FUNCTIONAL USEFULNESS VS. COMMUNICATIVE USEFULNESS: THIN COPYRIGHT PROTECTION FOR THE NONLITERAL ELEMENTS OF COMPUTER PROGRAMS

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*234 I. Introduction

Computer software has thus far presented a doctrinal problem to the law of intellectual property. Copyright and patent law have experienced a significant transition period in deciding exactly how to handle this new technology. This problem is caused by the form that software takes in that software looks like a "writing," even though it behaves like an "invention."

In regards to the protection of computer software, copyright law and patent law have experienced a reversal of fortune in the past ten years. Copyright protection started off broad, but has since been getting thinner.[1] In *Whelan Associates, Inc. v. Jaslow Dental Laboratory, Inc.,*[2] the Third Circuit defined the unprotectable idea of a computer program very generally as "the purpose or function of a utilitarian work," and said that "everything that is not necessary to that purpose or function would be part of the expression of the idea."[3] More recent cases have applied a much narrower approach.[4] For example, in ***235** *Computer Associates International, Inc. v. Altai, Inc.,*[5] the Second Circuit rejected the *Whelan* approach and instead applied the "abstraction-filtration-comparison" test.[6] Even more recently, the First Circuit in *Lotus Development Corp. v. Borland International, Inc.*[7] held that the Lotus command menu was an uncopyrightable method of operation.[8]

Meanwhile, patent protection for software has gone from merely a theoretical possibility to being available for nearly all software, assuming the patent attorney properly jumps through the doctrinal hoops.[9] In patent law, the problem has been whether computer programs are mathematical algorithms and therefore not statutory subject matter.[10] In *Gottschalk v. Benson,*[11] a unanimous Supreme Court had to reassure us that even though "[i]t is said that the decision precludes a patent for any program servicing a computer," they weren't so holding.[12] The door began to open, however, in *Diamond v. Diehr,*[13] when the Court concluded that "a claim drawn to subject matter otherwise statutory does not become nonstatutory simply because it uses a mathematical formula, computer program, or digital computer."[14] More recently, the Federal Circuit, to which the Supreme Court has generally abdicated its role as the final court in patent matters, stated in *In re Alappat*[15] that computer software "creates a new machine, because a general purpose computer in effect becomes a special purpose computer once it is programmed to perform particular functions pursuant to instructions from program software."[16]

*236 The logical conclusion to this trend is to narrow copyright protection all the way down to "thin" protection, while

leaving the nonliteral elements of computer programs to patent law. Thin protection means protection only against verbatim copying and near-verbatim copying (using "electronic massaging" techniques) of substantial portions of computer programs.[17]

This paper addresses the copyright aspect of this trend. In particular, this paper argues that copyright should give only thin protection to computer software. For the most part, this paper assumes without argument that patent law will protect the novel and nonobvious aspects of computer software. There are really two different assumptions here. First, this paper assumes that a sui generis form of protection for computer software will not replace patent or copyright protection. Second, this paper assumes that patents will, in view of *Alappat* and other modern software patent decisions, be available for computer software without significant section 101 limitations.[18] Finally, it is also important to note that this paper does not address the protection that copyright should give to the screen outputs of computer programs.[19]

Many people argue that it is a straightforward application of copyright law to protect the nonliteral elements of computer programs. Parts II and III explain why this is not true. In particular, Part II examines the subject matter domains of copyright law and patent law and concludes that the subject matter of copyright law is communicative whereas the subject matter of patent law is functional. Part III applies this distinction to computer programs. Part III argues that a computer program is functional rather than communicative. As a result, computer programs should be within the subject matter domain of patent law, but not within the subject matter domain of copyright law.

*237 However, people who are in favor of protecting the nonliteral elements of computer programs with copyright law might be willing to live with any doctrinal problems encountered in trying to do so. As a result, it is important to explain not only why doctrinal problems exist, but also why these doctrinal problems are important. This is the purpose of Parts IV, V, and VI of this paper. Part IV introduces the rationales for the patent and copyright systems. Part V applies these rationales and the fact that patent law protects functional subject matter whereas copyright law protects communicative subject matter to explain why patent law has a nonobviousness requirement, but copyright law does not. Next, the argument is made that patent law's nonobviousness requirement should be applied to computer software. Since this requirement is not currently applied, society is getting short-changed in its "bargain" with software developers. The analysis of Part VI is parallel to that of Part V, but deals with patent law's disclosure requirements.

II. The Subject Matter Domains of Copyright and Patent Law[20]

A. What Does Copyright Law Try to Protect?

The subject matter domain of copyright is communicative.[21] By the term "communicative," I mean that copyright protects things which communicate *to humans*. By the term "subject matter domain," I am referring to everything which copyright might protect. The subject matter domain includes things which ultimately turn out not to be protectable by copyright. (For example, a work might not fit into a class of works that Congress has decided to protect. Alternatively, a ***238** work might not meet the standards of copyright.) When I say that "the subject matter domain of copyright is communicative," I am saying that all things within the subject matter domain of copyright share the common element that they are communicative.

The notion of communication provides a common thread not only to the wide variety of works that copyright protects, but also to the wide variety of doctrines that have developed in copyright law. As explained below, communication is the very essence of copyright.

1. Statutory Definition of the Subject Matter of Copyright

Section 102(a) of the Copyright Act states four requirements for copyright protection: "Copyright protection subsists … in [1] original [2] works of authorship [3] fixed in any tangible medium of expression … [4] from which they can be perceived, reproduced or otherwise communicated …."[22] By examining each of these four requirements (though not in order), I will explain how the subject matter domain of copyright is communicative.[23]

The third requirement, fixation, does not tell us much about the subject matter domain of copyright. The fixation requirement is procedural in nature. For example, in order to be protectable, a choreographic work must be recorded.[24] The fact that the choreographic work has been recorded does not change the "nature" of the choreographic work. A dance routine is still the same dance routine once it is recorded. Further, the manner in which a work is fixed has no effect on what is protected.[25] In

theory, a choreographic work receives the same protection regardless of whether it is fixed in the form of Laban notation or whether it is fixed in the form of a motion picture.[26] The fixation requirement simply says that the choreographic work is not protectable if it has not been fixed in a tangible medium of expression. ***239** It does not tell us anything about the "nature" of the copyright subject matter domain.

In contrast, the fourth requirement does define the subject matter domain of copyright. In order to be protectable by copyright, a work must be capable of being perceived, reproduced or otherwise communicated.[27] This requirement, and the way in which it defines the subject matter domain of copyright, can be more clearly understood from an examination of the remaining two requirements.

Not everything that is within the subject matter domain of copyright is necessarily protectable by copyright. The second requirement embodies one reason why this might be the case, that is, the work might belong to a class of works which Congress has decided not to protect. A work must be a "work of authorship" in order to be protectable. For example, prior to 1978, Congress had failed to explicitly include choreographic works as protected subject matter.[28] As a result, choreographic works were unprotectable (unless they qualified under a class which Congress had decided to protect, such as dramatic works).[29] Eventually, choreographic works became one of the categories of works enumerated in section 102(a).[30] This Congressional action did not change "the essence of copyright" in that it did not change the subject matter domain of copyright. Choreographic works were always within the subject matter domain of copyright (since they are communicative), but it was not until 1978 that they became statutorily protectable.

It is important to note that each of the section 102(a) enumerated works of authorship categories (literary works, musical works, dramatic works, pantomimes, choreographic works, pictorial works, graphic works, sculptural works, motion picture and other audiovisual works, sound recordings, and architectural works[31]) is ***240** communicative. This supports the conclusion that the subject matter domain of copyright is, as a whole, communicative. This is especially true because the enumerated categories, though not exhaustive, are representative of the types of things that copyright protects and would consider protecting.[32]

The first requirement embodies another reason why a work that is within the subject matter domain of copyright may nevertheless be unprotectable by copyright. The first requirement states that a work must be original, meaning it must have been created by the author and must exhibit a modicum of creativity.[33] For example, telephone books are communicative and are therefore within the domain of copyright. However, a particular white pages telephone book may ultimately turn out not to be protectable because it does not exhibit a modicum of creativity.[34]

Compare the first requirement to the second requirement. Previously, it was argued that the fact that all of the categories enumerated in section 102(a) are communicative supports the conclusion that the subject matter of copyright is, as a whole, communicative. In contrast, works in the enumerated categories may or may not be creative. For example, a telephone book is a "literary work" regardless of whether it also exhibits a modicum of creativity. This indicates that the domain of copyright is not defined in terms of creativity, and that creativity is simply a limitation on the protectability of works that are already within the domain of copyright.[35]

2. The Limitations on Copyright Protection for Useful Articles

The limitations on the copyright protection for useful articles demonstrate how copyright law tries to avoid transgressing into the domain of patent law.[36] The design of a useful article is protectable as a pictorial, graphic and sculptural (PG&S) work "if, and only to the extent that, such design incorporates pictorial, graphic, or sculptural features that can be identified separately from, and are capable of existing ***241** independently of, the utilitarian aspects of the article."[37] Similarly, PG&S works are protected as to their "form," while their "mechanical and utilitarian aspects" are not protected.[38]

For example, in the well-known case *Carol Barnhardt Inc. v. Economy Cover Corp.,*[39] the Second Circuit considered the copyrightability of four original mannequin forms. Presumably, these mannequins were useful in two separate ways. First, the mannequins were useful for keeping clothes from falling to the floor. This use is noncommunicative, and the features of the mannequin that are directed toward serving this function are not protected (i.e., because these features are the mechanical or utilitarian aspects of the mannequins). Second, the mannequins were useful because they depicted an artistically appealing form. This use is communicative, and the features of the mannequins that are directed toward depicting this form are, in theory, protectable.[40]

Of course, the court in *Carol Barnhardt* found the mannequins to be uncopyrightable.[41] The majority and the dissent could not agree on the "crucial issue," that is, whether the mannequins possessed artistic or aesthetic features that are physically or conceptually separable from their utilitarian dimension.[42] The separability test demonstrates that copyright law is traditionally unwilling to protect anything more than the communicative aspects of a work of authorship.[43] The test is prophylactic in nature: In spite of the fact that a work may contain protectable expression, a work is nevertheless found uncopyrightable if there is a danger that a court might also be protecting functional aspects of a work. PG&S works is an area where copyright is at risk of transgressing the patent domain, and the separability test ensures that it will not do so.[44]

*242 3. The Goals of Copyright and the Idea/Expression Dichotomy

Copyright law's protection of the communicative aspects of works arises out of the goal of copyright. The goal of copyright is to promote the progress of science (i.e., to promote the progress of knowledge[45]) by creating incentives for the creation of works of authorship.[46] Importantly, then, the creation of works of authorship is not itself the end goal of copyright. Rather, the end goal is the promotion of the progress of knowledge. In copyright, the goal is achieved through dissemination: "The very object of publishing a book … is to communicate to the world the useful knowledge which it contains."[47]

In this regard, it is important to consider the role of the idea/expression dichotomy. This bedrock copyright doctrine makes clear that copyright only protects expression, that is, the way in which an idea is communicated.

