent laws may prevent an invention of the Creativity Machine from being patented—the lack of a human inventor.

Even though "inventor" is not defined within the Patent Code,[136] the Act strongly implies, as does the Copyright Act, that an inventor must be human.[137] The legislative history reinforces this

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133. Oka v. Youssefyeh, 849 F.2d 581, 583 (Fed. Cir. 1988).

134. If the Creativity Machine merely lists possible compounds and the aid of another person is needed to reduce the output of the Creativity Machine to practice, the party who reduced the matter to practice probably would be entitled to the patent without concern for any rights that the Creativity Machine, or its user, might have:

> The defect in the issue . . . is that it presumes that the naming of the compounds . . . constitutes a description of the invention within the meaning of § 102(b). We do not accept this presumption. In our view, [a] listing of the compounds by name constitute[s] nothing more than speculation about their potential or theoretical existence. The mere naming of a compound in a reference, without more, cannot constitute a description of the compound, particularly when, as in this case, the evidence of record suggests that a method suitable for its preparation was not developed until a date later than that of the reference.

In re Wiggins, 488 F.2d 538, 543 (C.C.P.A. 1973) (footnote omitted). "The production of a new group of chemical compounds, even though some one has stated that such a group of compounds may exist, may be an invention within the meaning of the patent laws." Eastman Kodak Co. v. Coe, 40 F. Supp. 891, 892 (D.D.C. 1941).

135. *See supra* note 129.

136. *See* 35 U.S.C. §§ 1-376 (1994). As with the term "author" in the copyright act, the term "inventor" originates in the Constitution. *See* U.S. CONST. art. I, § 8, cl. 8.

137. *See, e.g.*, 35 U.S.C. § 115 ("The applicant shall make oath that he believes himself to be the original and first inventor of the [invention] . . . ."). Congress has rarely used the term "inventor" within the United States Code outside of the Patent Act itself. Where it has done so, there is no suggestion that an inventor is anything but human. *See, e.g.*, 42 U.S.C. § 5906(a)(6) (1994); Beech Aircraft Corp. v. EDO Corp., 990 F.2d 1237, 1248 (Fed. Cir. 1993) ("EDO could never have been declared an 'inventor,' as EDO was merely a corporate assignee and only natural persons can be 'inventors.'"); *see also* 37

determination, declaring that "[a] person may . . . 'invent[]' a machine or a manufacture, which may include anything under the sun that is *made by man*."[138] Similarly, within the regulations promulgated by the Commissioner of Patents, the term has been used to apply to humans.[139] Even the common meaning of the word, "inventor," applies to humans.[140] Thus, it is unlikely that the Creativity Machine may be an inventor under the patent laws.

The user of the Creativity Machine has no stronger claim to be the inventor than the Creativity Machine does. The general requirement is that only the actual inventor can file a patent application;[141] indeed, there is not even a general work-made-for-hire doctrine in the Patent Code as there is in the Copyright Act.[142] Patents issue in the name of the actual inventor, even where the inventor has

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C.F.R. §1.41(a) (1996) ("A patent must be applied for in the name of the actual inventor or inventors. Full names must be stated, including the family name and at least one given name without abbreviation together with any other given name or initial."); *id.* §1.601(l) ("An inventor is the individual named as inventor in an application involved in an interference or the individual named as inventor in a patent involved in an interference.").

138. S. REP. No. 82-1979, at 6 (1952), *reprinted in* 1952 U.S.C.C.A.N. 2394, 2399 (emphasis added). Although the language quoted seems to imply that the Patent Act cannot possibly apply to nonhumans, too great a reliance should not be placed on this legislative history. When the Copyright Act was adopted in 1976, computer technology was commonplace, but when the Patent Act was revised in 1952, computer technology was in its infancy. *See* FREDERICK P. BROOKS, JR., THE MYTHICAL MAN-MONTH 291 (1975) (describing the first electromechanical computer dedicated in 1944; the first stored-program computer in use in 1952). Thus, in modifying the Patent Act, Congress could not have expected or predicted the development of autonomously creative computer programs.