The idea/expression dichotomy works in tandem with the rules pertaining to PG&S works. The PG&S rules ensure that the functions which a work *performs* will be unprotectable by copyright. Similarly, the idea/expression dichotomy ensures that the functions which a work *describes* will be unprotectable by copyright.
The description of the art in a book, though entitled to the benefit of copyright, lays no foundation for an exclusive claim to the art itself. The object of the one is explanation; the object of the other is use. The former may be secured by copyright. The latter can only be secured, if it can be secured at all, by letters-patent.[48]

*243 *Baker v. Selden* is fundamentally a case about preventing copyright owners from securing patent-like protection through the copyright laws.[49] But the idea/expression dichotomy is more generally applicable. For example, in *Nichols v. Universal Pictures Corp.,*[50] Judge Learned Hand applied the idea/expression dichotomy to a fictional play. As a result, the plaintiff was unsuccessful in claiming copyright protection in the "idea" of a play about "a Jewish and an Irish father, the marriage of their children, the birth of grandchildren and a reconciliation."[51]

This application of the idea/expression dichotomy furthers the goal of copyright, that is, promoting the progress of knowledge, by communicating ideas. In the case of the *Nichols* play, the goal of copyright is to promote the communication of the young lovers and feuding fathers idea.[52] Without the idea/expression dichotomy, the first author would be able to prevent future authors from creating works based on this idea, thereby seriously inhibiting its future communication. Hence, the idea/expression dichotomy permits the creation of additional communication channels for conveying the young lovers and feuding fathers idea.

The view of copyright law is that ideas exist which are worth communicating and that the goal of copyright is to promote the communication of those ideas.[53] Copyright furthers this goal in two ways. First, the idea/expression dichotomy ensures that those ideas can be communicated by many authors. Second, the offer of copyright protection gives authors the incentive to communicate ideas by protecting the way in which the ideas are communicated (i.e., the expression of those ideas). In short, copyright law gives authors the freedom and the incentive to communicate ideas, regardless whether those ideas have already been communicated, in order to maximize the communication of those ideas.[54]

*244 B. What Does Patent Law Try to Protect?

Patent law protects things that are functional.[55] By the term "functional," I mean things which operate to achieve results. This is the fundamental distinction between patent law and copyright law. Copyright law protects things that are communicative; patent law protects things which operate to achieve results. This subsection of the paper is devoted to developing the concept that patent law protects things which operate to achieve results.

1. The "Usefulness" Requirement

The usefulness requirement in patent law is stated in section 101 of the Patent Act.[56] Courts have interpreted "useful" to denote two related requirements. The first is that the invention must be directed toward achieving, or aiding in achieving, some type of result. In other words, the invention cannot be frivolous and insignificant, a matter of mere curiosity. For example, in *Brenner v. Manson,*[57] the applicant, having failed to prove that his compound had a tumor inhibiting effect, argued that the compound was useful on the basis that it belonged to a class of compounds that were the subject of serious scientific investigation.[58] The Supreme Court rejected this argument, however, reasoning that there is insufficient justification for awarding a patent where there is no specific benefit to the public from the applicant's invention.[59]

The second requirement is that the invention must not only be directed toward achieving some type of result, but the invention must actually achieve that desired result.[60] For example, in *Newman v. Quigg,*[61] the patent application was for an "Energy Generation System Having Higher Energy Output Than Input," a perpetual motion device.[62] The district court held that the applicant's invention was ***245** unpatentable on the basis that "[applicant's] device lacks utility (in that it does not operate to produce what he claims it does),"[63] and the Federal Circuit affirmed.[64]

2. Patent Subject Matter Domain Does Not Overlap with Copyright Subject Matter Domain

Just as copyright law does not traditionally transgress into the domain of patent law, so too patent law does not transgress into the domain of copyright law. Patent law does not protect things that are useful simply because they can be communicated.[65] A number of examples will be helpful in illustrating this point.

First, consider the usefulness requirement and the compound as discussed in *Brenner v. Manson.*[66] The compound can be analogized to a paper in a scientific journal. If an article in the scientific journal is studied, it may communicate important information to a scientist. However, the mere fact that it may communicate such information does not make the article patentable, because all inventions must be directed toward achieving some type of result. Like the article in the scientific journal, the compound had no use other than as an object of "serious scientific investigation." Hence, the compound, like the article in the scientific journal, was not patentable because it was not directed toward achieving some result.

Second, patent law has always considered "printed matter" to be unpatentable.[67] The printed matter rule in patent law is somewhat analogous to the ***246** rules about useful articles in copyright law (in that both sets of rules attempt to prevent the respective sets of laws from transgressing into each other's subject matter domains). In regards to the useful article rules in copyright law, I already argued this point in Part II.B.2. In regard to the printed matter doctrine in patent law, Professor Samuelson has recently written:

> Underlying the "printed matter" rule may be a perception that printed matter is among the set of things that are "writings" protectable by copyright law, not inventions in the "useful arts," and that copyright law strikes the appropriate balance between protection of expression and nonprotection of ideas for written texts. This balance would be disrupted if patents were available based on the content of the "printed matter." When "printed matter" has been patented, it has generally been in situations in which it has been integrated into some machine or physical structure which then supports the patent.[68]

It will be helpful to consider a few examples in order to support Professor Samuelson's point, and in order to help divine the boundary of the patent subject matter domain. In *In re Rice,*[69] the applicant's invention was directed to "the art of writing sheet music, which comprises reproducing upon a paper sheet certain information as an aid to beginners in learning to play the piano."[70] Finding the applicant's invention unpatentable, the C.C.P.A. stated that "[i]t is well established in patent law that invention cannot rest alone in novel printing arrangement ...."[71]

Although invention cannot rest in a novel printing arrangement, it may reside in some physical structures of printed matter.[72] For example, in *Cincinnati Traction Co. v. Pope,*[73] the patent involved a railway ticket comprising a body portion and a ***247** coupon.[74] Imprinted on the ticket were conventional indications showing that the body alone was good at one time of the day, and that the body and the coupon were required for the other portion of the day.[75] The court held the ticket patentable, reasoning that the patentable novelty was not in the arrangement of the printed text, but rather in the physical structure of the

ticket.[76]

More recently, in *In re Lowry,*[77] the Federal Circuit addressed the printed matter doctrine in the context of computer data structures.[78] The applicant's data structure comprised "a plurality of attribute data objects (ADOs) stored in memory."[79] The Board below analogized Lowry's data structure comprised of ADOs to printed matter and therefore did not give them patentable weight.[80]

In reversing the Board, the Federal Circuit focused on the fact that the ADOs performed a function. According to the court, the "critical question" in a printed matter case is "whether there exists any new and unobvious functional relationship between the printed matter and the [substance of the claims]."[81] The Federal Circuit found such a functional relationship:

> Lowry does not seek to patent the Attributive data model in the abstract. Nor does he seek to patent the content of information resident in a database. Rather, Lowry's data structures impose a physical organization on the data …. In sum, the ADO's perform a function. [Controlling precedent] requires no more.[82]

In *Lowry,* the Federal Circuit also noted that "[t]he printed matter cases have no factual relevance where 'the invention as defined by the claims requires that the information be processed not by the mind but by a machine, the computer.'"[83] This statement reflects a basic distinction that the printed matter cases have drawn. Where the printed matter is merely communicative, (e.g., where it communicates information to humans learning to play the piano) then the printed matter is not ***248** patentably significant. However, where there is a new and nonobvious *functional* relationship between the printed matter and the substance of the claims, then the printed matter is patentably significant.

C. Concluding Thoughts on the Distinction Between the Patent Subject Matter Domain and the Copyright Subject Matter Domain

What emerges are two systems that have generally been kept separate.[84] The likely reason is a judicial perception that each system strikes the appropriate balance of protection versus nonprotection for its respective subject matter domain.[85] In patent law, the borderline cases are those involving printed matter. In these cases, printed matter is not entitled to patentable weight unless there is a new and nonobvious functional relationship between the printed matter and the substance of the claims. In copyright law, the borderline cases are those involving useful articles. In these cases, only the artistic "form" of useful articles is protectable. The "mechanical and utilitarian aspects" of useful articles are not protectable. Moreover, in the very borderline cases, where the artistic features cannot be identified separately from the utilitarian aspects of the useful article, copyright "plays it safe" by not giving any protection at all.