Further, § 101 of the Patent Act was not substantially modified by the 1952 enactment. *See* S. REP. No. 82-1979, at 6 (1952), *reprinted in* 1952 U.S.C.C.A.N. at 2398. The language being construed is, in fact, from the 1870 Patent Act. *See id.* Clearly, in 1870, Congress could not have predicted a technology such as the Creativity Machine.

139. *See, e.g.*, 37 C.F.R. § 1.41(a) (1996) (requiring the inventor to set forth his or her full name, including family and given names).

140. *See* RANDOM HOUSE UNABRIDGED DICTIONARY, *supra* note 66, at 1003 ("[A] person who invents, esp. one who devises some new process, appliance, machine, or article . . . ."). A "person" is defined as "a human being, whether man, woman, or child." *Id.* at 1445.

141. *See* 35 U.S.C. § 102(f) ("A person shall be entitled to a patent unless . . . he did not himself invent the subject matter sought to be patented . . . ."); *see also id.* § 115 ("The applicant shall make an oath that he believes himself to be the original and first inventor . . . ."). *See generally* EPSTEIN, *supra* note 65, §§ 5.02[C][1][f], 5.03[A][2].

142. *See* 6 CHISUM, *supra* note 129, § 22.03 (indicating that the individual owns the patent unless there is an express agreement that the employer will own it or the employee was hired "to exercise his or her 'inventive faculties.'"). The only patent doctrine similar to the general, implied work-made-for-hire doctrine in the copyright law is the employer's "shop right." This gives the employer a "non-exclusive and nontransferable royalty-free license . . . to use the employer's [sic] patented invention." *Id.*

died[143] or refuses to seek a patent that he or she is legally obliged to transfer to another.[144] Where the Creativity Machine generates a patentable invention, it would be inappropriate for the individual who used the Creativity Machine to claim to be the inventor, as neither the conception of the idea nor the reduction of it to practice was done by the user. By using the Creativity Machine, the human did not invent[145] anything—the computer did.

As in the case of copyright law, the Creativity Machine is outside of the scope of protection. The human user of the Creativity Machine cannot claim a patent, as he or she did not conceive the invention. The Creativity Machine cannot claim a patent, as it is not an inventor. Once again, the work would appear to be in the public domain.[146]

IV. DOES THE LACK OF INTELLECTUAL PROPERTY RIGHTS ASSOCIATED WITH THE CREATIVITY MACHINE CONFLICT WITH CONSTITUTIONAL OR PUBLIC POLICY CONSIDERATIONS?

As the above discussion demonstrates, the use of an autonomously creative computer program such as the Creativity Machine leaves no one able to claim the associated federal intellectual property rights in the works produced. Thus, the work would be unprotected by the copyright and patent law currently in force and the work would enter the public domain.[147] This result, however, is not

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143. *See* 35 U.S.C. § 117.

144. *See id.* § 118.

145. *See* RANDOM HOUSE UNABRIDGED DICTIONARY, *supra* note 66, at 1003 (defining "invent" as "to originate or create as a product of one's own ingenuity, experimentation, or contrivance").

146. *See* Bonito Boats, Inc. v. Thunder Craft Boats, Inc., 489 U.S. 141, 149 (1989) (

> Once an inventor has decided to lift the veil of secrecy from his work, he must choose the protection of a federal patent or the dedication of his idea to the public at large. As Judge Learned Hand once put it: "[I]t is a condition upon the inventor's right to a patent that he shall not exploit his discovery competitively after it is ready for patenting; he must content himself with either secrecy or legal monopoly."

(quoting Metallizing Eng'g Co. v. Kenyon Bearing & Auto Parts Co., 153 F.2d 516, 520 (2d Cir. 1946)).

147. This is certainly not the first time that a broad category of work would be excluded from federal intellectual property protection. In *White-Smith Music Publishing Co. v. Apollo Co.*, 209 U.S. 1 (1908), the Supreme Court held that piano roll (and ultimately recorded) versions of a copyrighted musical composition did not infringe the underlying copyright in the music:

> These perforated [piano] rolls are parts of a machine which, when duly applied and properly operated in connection with the mechanism to which they

just a consequence of statutory drafting. The exclusion of these works from coverage by the federal intellectual property laws is mandated by the Constitution and comports with sound public policy.

"The Congress shall have Power To . . . promote the Progress of Science and useful Arts, by securing for limited Times to Authors and Inventors the exclusive right to their respective Writings and Discoveries . . . ."[148] With this relatively uncontroversial grant of power,[149] the Constitution allows both patent and copyright law to be federalized. Early in the history of the United States, Congress chose to federalize these areas.[150] More recently, the federalization of the areas has become largely exclusive and preemptive.[151]

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are adapted, produce musical tones in harmonious combination. But we cannot think that they are copies within the meaning of the copyright act.

It may be true that the use of these perforated rolls, in the absence of statutory protection, enables the manufacturers thereof to enjoy the use of musical compositions for which they pay no value. But such considerations properly address themselves to the legislative and not to the judicial branch of the Government. As the act of Congress now stands we believe it does not include these records as copies or publications of the copyrighted music involved in these cases.

Id. at 18. *White-Smith* resulted in a lack of protection for recorded performances of copyrighted works until Congress passed the Act of October 15, 1971, Pub. L. No. 92-140, 85 Stat. 391, effective on February 15, 1972, bringing recordings within the Copyright Act for the first time. Estimates of the time indicated that the loss to the record producers exceeded $100 million per year. *See* H.R. REP. NO. 92-487 (1971), *reprinted in* 1971 U.S.C.C.A.N. 1567. *See generally* 1 MELVILLE B. NIMMER & DAVID NIMMER, NIMMER ON COPYRIGHT § 2.10[A] (1996).

148. U.S. CONST. art. I, § 8, cl. 8.

149. *See* THE FEDERALIST No. 43 (James Madison).

> The utility of this power will scarcely be questioned. The copyright of authors has been solemnly adjudged, in Great Britain, to be a right of common law. The right to useful inventions seems with equal reason to belong to the inventors. The public good fully coincides in both cases with the claims of individuals. The States cannot separately make effectual provisions for either of the cases, and most of them have anticipated the decision of this point, by laws passed at the instance of Congress.

Id.; *accord* 1 NIMMER & NIMMER, *supra* note 147, § 1.01[A].

150. *See* John G. Byrne, *Changes on the Frontier of Intellectual Property Law: An Overview of the Changes Required by GATT*, 34 DUQ. L. REV. 121, 123-24 (1995) (indicating that the first patent act and first copyright act were enacted in 1790 by the first Congress).

151. *See* 17 U.S.C. § 301(a) (1994) (preempting statutes and common-law copyright, effective Jan. 1, 1978, Pub. L. No. 94-553, § 102, 90 Stat. 2572 (1976)); *Bonito Boats, Inc.*, 489 U.S. at 141 (patent); Sears, Roebuck & Co. v. Stiffel Co., 376 U.S. 225, 232-33 (1964) (patent); Rosciszewski v. Arete Assocs., 1 F.3d 225 (4th Cir. 1993) (copyright); 1 NIMMER & NIMMER, *supra* note 147, § 1.01[B] (discussing partial preemption under Copyright Act of 1909).

The grant of power to Congress under the Patent and Copyright Clause is not unrestricted, however. The clause reflects a Mephistophelean exchange—an author or inventor is given a monopoly over the use of his or her work for a limited period of time, but society obtains and can exploit the ideas in the writing or invention in perpetuity.[152] To implement this bargain, the Constitution requires that patents and copyrights be extended for a limited time,[153] only to "authors"[154] or "inventors,"[155] and only for proper purposes.[156] "The

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152. For copyrights, the ideas underlying the work are never protected from use by others. *See* 17 U.S.C. § 102(b). The patent monopoly is broader since the invention cannot be made, used, or sold during the term of the patent. *See* 35 U.S.C. § 271(a). This does not prevent the underlying ideas incorporated in the invention from being part of the basis for a new invention as would happen in an improvement patent even though the second inventor would not necessarily be free to practice his improvement. *See* Hughes v. Salem Coop. Co., 134 F. Supp. 572, 576 (W.D. Mich. 1955), *aff'd*, 237 F.2d 918 (6th Cir. 1956).