III. Computer Programs as Functional

This portion of the article examines the implications of the distinction that was drawn in Part II between the subject matter domain of copyright law and the subject matter domain of patent law. In particular, this section argues that computer programs are functional and not communicative. This section then discusses the protection that should be given to computer programs. In theory, since computer programs are functional and copyright does not protect functionality, computer programs should not be protectable by copyright at all. This paper acknowledges, however, that it may be appropriate to use copyright law to protect computer programs against literal copying.

*249 A. Computer Programs are Functional

1. Computer Programs Operate to Achieve Results

Computer programs are functional because they operate to achieve results.[86] Most computer programs would not have a serious problem satisfying the usefulness requirement of the Patent Act.[87] The first requirement is that the invention must be directed toward achieving some useful result.[88] Every sensible program causes a computer to perform some type of task.[89] This is the sole reason for the program's existence. Like other things which operate to achieve results, many programs perform a variety of tasks. For example, WordPerfect® has a "move" function for moving patches of text, a "save" function

for saving patches of text, a "print" function for printing patches of text, and a "search" function for searching out patches of text. All of these functions assist in performing the overall task of writing a document, and as a result the underlying code which causes the computer to perform these functions is patentable (again, assuming novelty and nonobviousness).

The second requirement is that the invention must actually achieve the desired result.[90] Computer programs may or may not ultimately meet this requirement. As discussed below, that is not the point. The point is that the inquiry makes sense when talking about computer programs. The second requirement makes sense with inventions that are (or are intended to be) "useful" within the patent sense of the term. For example, in *Brenner v. Manson,* the applicant's invention failed the usefulness requirement because the applicant could not prove that it had a tumor-inhibiting effect.[91] In *Newman v. Quigg,* the applicant's invention failed the usefulness requirement because the applicant could not prove that it operated perpetually.[92] In both cases, the inventions turned out to be unpatentable because they did not achieve the results the inventors claimed they achieved. Nevertheless, the inquiry made sense, since the inventions were within the domain of patent subject matter. Similarly, a given computer program may or may not meet the second requirement. The computer program may or may not achieve the result the ***250** inventor claims it achieves. As in *Brenner* and *Newman,* the inquiry at least makes sense for computer programs, since computer programs are within the domain of patent subject matter. The fact that the inquiry makes sense indicates that computer programs are within the domain of patent subject matter (as opposed to the domain of copyright subject matter), regardless whether they ultimately turn out to be patentable.[93]

2. The Noncommunicative Aspects of Computer Program "Text"

To say that computer programs are "texts" is to draw a false analogy.[94] The underlying text in computer programs serves as a medium of construction and is not communicative in the copyright sense of the term.[95]

The text of a computer program serves as its medium of construction.[96] The medium of construction need not be text, it could be something else. Any computer program can be implemented completely with transistors or vacuum tubes. The medium of construction could be hardwired transistors or vacuum tubes. Once the "text" is assembled, a device which performs a function or variety of functions has been created.[97]

The text of a computer program is not communicative in the copyright sense of the term. Copyright is designed to promote the dissemination of useful knowledge ***251** *to humans.*[98] A computer program communicates only in the sense that a transistor inside the computer's microprocessor communicates to other transistors. While strictly true, neither communication is the type of communication that copyright is trying to protect.[99]

In this regard, it is important to distinguish music stored on a compact disk from a computer program stored on a compact disk (i.e., CD ROM).[100] Neither compact disk is itself communicative, as nothing can be gained from looking at the surface of the disk. With musical compact disks, however, there is a direct correlation between input (the 1's and 0's) and the output (what comes out of the human listener's stereo). The listener's stereo is merely "aiding" the communication of the work embodied on the compact disk.[101] Unless otherwise instructed by the listener, the compact disk will be played sequentially from beginning to end. In the process, all of the information on the compact disk is communicated to humans. Hence, by protecting the 1's and 0's stored on a musical compact disk, copyright is protecting communication to a human. Protecting the input is just another way of protecting the output.

With a computer program stored on a CD ROM, there is no such direct correlation between input and output.[102] The screen output of a computer program is, depending on a host of variables, likely to be different every time the program is ***252** executed. More importantly, the computer program is not simply executed sequentially from beginning to end. Furthermore, many of the functions it performs (i.e., system maintenance) are completely transparent to the user. Finally, the computer program and the output of the computer are largely independent.[103] Two completely different computer programs can have very similar outputs. In short, protecting the input of a computer program is not just another way of protecting the output. Therefore, copyright should limit its protection of the CD ROM program to the audiovisual outputs of the computer.[104] By protecting the audiovisual outputs, copyright would be protecting the full range of communicative elements that the 1's and 0's function to produce, and nothing more.

It is also important to note that there is a difference between creativity and creative expression. The work of an electrical engineer, like that of a computer programmer, certainly may exhibit creativity. The first engineers to complete an operative RADAR system during World War II exercised a great amount of creativity. Similarly, Alexander Graham Bell exercised

significant creativity in inventing the telephone. However, the fact that these accomplishments were creative does not mean they produced copyrightable expression. Decisions that go into creating functional objects, such as computer programs, are themselves functional. These decisions are not copyrightable expression.[105]

B. Functionality and Protection of Computer Programs

1. Copyright Law Should Not Provide Any Protection to Computer Programs

Copyright law should not provide any protection to computer programs for the simple reason that computer programs are not within the domain of copyright.[106] ***253** Computer programs are functional, and copyright does not protect that which is functional. Instead, copyright protects that which is communicative.[107]

It is important to distinguish between factual works and functional works. Factual works are works that are useful because they communicate factual information. Functional works are works that operate to achieve results. This distinction, which is frequently glossed over,[108] is helpful in understanding why computer programs should receive no protection from copyright law.

Factual works are within the subject matter domain of copyright because they are communicative. For example, maps, telephone books, dictionaries, code books, encyclopedias, and "how to" manuals are all examples of factual works. The scope of protection in a factual work is limited by the constitutional requirement of originality.[109] This means that a factual work is only protectable to the extent that it contains original expression and that facts are never protectable. For example, the facts contained in a telephone book are not protectable, but the organization of the telephone book is protectable if it reflects a modicum of creativity.[110] Note that the question is not whether a telephone book is a literary work, but rather whether it embodies a modicum of creativity. It is clear that telephone books are within the subject matter domain of copyright law. As described in Part II.B.1 above, however, simply being within the subject matter domain of copyright law is not enough. Once within the subject matter domain of copyright law, a work still must meet additional requirements, such as embodying a modicum of creativity.

In contrast, the argument of this paper is that functional works are not even within the subject matter domain of copyright. Functional works are not communicative, they are works that operate to achieve result. Hence, with functional works, the work is unprotectable *ab initio*. Functional elements may not ***254** simply be removed. Computer programs simply are ineligible for copyright; it is not a matter of dissection.[111]

2. Computer Programs Are Receiving Patent-Like Protection Under the Guise of Copyright Law

The argument that copyright law is providing patent-like protection to computer programs is straightforward: Patent law protects functionality; copyright does not. Computer programs are functional. Therefore, to the extent that copyright is protecting computer programs, it is providing patent-like protection.[112]

A counterargument might be made that copyright law does not provide patent-like protection since copyright is not exclusionary as is patent law (i.e., since copyright law protects only against *copying* whereas patent law also protects against *independent development*). While it is true that copyright protects only against copying, that does not change or eliminate the basic problem. In *Baker v. Selden,* the Court did not grant Selden a right to his system of accounting because that right was "the province of letters-patent, not of copyright."[113] The fact that copyright grants protection only against copying did not change the Court's conclusion.

To be sure, the fact that the recent trend in copyright has been to narrow protection for computer programs reduces this problem somewhat. Certainly, the *Whelan* approach is more unacceptable than the *Computer Associates* approach. However, there is no reason why society should have to accept *any* limitations on its right to copy what is in the public domain.[114]

*255 For example, in *Bonito Boats, Inc. v. Thunder Craft Boats, Inc.,*[115] Florida passed a statute that made it unlawful "to use the direct molding process to duplicate for the purpose of sale any manufactured vessel hull."[116] Hence, the statute required not only duplication, but duplication using the direct molding process. Nevertheless, the Supreme Court unanimously held that the statute was preempted by the Patent Act through the supremacy clause. The Court reasoned:

By offering patent-like protection for ideas deemed unprotected under the present federal scheme, the Florida statute conflicts with the "strong federal policy favoring free competition in ideas which do not merit patent protection." We therefore agree with the majority of the Florida Supreme Court that the Florida statute is preempted by the Supremacy Clause, and the judgment of that court is hereby affirmed.[117]

Thus, in spite of the fact that the statute only prohibited one method of copying, the Supreme Court viewed this as patent-like protection and therefore held the statute preempted. In the present context, the lesson of *Bonito Boats* is that there is no taking solace in the fact that copyright protects only against copying, or in the fact that copyright law does not protect as much functionality as it used to protect.[118]

The Supreme Court has consistently made it clear that society has a fundamental right to copy that which is in the public domain. The law is intended to encourage future creators to build upon things which are in the public domain.[119] If copying were not allowed, there would be no way for future creators to stand "on the shoulders of giants." "[I]mitation and refinement through imitation are both necessary to invention itself and are the very lifeblood of a competitive economy."[120]

*256 3. The Effect of Congress' Amendments to the Copyright Act Should Be Limited to Giving Computer Programs Thin Protection

a) Giving Meaning to Congress' Mandate

Professor Miller has argued that Congress intended "to accord computer programs full copyright protection."[121] Therefore, the question is raised whether protecting only the literal elements of computer programs would be adequate to give meaning to Congress' mandate that computer programs be protectable by copyright. There are two separate answers to this question. First, it is unlikely that Congress intended for computer programs to receive "full copyright protection" in the sense that Professor Miller claims. Second, protection against literal copying does provide meaningful protection to software developers.

Professor Miller's article has been criticized as "a kind of crescendo of increasingly strong assertions about congressional intent relating to computer programs."[122] Although CONTU made clear its views about "the impropriety of program piracy,"[123] its views about other forms of copying are not so clear.[124]

CONTU identified four statements regarding the copyright protection for computer programs which "ought to be true."[125] Of these statements, only one deals with providing protection to software proprietors ("Copyright should proscribe the unauthorized copying of these works."[126]). The remaining three statements say that the users of the programs and the general public should not be unduly burdened. ("Copyright should in no way inhibit the rightful use of these works."[127] "Copyright should not block the development and dissemination of these works."[128] "Copyright ***257** should not grant anyone more economic power than is necessary to achieve the incentive to create."[129])

Turning to the one statement that concerns protection for proprietors, it is unclear what CONTU meant by the phrase "unauthorized copying." In the section of the CONTU report entitled "Scope of Copyright in Programs," the report mainly discusses the preliminary issue concerning the *existence* of copyright protection (i.e., "whether a work *is* copyrighted"[130]). The discussion of the *scope* of protection issue is relatively brief, perhaps because of CONTU's view that "most infringements, at least in the immediate future, are likely to involve simple copying."[131] Importantly, the primary method of gaining access to the functional elements of computer programs (i.e., reverse engineering) was available then just as it is available today. CONTU did not appear to take a position on where the line should be drawn for nonliteral copying, stating that the "line should be drawn on a case-by-case basis by the institution designed to make fine distinctions--the federal judiciary."[132]

It should also be remembered that CONTU's recommendations are not law. Indeed, they are not even legislative history.[133] What is law is section 102(b) of the Copyright Act, which states that "in no case does copyright protection for an original work of authorship extend to any idea, procedure, process, system, method of operation, concept, principle, or discovery …."[134] The legislative history makes it clear that Congress had computer programs in mind when adopting section 102(b) ***258** and meant for it to limit the scope of copyright protection available for computer programs.[135]

Second, protection against literal copying does provide meaningful protection to software developers. Legal verbatim copying would present a substantial disincentive to software developers because it is so easily accomplished.[136] Protection against verbatim copying would remove this disincentive. Further, with respect to nonliteral copying, the software developer would still have protection in the form of lead time advantages because reverse engineering of software is a time-consuming task. Without actual copying, a clone product is time-consuming (and costly) to develop partly because it requires debugging.[137]

b) The Appropriateness of Protecting the Literal Elements of Computer Programs

Is it inappropriate to use copyright protection only against verbatim copying? If taken to its logical conclusion, the distinction between patent law and copyright law, as argued by this paper, would say that copyright should not protect computer programs at all. This subsection of the paper recognizes that, as a practical matter, allowing copyright protection against verbatim copying may be an acceptable approach.[138]

First, there is a strong policy argument that verbatim copying of computer programs should not be allowed. Although computer programs are qualitatively different than books, they do share the trait that they can be easily copied.[139] As a result, computer programs may not be produced at all, because computer programmers would not be able to compete with copyists who do not incur the cost of expression or the risk costs associated with developing a new computer program. ***259** Therefore, to maintain incentive to create computer programs, it may be worthwhile to protect the computer program against verbatim copying.[140]

Although there are several possible ways of doing this, copyright appears to be the most acceptable. Patent law would not work because it would not protect all computer programs due to its stringent requirements. A sui generis form of protection could be passed, but it is debatable whether we want to pass specialized legislation for every new technological development that occurs.[141] Additionally, the copyright system is already in place, and making limited use of the system to protect only against verbatim copying of computer programs is arguably appropriate. It may be the "least unacceptable" of the three above-mentioned solutions.

Second, copyright protection only against verbatim copying may be an acceptable solution because it prevents the more egregious offenses of copyright protection. There is an inherent desire to want to protect the functionality of computer programs, since that is where the value of the computer program is located. For example, Professor Miller recently stated that, "a court must employ considerable caution in excluding efficient or speedy program expression lest it undermine the effective protection of computer programs."[142] This statement, made by a prominent legal scholar, is at odds with traditional copyright doctrine.[143] However, it illustrates the point that once judges and juries start heading down the path of protecting things beyond the literal code, it is difficult for them to stop.[144] ***260** Hence, a bright line drawn at verbatim copying would avoid what are arguably the most egregious offenses of copyright protection for computer programs.

C. Concluding Thoughts on the Functionality of Computer Programs

Congress' decision to give copyright protection to computer programs, when limited to protection against verbatim copying, is difficult to attack as a policy matter. Copyright law is a convenient choice because it is already in place, it looks like it applies, and it protects against verbatim copying. But make no mistake that computer programs do not fit into copyright law. In fact, applying copyright to computer software is like trying "to fit the proverbial square peg in a round hole."[145] This is because computer programs are functional and copyright law protects communicative works, as discussed above. As a practical matter, perhaps the only reason we use copyright law at all is because computer programs share a superficial trait of many communicative works, that is, they can be copied with ease and at low expense. Once we are no longer discussing verbatim copying, however, the analogy to copyright should no longer be used. Patent law should govern the protection of nonliteral elements of computer programs. A theoretical argument for this conclusion, based on the rationales for patent and copyright law, will now be developed.

IV. The Rationales for Patent and Copyright Law

So far, I have argued that there exists a fundamental difference between the subject matter domains of patent law and

copyright law and that computer programs are not within the subject matter domain of copyright law. In the remainder of the paper, I combine this distinction with the rationales for patent and copyright law to explain why patent law has nonobviousness and disclosure requirements whereas copyright does not. Additionally, I apply this analysis to computer programs to argue that society is being harmed by the lack of nonobviousness and disclosure requirements for computer programs.

A. The Rationales for Patent Law

The existence of patent law has been explained in terms of a variety of rationales. The two most prominent theories will be discussed here: the monopoly- ***261** profit incentive theory and the exchange-for-secrets theory.[146] These two theories give rise to the basic requirements for a patent,[147] and are complementary in that they emphasize different benefits from patents.[148]

First, the monopoly-profit incentive rationale assumes that inventions (and their exploitation) will not be obtained in sufficient measure if inventors (and their financial backers) can hope only for such profits as the competitive exploitation of all technical knowledge will permit.[149] From the inventor's standpoint, it would not be worthwhile to invest money in the inventive process if her competitors have costless access to the technological knowledge that is gained from such investments.[150] If her competitors have costless access to the knowledge, the inventor would receive an inadequate return on the investment. Any attempt to obtain a reasonable return would allow the competitors to undercut the inventor's price. Therefore, to make it worthwhile for inventors and their financial backers, society must intervene to increase the inventor's profit expectations.[151] The simplest, cheapest, and most effective way for society to hold out these incentives is to grant temporary monopolies in the form of exclusive patent rights in inventions.[152]

Second, the exchange-for-secrets theory assumes that industrial progress at a sustained rate cannot be obtained if inventors and innovating entrepreneurs keep inventions secret.[153] Unlike the monopoly-profit incentive theory, the exchange-for-secrets theory assumes that inventions would occur absent the patent system, at least in technological areas where the invention could be exploited in secrecy. Here, the function of the patent system is to induce disclosure of inventions that would ***262** otherwise be kept secret.[154] If inventions are kept secret, the new technology may only much later become available for general use.[155] Indeed, technological secrets may die with their inventors and forever be lost to society.[156] Society would much prefer to know about the invention today. Even during the term of the patent, the knowledge it discloses may make it possible for others to make further inventions (that may or may not be claimed by the initial patent) in the same or related fields.[157] In any event, the patent disclosure guarantees that the public will at least eventually have complete access to the invention itself, rather than having the information die with the inventor.[158] Hence, it is in the interest of society to offer an exclusive patent right in return for public disclosure of the invention.[159]

B. The Rationale for Copyright Law

The principal rationale for copyright law in the United States is the incentive rationale.[160] The incentive rationale assumes that works of authorship and their exploitation and dissemination will not be obtained in sufficient measure if authors and their publishers can only hope for such profits as the competitive exploitation of an unprotected work will permit.[161] According to Professor Landes and Judge Posner, works will not be produced at all, because authors and publishers will not be able to compete with copyists who do not incur the cost of expression or the risk costs associated with publishing a new work.[162] Hence, to make it worthwhile for authors and their publishers, society must intervene to increase their profit expectations. The simplest, cheapest, and most effective way for society to hold out these incentives is to grant a copyright to temporarily protect the work of authorship from copying.

Hence, like patent law, copyright promotes both "invention" and "disclosure."[163] That is, patent law promotes invention, and copyright promotes ***263** creation of new works. Further, patent law promotes the disclosure of new inventions to the public, and copyright promotes dissemination of works of authorship. In spite of these basic similarities, however, important differences between the two doctrines exist, as explained below. These differences can be explained by the fact that patent law protects functional works, whereas copyright protects communicative works.

V. Nonobviousness and Computer Programs

A. The Rationales for Patent Law and Patent Law's Nonobviousness Requirement

To be patentable, patent law requires that an invention be not only novel (i.e., different than anything in the prior art),[164] but also nonobvious (i.e., that it would not have been obvious at the time the invention was made to a person having ordinary skill in the art).[165] The nonobviousness requirement is designed to ensure that society only grants patents where necessary to induce the inventive effort or to induce disclosure of the invention.[166] An underlying assumption of this explanation is that there is a high social cost to awarding patents.[167] This high social cost arises out of the functional nature of patent subject matter.