Obviously, after the term of protection for the work expires, no further protection for any aspect of the work exists. *See* 17 U.S.C. § 302(a), (c) (indicating that term for copyright is life of the author plus 50 years or, if the author is not an identified human, 75 years from creation); 35 U.S.C. § 154(a) (indicating that patent term is 17 years from issue date for pre-WTO patents); *id.* § 154(a)(2) (stating patent term is 20 years from application date for post-WTO patents).

153. *See* Twentieth Century Music Corp. v. Aiken, 422 U.S. 151, 156 (1975) ("[A] limited copyright duration [is] required by the Constitution . . . ."); 1 NIMMER & NIMMER, *supra* note 147, § 1.05[A] ("A federal copyright statute that purported to grant copyright protection in perpetuity would clearly be unconstitutional."). Since the patent power is created by the same clause and is subject to the same limitations in the language of the Constitution, patents are similarly required to be of limited duration. *Cf.* Diamond v. Chakrabarty, 447 U.S. 303, 307 (1980) (discussing the constitutional basis of the Patent Act, noting that it provides exclusive rights for only a limited duration).

154. *See* U.S. CONST. art. I, § 8, cl. 8. It can be argued that the work-made-for-hire provision of the Copyright Code, 17 U.S.C. § 201(b), violates this constitutional provision because the employer, rather than the individual who did the actual composition, is treated as the author. Thus, one could argue that a nonauthor was given rights despite the constitutional limitation that copyrights can only be given to authors. Alternatively, it can be argued that:

> Congress has in effect created an implied assignment of rights from the employee-author to his employer—in the absence of an express agreement to the contrary. Thus the employer may be regarded as at least a "quasi-assignee" and as such entitled to the privileges of the author, even if he may not be regarded as the author himself.

1 NIMMER & NIMMER, *supra* note 147, § 1.06[C], at 1-44.45.

The language of the statute favors this second interpretation. The Copyright Act does not state that the employer is the author of a work under the Copyright Act; rather, it indicates that the employer "is considered" the author of it. *See* 17 U.S.C. § 201(b). It is this legal fiction—the presumption that the employer obtains the copyright by assignment—that preserves the constitutionality of the work-made-for-hire provisions of the Copyright Act.

155. *See* U.S. CONST. art. I, § 8, cl. 8.

156. *See* Sony Corp. of Am. v. Universal City Studios, Inc., 464 U.S. 417, 429 (1984) ("The monopoly privileges that Congress may authorize are [not] primarily designed to

primary objective of copyright is not to reward the labor of authors, but '[t]o promote the Progress of Science and useful Arts.'"[157]

To be an author or inventor under the Constitution, a human[158] must creatively toil to produce the work.[159] "The immediate effect of our copyright law is to secure a fair return for an 'author's' creative labor."[160] Similarly, "[t]he patent laws promote ... progress by offering inventors exclusive rights ... as an incentive for their inventiveness and research efforts."[161] Without a confluence of writer or discoverer with creativity and labor, no constitutional author or inventor exists and, consequently, no work exists for which federal intellectual property protection can be sought.[162]

Extending to the computer the right to claim protection under federal intellectual property laws, assuming that the problems of a computer's personhood can be solved, would also fail to advance the purpose underlying the Patent and Copyright Clause. "The system has allocated rights only to humans for a very good reason: it simply does not make any sense to allocate intellectual property rights to machines because they do not need to be given incentives to generate output."[163]

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provide a special private benefit. Rather, the limited grant is a means by which an important public purpose may be achieved."); Graham v. John Deere Co., 383 U.S. 1, 5-6 (1966) ("The clause is both a grant of power and a limitation. This qualified authority ... is limited to the promotion of advances in the 'useful arts.' ... The Congress in the exercise of the patent power may not overreach the restraints imposed by the stated constitutional purpose.").