The nonobviousness requirement can be justified both in terms of the monopoly-profit incentive rationale and the exchange-for-secrets rationale.[168] According to the monopoly-profit incentive theory, society holds out a patent like a carrot in order to encourage the inventive act. However, society does not want to have to give away that carrot if the invention was trivial and would have occurred anyway.[169] Hence, the nonobviousness requirement serves as a proxy for the likelihood that an invention would have been made without the promise of a patent.[170]

*264 According to the exchange-for-secrets theory, the function of the patent system is to induce disclosure of inventions that would otherwise be kept secret. Again, however, the patent grant is not to be given lightly, because of the high social cost to granting patents.[171] Therefore, patents should only be given to obtain disclosure of inventions that would otherwise be unlikely to become known.[172] If a person of ordinary skill in the art could develop the invention, it is likely that the invention would become known despite the grant of the patent. In contrast, if the invention is nonobvious, then it might remain secret permanently.[173] Therefore, the nonobvious invention justifies the award of a patent to induce its disclosure, but the obvious invention does not.[174]

Both of these rationales are premised on the following assumption: A patent should not be granted if it is likely that the invention (or its disclosure) would have occurred absent the offer of a patent.[175] This assumption is itself based on another assumption: The cost of awarding patents is high.[176] In other words, if it were not for the high cost of awarding patents, society could grant patents freely. Society would not need to worry about whether the invention would have occurred absent the offer of a patent. Similarly, society would not need to worry about whether the invention would have been disclosed absent the offer of a patent. In fact, however, the cost of granting patents is high, and therefore society must be careful not to award patents unnecessarily.

The high cost of awarding patents arises out of the functional nature of what patent law protects.[177] Inventions operate to achieve results. While many methods for achieving a particular result may exist, a particular invention may represent just ***265** one of these methods. Necessarily, some of these methods will be better (more effective, more efficient, etc.) than others. Only some of these methods will be able to compete in the marketplace. To the extent that patents take commercially practicable methods out of the public domain, patents have competition reducing effects.[178] The high social costs of awarding patents arise out of the competition reducing effects, and thus out of the functional nature of what patent law protects.[179]

B. Copyright Law's Lack of a Nonobviousness Requirement

The reason that copyright law does not have a nonobviousness requirement is the opposite of the reason that patent law does have such a requirement. Society is simply not as worried about granting copyrights without a specific justification because works of authorship are not functional.[180] Unlike patent law, which specifically examines each invention, copyright takes a broad-based approach and worries simply about whether classes of works of authorship should be copyrightable. Copyright has always eschewed the role of art critic. There are several reasons for this.

First, since works of authorship are not functional, taking one expression of a plot line out of the public domain simply does not have the same competitive consequences that taking a method of achieving a result out of the public domain has in patent law. Patent law assumes that only a limited number of commercially practicable ways of achieving a given result exist. That assumption does not hold true when the work is communicative as in copyright law, not functional. There may ***266** be an infinite number of equally "commercially practicable" stories about young lovers whose parents are feuding. The same basic idea can be recycled over and over, and expressed better in each subsequent work of authorship. Taking one expression of a plot line out of the public domain in copyright law does not have the same competitive consequences that exist in patent law.[181]

Second, since works of authorship are not functional, they are also not "technical" and "impersonal." The obviousness inquiry is an objective one. Patent law has a reasonably mechanistic test for measuring nonobviousness: "[T] he scope and content of the prior art are to be determined; differences between the prior art and the claims at issue are to be ascertained; and the level of ordinary skill in the pertinent art resolved."[182] Additionally, the so-called "secondary factors" are considered.[183] Hence, to the extent that improved efficiency and effectiveness of an invention is reflected in its commercial success, that may be used to demonstrate nonobviousness. While this inquiry may not be easy, it does not require the judge to be an art critic. Unlike patent subject matter, copyright subject matter does not lend itself to an objective inquiry of the merits of the work. As a result, there is greater reason to be concerned about government officials becoming the "final judges" of works of authorship.[184]

Third, the nonobviousness requirement must also be considered in view of patent law's usefulness requirement. An invention must be directed toward achieving a desired result.[185] Therefore, the fact that it is nonobvious to combine elements A, B, and C is not enough. Rather, the A-B-C combination must yield an invention that achieves a desired result. The nonobviousness and usefulness requirements are independent, yet complementary. In contrast, a nonobviousness requirement for a communicative work in copyright law would not have this supporting inquiry. It may be nonobvious to express an idea using elements A, B, and C, but that line of inquiry does not help much. There is no independent way of knowing whether the combination of elements A, B, and C furthers the goal of expressing a particular idea.

*267 C. Nonobviousness and Computer Programs

Patent law's nonobviousness requirement should be applied to computer programs. The reasons why copyright law does not have a nonobviousness requirement do not apply to computer programs. Further, society is harmed when copyright law protects computer programs without applying a nonobviousness requirement.

As described in subsection B, the fundamental reason why copyright law does not apply a nonobviousness requirement to works of authorship is that the subject matter domain of copyright is not functional, but rather is communicative. This fundamental reason generated a variety of more specific reasons, but none of these reasons applies to computer programs.

Unlike traditional copyright subject matter, computer programs are functional and not communicative. As a result, computer programs are technical and impersonal. An inquiry into the merits of a computer program can be completely objective and does not require a judge to be an art critic. Further, the nonobviousness inquiry is a helpful one in the context of computer programs, because it is independently supported by the usefulness inquiry. The fact that a computer program is nonobviously comprised of elements A, B, and C, combined with the fact that the computer program actually does something useful, is worth knowing.

The fact that a nonobviousness inquiry makes sense and provides society with beneficial information is arguably not enough to demand that computer programs be nonobvious before protection is given to their nonliteral elements. However, there is affirmative harm which results from the lack of a nonobviousness requirement. The lack of a copyright nonobviousness requirement is harmful to society in that it disrupts the "patent balance." The patent system reflects a careful balance between the need to encourage innovation and disclosure and the avoidance of monopolies that stifle competition without any concomitant advance in the "Progress of … the useful Arts."[186] The lack of a nonobviousness requirement upsets both sides of this balance.[187]

First, the lack of a nonobviousness requirement diminishes the incentive to invent and disclose new inventions. As discussed previously, the patent system is premised on the notion that inventors will be encouraged to invent and disclose inventions if society offers a patent in exchange for such invention and disclosure. ***268** The offer of a patent is rendered meaningless, however, where substantially similar alternative forms of protection are readily available.[188] As the law currently stands, copyright law will protect functionality in computer programs, even though that should be within the sole domain of patent law. Further, copyright protection is readily available to protect functionality in any computer program. There is no need for the program to be nonobvious. If copyright law is readily available to protect the functional elements of computer programs that are *obvious* in light of the prior art, what incentive does patent law provide to develop programs that are *nonobvious* in light of the prior art? "The attractiveness of the bargain, and its effectiveness in inducing creative effort and disclosure of the results of that effort, depend almost entirely on a backdrop of free competition in the exploitation of unpatented designs and ideas."[189] The fact that software developers can always get copyright protection for their computer programs undermines the incentive offered by the patent system. Consequently, within the domain of patent subject matter, the patent laws must

determine not only what is protected, but also what is free for all to use.[190]

Second, by taking information out of the public domain, the lack of a nonobviousness requirement stifles competition without any concomitant advance in the progress the useful arts. Rather than advancing the progress of the useful arts, granting patent-like protection can have a harmful effect on innovation and advancement by removing existing knowledge (and trivial variations thereof) from public use.[191] Essential to the goal of promoting the useful arts is a public domain of freely available materials: It is often necessary to imitate unpatented computer programs in order to develop inventive new programs.[192]

Patent law's view is that subsequent computer programmers should be able to freely copy *any* unpatented aspect of another computer program.[193] The fact that the aspect of the other computer program is novel (i.e., new) is not dispositive.[194] In ***269** contrast, under the *Computer Associates* test, novelty is dispositive.[195] Subsequent programmers are only allowed to copy techniques that are "widely accepted" within the computer industry."[196] If the technique is not "widely accepted" (and if the technique is not unprotectable for some other reason), then there is no right to copy, regardless whether the technique would be obvious. As a result, because copyright does not require nonobviousness, it depletes the potential stock of resources available to subsequent programmers, and hinders the advancement of the useful arts.

Unpatentable computer programming techniques should be in the public domain and available for exploitation. The patent system presupposes a backdrop of free competition. Free exploitation of ideas is the rule to which patent protection is the exception.[197] The Patent Clause is disserved when copyright takes unpatentable programming techniques out of the public domain and is best served by free exploitation of publicly available programming techniques and trivial extensions thereof.[198]

VI. Disclosure Requirements and Computer Programs

A. The Rationales for Patent Law and Patent Law's Disclosure Requirements

In patent law, simple disclosure of the invention ("Hey! Look what I invented!") is not good enough. Pursuant to section 112 of the Patent Act, the specification must be enabling, that is, the specification and drawings must provide sufficient information about the invention so as "to enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the same."[199] Additionally, the best mode "contemplated by the inventor of carrying out his invention" must also be disclosed in the specification.[200] The exchange-for-secrets theory explains both of these requirements.