157. Feist Publications, Inc. v. Rural Tel. Serv. Co., 499 U.S. 340, 349 (1991) (quoting U.S. CONST. art. I, §8, cl. 8).

158. For a discussion of why an author or inventor must be human, see *supra* Parts II.A.1 & III.B, respectively.

159. *See* Twentieth Century Music Corp. v. Aiken, 422 U.S. 151, 156 (1975). The requirement that the author originate the work has been long-standing as a constitutional requirement. *See* Burrow-Giles Lithographic Co. v. Sarony, 111 U.S. 53, 57-58 (1884); Trade-Mark Cases, 100 U.S. 82, 94 (1879).

160. *Twentieth Century Music Corp.*, 422 U.S. at 156.

161. Diamond v. Chakrabarty, 447 U.S. 303, 307 (1980).

162. See Feist Publications, Inc., 499 U.S. at 346:

> Originality is a constitutional requirement. The source of Congress' power to enact copyright laws is Article I, § 8, cl. 8, of the Constitution, which authorizes Congress to "secur[e] for limited Times to Authors ... the exclusive Right to their respective Writings...."
>
> ... For a particular work to be classified "under the head of writings of authors," ... "originality is required."... [O]riginality requires independent creation plus a modicum of creativity....
>
> ... "[A]uthor," in a constitutional sense, ... mean[s] "he to whom anything owes its origin; originator; maker."

Id. (citations omitted).

163. Samuelson, *supra* note 41, at 1199.

Only electricity (or some other motive force) is required to initiate production. The goal of the intellectual property system is to induce creators to innovate by granting the certain rights. "The system has assumed that if such incentives are not necessary, rights should not be granted."[164]

As current computer technology[165] does not require an incentive to produce, extending the right to claim protection would have no effect on the "Progress of Science and useful Arts."[166] Allowing the computer intellectual property rights would not advance the constitutional balance. Thus, the granting of protection for "creature" works would be questionable constitutionally and would achieve little for society.[167]

V. CONCLUSION

The development of autonomously creative computer programs challenges our present concepts of intellectual property rights. The current federal systems are based on the axiom that works will be created only through the exercise of human creativity, whether machine-assisted or not. Once the computer can literally "do it on its own," the created works fall outside of the scope of intellectual property protection. Although this exclusion from coverage was not intentional, it is the appropriate policy for the present age. No extra incentives are needed to make currently available creative computers

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164. *Id.*

165. This limitation to "today's computers" may prove not to be necessary depending on the outcome of one of the fundamental debates among scientists working to develop artificial intelligence. Some argue that truly intelligent computers are possible without recreating the motivational complexity of a human, while others argue that without it intelligence will never be achieved. *See* FREEDMAN, *supra* note 9, at 177-78. Should the former position prove correct, incentives should never be needed to foster the production of creative works by a computer. If, however, the latter position should prove correct, artificially intelligent computers would require the kind of stimulation and reward expressed in the constitution. *See* Kenneth M. Colby, *Modeling a Paranoid Mind*, 4 BEHAV. & BRAIN SCI. 515-60 (1981). *See generally* David J. Chalmers, *The Puzzle of Conscious Experience*, SCI. AM., Dec. 1995, at 80 (addressing various arguments concerning the study of consciousness).

166. U.S. CONST. art. I, § 8, cl. 8.

167. *See* Diamond v. Chakrabarty, 447 U.S. 303, 307 (1980) ("The authority of Congress is exercised in the hope that '[t]he productive effort thereby fostered will have a positive effect on society through the introduction of new products and processes of manufacture into the economy, and the emanations by way of increased employment and better lives for our citizens.'" (quoting Kewanee Oil Co. v. Bicron Corp., 416 U.S. 470, 480 (1974))). *But see* Stewart E. Sterk, *Rhetoric and Reality in Copyright Law*, 94 MICH. L. REV. 1197, 1197-98 (1996) (arguing that the current Copyright Code fails to enhance this balance).

produce works—if the computer program is executed, the works will result.

This policy preventing protection for works generated by creative computer programs will be appropriate until computers are endowed with a consciousness that makes evaluation of "personhood" for computers mandatory. Once, and if, this consciousness occurs, the fundamental changes required in intellectual property law will be insignificant in comparison to the changes required in society at large.