First, if the invention is not enabled, then according to the exchange-for-secrets theory there is no reason to award a patent. Society may never get the benefit of the invention, since the patentee may be able to maintain trade secret protection in the patented invention once the patent has expired. Since the exchange is supposed to be an exchange for secrets, the inventor is supposed to tell society her secrets. Failing to require an enabling disclosure would, at least under the exchange-for-secrets ***270** theory, totally defeat the purpose of giving an inventor a patent.[201] The enablement doctrine is designed to ensure that the subject matter of the claims is placed in the possession of the public.[202]

Additionally, the inventor must disclose the invention's best mode.[203] Society requires the inventor to fully live up to her side of the deal.[204] She cannot just partially disclose how to make and use her invention. For example, if there are some "preferred" ways of implementing the algorithm that work better than others, the inventor must disclose those preferred ways. Society would get short-changed in the exchange for secrets bargain if it did not require that the *all* of the relevant secrets be disclosed.[205]

The disclosure requirements presuppose that the value in inventions lies in what they do and not in what they say (i.e., that the value lies in their functional aspects and not their communicative aspects). The subject matter of patent law is not inherently communicative. In order to exploit the invention, the inventor need not tell society anything about it (except perhaps as part of sales pitch to get members of society to purchase the invention). Rather, part of the value in an inventive widget lies in knowing how it works and how to use it. There is value above and beyond that which is gained from a simple inspection of the widget; the widget does not speak for itself. As a result, society imposes disclosure requirements on the inventor.[206]

B. Copyright Law's Lack of Disclosure Requirements

In contrast to patent law, copyright has never required more than simple disclosure ("Hey! Look at the book I wrote!"). Although copyright law once had ***271** more "formalities" (e.g., publication, deposit), these requirements were never as stringent as patent law's enablement and best mode requirements. The copyright registration procedure has been characterized as "largely a formality."[207] Copyright law does not need disclosure requirements because of the very fact that the subject matter of copyright is communicative.[208] Copyright presupposes that the value of the work rests in what is communicated and perceived. Works of authorship speak for themselves; exploitation of the work necessitates communication. Further, since traditional works of authorship are not functional, there is no need to "enable" them or to describe their "best mode."[209]

C. Disclosure Requirements and Computer Programs

It was argued above that the lack of a disclosure requirement in copyright comes from the very fact that copyright protects works which are communicative: Copyrighted works speak for themselves.

However, that is not true in the case of computer programs.[210] Having a copy of the object code discloses almost nothing about the computer program itself.[211] A consumer does not need to understand or even read the underlying code to get value ***272** from the computer program. In contrast, life is not so easy for subsequent programmers trying to make use of the unpatented information embodied in the computer program. Subsequent programmers must go through the painstaking process of reverse engineering the computer programs.[212]

This result is unfair to society. Society has granted a property right in the computer program, and in return should receive a complete disclosure about the computer program.[213] Rather than require disclosure, copyright law permits computer programmers to seek trade secret protection. Pursuant to copyright regulations, a registrant need not deposit the entire computer program when registering the work. Rather, the registrant need only deposit the first and last twenty-five pages.[214] Further, any trade secrets contained within those pages may be blocked out.[215] This result is completely contrary to the exchange-for-secrets rationale of patent law. Unless a subsequent programmer reverse engineers the copyrighted program, society may never have access to the copyrighted knowledge the program contains.

The difference in approaches taken by patent law and copyright law is striking. Copyright law appears to encourage computer programmers to seek trade secret protection. In contrast, an accidental failure to disclose the best mode can result in invalidation of the patent claim.[216] Intentional concealment of the best mode is viewed as inequitable conduct ("fraud on the Patent Office"), and renders the entire patent unenforceable.[217] In extreme cases, courts have gone so far as to render other ***273** patents unenforceable.[218] If the reasons for patent law's disclosure requirements are to be taken seriously, society should demand that computer programmers be treated just like any other inventor.

VII. Conclusion

The fundamental distinction between copyright law and patent law is that copyright law protects things which are communicative while patent law protects things which are functional. The fact that copyright law protects things which are communicative is demonstrated not only by the statutory definition of copyrightable subject matter, but also by the goals of copyright and the limitations embodied in the idea/expression dichotomy. Patent law protects things which are functional. This is demonstrated by the Patent Act's usefulness requirement, as interpreted by the courts. The limitations on copyright protection for useful articles and patent law's treatment of printed matter, demonstrate there is no overlap between the subject matter domains of the two regimes.

Computer programs are functional, and are therefore within the subject matter domain of patent law, because they operate to achieve results. Computer programs are not communicative, because the text of a computer program merely serves as its medium of construction. Copyright is concerned only about communication to humans, but the text of a computer program is generally not communicated to humans. There is also a distinction between creativity (such as the creativity that goes into designing an electrical circuit) and creative expression. In theory, since computer programs are functional and do not involve creative expression, copyright should not protect them at all. However, it may be worthwhile to afford computer programs thin protection under copyright law in order to give meaning to Congress' mandate.

More generally, copyright protection is inappropriate because copyright does not require that computer programs be

nonobvious. The lack of a nonobviousness requirement diminishes the incentive to invent and disclose inventions, because alternative protection is available under copyright law. Further, the lack of a nonobviousness requirement stifles competition without any concomitant advance in the progress of science and the useful arts.

Copyright protection is also inappropriate because copyright law does not have any disclosure requirements. Computer programmers are inappropriately allowed to secure both copyright protection and trade secret protection. As a result, society is giving away a property right without receiving any knowledge in return.

The contribution of this paper has not been to advance a radical conclusion about the protection of computer programs. Rather, the contribution of this paper ***274** has been to articulate in depth a notion that some people have found to be intuitively obvious. Except perhaps in regard to verbatim copying, computer programs should be protected by patent law and not by copyright law.

Footnotes

a1 Nilles & Nilles, S.C., Milwaukee, Wisconsin. The author would like to thank Professor Neil Netanel and Professor Mark Lemley for their help in preparing the article. The opinions expressed herein are the author's own and should not be attributed to Professor Netanel, to Professor Lemley or to Nilles & Nilles, S.C. or its present or former clients.

1 It has been argued that the initial expansiveness of copyright protection for computer software was linked to the perceived unavailability of patent protection. *See* Willis E. Higgins, *Technological Poetry: The Interface Between Copyright and Patents for Software,* 12 HASTINGS COMM. & ENT. L.J. 67 (1989). The perceived unavailability of patent protection also influenced CONTU's recommendation that copyright protection for computer programs not be withdrawn. FINAL REPORT OF THE NATIONAL COMMISSION ON NEW TECHNOLOGICAL USES OF COPYRIGHTED WORKS at 17, *reprinted in* 3 COMPUTER L.J. 53, 69 (1978) [hereinafter *CONTU Report*].

2 797 F.2d 1222, 230 U.S.P.Q. (BNA) 481 (3d Cir. 1986).

3 *Id.* at 1236, 230 U.S.P.Q. at 490 (emphasis omitted).

4 S. Carran Daughtrey, Note, *Reverse Engineering of Software for Interoperability and Analysis,* 47 VAND. L. REV. 145, 171 (1994) (noting that recent decisions exhibit an underlying shift in their interpretation of legal doctrine and policy from a broad standard of infringement that favors software copyright owners to a more narrow standard).

5 982 F.2d 693 (2d Cir. 1992).

6 *Id.* at 705-06.

7 49 F.3d 807, 34 U.S.P.Q.2d (BNA) 1014 (1st Cir. 1995), *aff'd* 116 S. Ct. 804 (1996).

8 *Id.* at 815, 34 U.S.P.Q.2d at 1021.

9 *See* Peter J. Ayers, *Interpreting* In re Alappat *with an Eye Towards Prosecution,* 76 J. PAT. & TRADEMARK OFF. SOC'Y 741, 763-65 (1994).

10 35 U.S.C. § 101 (1994) provides that patents may be granted for "any new and useful process, machine, [article of] manufacture, or composition of matter, or any new and useful improvement thereof …." This has been interpreted to mean that mathematical algorithms and abstract ideas are not patentable.

[11]   409 U.S. 63, 175 U.S.P.Q. (BNA) 673 (1972).

[12]   *Id.* at 71, 175 U.S.P.Q. at 676.

[13]   450 U.S. 175, 209 U.S.P.Q. (BNA) 1 (1981).

[14]   *Id.* at 187, 209 U.S.P.Q. at 8. *See generally* A. Samuel Oddi, *An Uneasier Case for Copyright Than for Patent Protection of Computer Programs,* 72 NEB. L. REV. 351, 407 (1993) (linking the increased availability of patent protection to the erosion of the Supreme Court's anti-patent sentiment in the early 1980's); Peter S. Menell, *An Analysis of the Scope of Copyright Protection for Application Programs,* 41 STAN. L. REV. 1045, 1075 (1989) ("The Supreme Court's 1981 decisions in Diamond v. Diehr and Diamond v. Bradley … cleared the way for patent protection for computer programs.").

[15]   33 F.3d 1526, 31 U.S.P.Q.2d (BNA) 1545 (Fed. Cir. 1994) (en banc).

[16]   *Id.* at 1545, 31 U.S.P.Q. at 1558; *see also In re* Trovato, 60 F.3d 807, 35 U.S.P.Q.2d (BNA) 1570 (Fed. Cir. 1995) (en banc) (withdrawing panel opinion reported at 42 F.3d 1376, which held a data structure not statutory subject matter where the specification provided no grasp of any underlying physical process and did not provide a hardware enablement of the claimed invention); *but see In re* Warmerdam, 33 F.3d 1354, 31 U.S.P.Q.2d (BNA) 1754 (Fed. Cir. 1994) (data structure not statutory subject matter where claim involved no more than the manipulation of abstract ideas). For a more complete discussion of the development of patent law regarding computer programs see Pamela Samuelson, *Benson Revisited: The Case Against Patent Protection for Algorithms and Other Computer Program-Related Inventions,* 39 EMORY L.J. 1025, 1032-1112 (1990) [hereinafter, Samuelson, *Benson Revisited*].

[17]   Some authors use the term "thin protection" to mean simply something less than the "full scope" of protection, but not necessarily protection only against verbatim copying. That is not how this paper uses the term. According to the usage of this paper, *none* of the non-literal elements of the computer program (i.e., structure, sequence, and organization) would be protectable under a "thin" copyright standard. The only protection would be against verbatim copying.

[18]   The suggestion that copyright should protect computer programs only against verbatim copying is likely to be more favorably received in a regime where patent protection is also available. But the unavailability of patent protection would not change my argument. The fact remains that within its domain, "the federal patent laws must determine not only what is protected, but also what is free for all to use." Bonito Boats, Inc., v. Thunder Craft Boats, Inc., 489 U.S. 141, 151, 9 U.S.P.Q.2d (BNA) 1847, 1852 (1989).

[19]   Screen outputs are a separate issue altogether, since screen outputs are more communicative and less functional than program code. Perhaps screen outputs should be treated as useful articles (i.e., even though they are not three-dimensional "articles"). Under this approach, for example, a screen saver would receive very broad protection since its pictorial and graphic features are easily separated from its utilitarian features. In contrast, the screen outputs of a program such as PKZip would probably not be protected, because the pictorial and graphic aspects could not be identified separately from the utilitarian aspects. In any event, however, I do not attempt to justify this treatment of screen outputs.

[20]   *See* Steven R. Englund, Note, *Idea, Process, or Protected Expression?: Determining the Scope of Copyright Protection of the Structure of Computer Programs,* 88 MICH. L. REV. 866, 890 (1990).

[21]   Pamela Samuelson, *CONTU Revisited: The Case Against Copyright Protection for Computer Programs in Machine-Readable Form,* 1984 DUKE L.J. 663, 749 [hereinafter Samuelson, *CONTU Revisited*] ("What has distinguished copyright from other forms of intellectual property, what has been at its base but not at the base of the others, is that the content of a copyrighted work has always had some nonfunctional aesthetic, informational, or entertaining qualities *which are communicated to a human audience.* The only 'function' of copyrightable works has been 'to portray the appearance of an article or to convey information.' What has been protected has only been the expression of what has been portrayed or conveyed: the words made visible, the sounds made audible, and the like.") (emphasis added); *see also CONTU Report, supra* note 1, at 28 (Hersey, Comm'r, dissenting) (copyright has always covered only communication with humans, computer programs are the first exception); Dennis S. Karjala, *Copyright*

Protection of Computer Documents, Reverse Engineering, and Professor Miller, 19 U. DAYTON L. REV. 975, 977 (1994) [hereinafter, Karjala, *Copyright Protection*] (arguing that copyright law does not protect things which perform some utilitarian task other than to inform, entertain, or portray an appearance to human beings); Donald S. Chisum, *The Patentability of Algorithms,* 47 U. PITT. L. REV. 959, 967 (1986). ("The cases suggest that the appropriate [printed matter] inquiry with 'software' inventions should be on whether the claimed subject matter produces specific, active, useful results *and not simply communication with humans.*") (emphasis added). Some commentators have attempted to distinguish copyright and patent law on the basis that only patent law protects things which are "useful" or "utilitarian." This is a false distinction, because copyright also protects some utilitarian works (i.e., such as dictionaries, maps, and telephone books). *See* discussion *infra* Part III.B.1, distinguishing between things which are utilitarian because of the facts they contain, and things which are utilitarian because of the functions they perform.

[22]   17 U.S.C. § 102(a) (1994).

[23]   Congress, when passing the 1976 Act, contemplated that computer programs would be protectable by copyright. My argument is that Congress' decision to give copyright protection to computer programs was inconsistent with its definition of the subject matter of copyright, embodied in section 102(a). Further, since the section 102(a) definition of the subject matter of copyright is consistent with general copyright principles, as discussed in subsequent sections, the problem is with Congress' decision to protect computer programs and not with its definition of the subject matter of copyright. However, as argued in Part III.B.3, *infra,* the inconsistency can be minimized, and meaning can be given to both of Congress' mandates, by using copyright law to protect only against verbatim copying.

[24]   *See* 17 U.S.C. § 101 (1994).

[25]   H.R. REP. NO. 94-1476, 94th Cong., 2d Sess. 52-53 (1976), *reprinted in* ROBERT A. GORMAN AND JANE C. GINSBURG, COPYRIGHT FOR THE NINETIES, 93-94 (1993) ("Under the bill it makes no difference what the form, manner, or medium of fixation may be ....").

[26]   Leslie Erin Wallis, *The Different Art: Choreography and Copyright,* 33 UCLA L. REV. 1442, 1449-50 (1986).

[27]   The phrase "or otherwise communicated" indicates that the statute envisions that perception and reproduction are also forms of communication. For example, recombinant DNA is "capable of being reproduced;" nevertheless, it is not within the subject matter of copyright law. Hence, for simplicity, I will simply refer to "communication" and the "communicative" nature of copyright.

[28]   Wallis, *supra* note 26, at 1449.

[29]   *Id.*

[30]   17 U.S.C. § 102(a)(4) (1994).

[31]   17 U.S.C. § 102(a) (1994). Architectural works present the most serious challenge to the claim that all of the section 102(a) categories are communicative. Architectural works are like useful articles, in that they comprise both communicative aspects and functional aspects. *See infra* text accompanying notes 36-44. However, Congress deliberately avoided applying the separability test to architectural works. Congress instead decided that the "poetic language" but not the "internal language" of the architecture should be protected. "Poetic language" refers to elements responsive to issues external to the building (such as how the building fits in with its environment), whereas "internal language" refers to issues that are determined by pragmatic and technical requirements of the building. *See* H.R. REP. NO. 101-735, 101st Cong., 2nd Sess. (1990), *reprinted in* 41 PAT. TRADEMARK & COPYRIGHT J. (BNA) 141, 149-51 (1990). Hence, the decision to protect the "poetic language" of the architecture indicates that the communicative aspects of the building will (at least to some extent) be protected. The extent to which functional aspects also will be protected is, as noted by at least one commentator, unclear. *See* Dennis S. Karjala, *Copyright and Misappropriation,* 17 U. DAYTON L. REV. 885 n.125 (1992).

32   Karjala, *Copyright and Misappropriation, supra* note 31.

33   Feist Publications v. Rural Tel. Serv., 499 U.S. 340, 346-47, 18 U.S.P.Q.2d (BNA) 1275, 1278-79 (1991).

34   *Id.* at 363, 18 U.S.P.Q.2d at 1284.

35   Further, copyright is not trying to protect all creativity, just the creativity in things which are communicative. For example, an electrical circuit design is creative, but copyright would never consider protecting it. As a result, creativity can not be a "defining element" of copyright law. *See infra* note 105 and accompanying text. Note that the statute does not offer any other suggestions apart from creativity and communicativeness as to what might be the "defining element" of copyright law.

36   *See* Samuelson, *CONTU Revisited, supra* note 21, at 727 ("It has long been copyright policy to deny copyright protection to utilitarian works."). Professor Samuelson also concludes that there may be constitutional problems with extending copyright protection to utilitarian works. *Id.* at 732-33. *But see* Oddi, *supra* note 14, at 432 (arguing that overlap between patent subject matter and copyright subject matter is permissible, and that strict pigeonholing of the two constitutional titles of protection is reminiscent of the formalistic jurisprudence of the late nineteenth and early twentieth centuries).

37   17 U.S.C. § 101 (1994). A "useful article" is an article having an intrinsic utilitarian function that is not merely to portray the appearance of the article or to convey information. *Id.*

38   *Id.*

39   773 F.2d 411, 228 U.S.P.Q. (BNA) 385 (2d Cir. 1985).

40   *Id.* at 418, 228 U.S.P.Q. at 390.

41   *Id.*

42   *Id.* at 414, 228 U.S.P.Q. at 386-87.

43   *See* Paul Goldstein, *Infringement of Copyright in Computer Programs,* 47 U. PITT. L. REV. 1119, 1123-24 (1986) ("The distinct roles that Congress and the courts have assigned to patent and copyright laws respectively are nowhere more evident than in copyright infringement decisions. Specifically, in applying traditional infringement standards to copyrighted functional works, courts take great care to protect only the work's expression and not any part of its underlying function.").

44   Arguably, the reason that the separability test is applied exclusively to PG&S works is that the protection of PG&S works presents by far the most serious risk of transgressing the domain of patent law. The risk is present because the PG&S category includes useful articles, to the extent that useful articles are copyrightable. A useful article is an article "having an intrinsic utilitarian function that is not merely to portray the appearance of the article or to convey information." 17 U.S.C. § 101 (1994). Unlike other works of authorship, which by definition have no intrinsic utilitarian function other than merely portraying the appearance of the article or conveying information, protecting the expression in a useful article runs a serious risk of also protecting the intrinsic non-communicative utilitarian function. While other works may perform non-intrinsic "utilitarian functions" in some cases (i.e., a large book used to hold down the table cloth of a picnic table on a windy day), there is generally little risk that protecting the expression in the book will also protect the function of holding down a table cloth. The separability test tries to repeat this result for useful articles.

45   U.S. CONST. art. I, § 8, cl. 8. Note that in the Patent-Copyright Clause, "Science" refers to the work of authors and "useful Arts" refers to the work of inventors. Graham v. John Deere Co., 383 U.S. 1, 6, 148 U.S.P.Q. (BNA) 459, 462 (1966) (explaining that the

patent system must promote the progress of the useful arts). The apparent explanation is that, in colonial times, the term "Science" was used in the sense of general knowledge rather than the modern sense of physical or biological science. Williams & Wilkins Co. v. United States, 172 U.S.P.Q. 670, 683 (Cl. Ct. 1972). *Cf.* MELVILLE NIMMER AND DAVID NIMMER, NIMMER ON COPYRIGHT, § 1.03[A] n.1 and § 1.03[B] n.21 (1988) (describing the possibility that the term "useful arts" refers to the work of authors as "doubtful").

46   Although other rationales such as moral rights have been used to explain copyright, "[t]he primary objective of copyright is not to reward the labor of authors, but '[t]o promote the Progress of Science and the useful Arts.'" *Feist Publications,* 499 U.S. at 349, 18 U.S.P.Q.2d at 1279 (quoting U.S. CONST. art. I, § 8, cl. 8).

47   Baker v. Selden, 101 U.S. 99, 103 (1879), *quoted in Feist Publications,* 499 U.S. at 350, 18 U.S.P.Q.2d at 1279-80.

48   *Baker,* 101 U.S. at 105 (1879), *quoted in* Lotus Dev. Corp. v. Borland Int'l, 49 F.3d 807, 817, 34 U.S.P.Q.2d (BNA) 1014, 1022 (Fed. Cir. 1994).

49   *See* John P. Sumner, *The Copyright/Patent Interface: Patent Protection for the Structure of Program Code,* 30 JURIMETRICS J. 107 (1989) (*Baker v. Selden* makes clear that subject matter protectable by patent law is not the object of copyright protection). Some commentators view this separation as constitutional in nature. *See CONTU Report, supra* note 1, at 92-93 (Hershey, Comm'r, dissenting).

50   45 F.2d 119 (2d Cir. 1930).

51   *Id.* at 123.

52   *Id.* at 122.

53   *See supra* text accompanying notes 45-47; *see also* Pamela Samuelson, *Fair Use for Computer Programs and Other Copyrightable Works in Digital Form: The Implications of* Sony*,* Galoob*, and* Sega, 1 J. INTELL. PROP. L. 49, 57 (1993) ("In the American tradition, the ultimate purpose of copyright is not the maximization of financial rewards to copyright owners …, but fostering the creation and dissemination of literary and artistic works *in order to enhance the public's access to knowledge.*") (emphasis added).

54   Implicit in this explanation is that copyright is concerned only with the communication of knowledge *to human beings. See supra* note 21.

55   *See* Karjala, *Copyright Protection, supra* note 21, at 976-78 (distinguishing patent and copyright law on the basis that "Patent law protects creative but functional invention; copyright law protects creative but nonfunctional authorship.").

56   35 U.S.C. § 101 (1994) (inventions and discoveries must be "new and useful" in order to be patentable). *See* Karjala, *Copyright Protection, supra* note 21, at 980 ("That patent law protects functional works is expressly reflected in the 'usefulness' condition that has always been a part of patent law.").

57   383 U.S. 519, 148 U.S.P.Q. (BNA) 689 (1966).

58   *Id.* at 532, 148 U.S.P.Q. at 694-95.

59   *Id.* at 534-35, 148 U.S.P.Q. at 695.

60   Stiftung v. Renishaw PLC, 945 F.2d 1173, 1180, 20 U.S.P.Q.2d (BNA) 1094, 1100 (Fed. Cir. 1991) ("To meet the utility requirement, the Supreme Court has held that a new product or process must be shown to be 'operable'--that is, it must be 'capable of being used to effect the object proposed.'") (citing Mitchell v. Tilghman, 86 U.S. (19 Wall.) 287, 396 (1873)).

61   681 F. Supp. 16, 5 U.S.P.Q.2d (BNA) 1880 (D.D.C. 1988).

62   *Id.* at 17, 5 U.S.P.Q.2d. at 1880.

63   *Id.* at 23, 5 U.S.P.Q.2d at 1885.

64   877 F.2d 1575, 1582, 11 U.S.P.Q.2d 1340, 1345 (Fed. Cir. 1989). *Cf.* DONALD S. CHISUM, PATENTS: A TREATISE ON THE LAW OF PATENTABILITY, VALIDITY AND INFRINGEMENT, § 4.01 (1995) ("To comply with the utility requirement, an invention … must meet three tests. First, it must be operable and capable of use. It must operate to perform the functions and secure the result intended. Second, it must operate to achieve some minimum human purpose. Third, it must achieve a human purpose that is not illegal, immoral or contrary to public policy."). As indicated, Chisum points out a third "public policy" requirement. "Properly viewed, however, the public policy doctrine is a narrow one." Chisum, § 4.03.

65   The design patent system does not undermine the argument that patent law does not transgress into the domain of copyright. Rather, the design patent system merely requires a clarification of the argument that is being made in this paper: The argument of this paper is that the nonliteral elements of computer programs should not be protected by copyright law but instead by patent law, i.e., by *utility* patent law. Design patents have always been considered separate from "ordinary" patent law. *See* DRAFT, SECOND SUPPLEMENTARY REPORT OF THE REGISTER OF COPYRIGHTS ON THE GENERAL REVISION OF THE U.S. COPYRIGHT LAW, CHAPTER VII (1975) (Legislative History of 17 U.S.C. § 113), *reprinted in* ROBERT A. GORMAN & JANE C. GINSBURG, COPYRIGHT FOR THE NINETIES, 182-83 (4th ed. 1993) ("In 1952, a successful program for the general revision of the patent laws resulted in comprehensive new patent legislation in which the design patent provisions were deliberately left untouched. The basic reason for leaving the design provisions alone was an agreement among the sponsors of the legislation that the patent law was not the place to deal with design protection."); *see also* DONALD S. CHISUM & MICHAEL A. JACOBS, UNDERSTANDING INTELLECTUAL PROPERTY LAW (1992) (Chisum and Jacobs do not discuss design patents in the chapter entitled "Patents," but rather discuss them in a separate section entitled "Other Intellectual Property Rights").

66   *See supra* text accompanying notes 57-59.

67   *See, e.g., In re* Russell, 48 F.2d 668, 669 (C.C.P.A. 1931) (holding method of arranging directories in a phonetic order not patentable).

68   Samuelson, *Benson Revisited, supra* note 16, at 1037 n.36 (citing Note, *The Patentabililty of Printed Matter: Critique and Proposal,* 18 GEO. WASH. L. REV. 475 (1950)). An extension of this reasoning would say that copyright disrupts the balance of patent law by protecting the functionality of computer programs. *See infra* Parts III-V. As the quote of Professor Samuelson indicates, although the printed matter rule has not been explained in patent law as a rule about policing the patent-copyright boundary, that has been its practical effect. The printed matter rule has its origins in the rule that business methods are not patentable. Most early printed matter cases involved arrangements of information designed to implement some business system. *See* Note, *The Patentability of Printed Matter: Critique and Proposal,* 18 GEO. WASH. L. REV. 475, 476 (1950). In view of these origins, however, Professor Chisum notes that the printed matter rule suffers "from a common infirmity--the absence of a firm footing in either statutory language or well-reasoned, extrastatutory policy." Donald S. Chisum, *The Patentability of Algorithms,* 47 U. PITT. L REV. 959, 964 (1986) [hereinafter Chisum, *Patentability of Algorithms*]. Chisum then suggests a role for the printed matter inquiry in modern software cases: "The cases suggest that the appropriate [printed matter] inquiry with 'software' inventions should be on whether the claimed subject matter *produces specific, active, useful results and not simply communication with humans.*" *Id.* at 967 (emphasis added). As Chisum's suggestion indicates, the printed matter rule can be properly based upon the extrastatutory policy of separating the communicative subject matter of copyright from the functional subject matter of patent.

69   132 F.2d 140 (C.C.P.A. 1942).

70   *Id.* at 141.

71   *Id.*

72   *Id.*

73   210 F. 443 (6th Cir. 1913).

74   *Id.* at 444.

75   *Id.* at 444-45.

76   *Id.* at 446-47.

77   32 F.3d 1579, 32 U.S.P.Q.2d (BNA) 1031 (Fed. Cir. 1994).

78   *Id.* at 1580, 32 U.S.P.Q.2d at 1032.

79   *Id.* ADOs are used in conjunction with attributive data models. An attributive data model represents complex information in terms of attributes and relationships between attributes. The attributive data model capitalizes on the concept that a database is a collection of attributions, such that information is represented in terms of its characteristics and relationships to other information. A data structure organized in accordance with an attributive data model comprises a plurality of attribute data objects stored in memory. An ADO is a single primitive data element (comprising sequences of bits stored in the memory) which contains information used by the application program and information regarding its relationship with other ADOs. *Id.*

80   *Id.* at 1582, 32 U.S.P.Q.2d at 1032.

81   *Id.* (quoting *In re* Gulack, 703 F.2d 1381, 1386, 217 U.S.P.Q. (BNA) 401, 404 (Fed. Cir. 1983)).

82   *Id.* at 1583-84, 32 U.S.P.Q.2d at 1034-35.

83   *Id.* (quoting *In re* Bernhart, 417 F.2d 1395, 1399, 163 U.S.P.Q. 611, 615 (C.C.P.A. 1969)).

84   Samuelson, *CONTU Revisited, supra* note 21, at 735 ("[T]he copyright and patent realms have generally been kept separate by the requirement that a thing have utility to be patentable and not have utility to be copyrightable."); Karjala, *Copyright Protection, supra* note 21, at 982 ("The functionality and nonfunctionality distinction between patent law and copyright law is, therefore, not historically perfect. It is surely correct to say, however, that copyright law has generally eschewed protection of function ….").

85   *See supra* text accompanying note 68.

86   Karjala, *Copyright Protection, supra* note 21, at 978 ("A computer program in object code form is functional because it causes a computing machine to operate so as to achieve a certain result.").

[87] Although there has been an issue about whether computer programs are statutory subject matter, that issue has arisen in the context of whether computer programs are mathematical algorithms. Computer programs, as a class, have never had any problem satisfying the usefulness requirement.

[88] 35 U.S.C. section 101 states the usefulness requirement, and the courts' interpretation of this requirement was discussed above. *See supra* text accompanying notes 56-64.

[89] Pamela Samuelson, Randall Davis, Mitchell D. Kapor, and J.H. Reichman, *A Manifesto Concerning the Legal Protection of Computer Programs,* 94 COLUM. L. REV. 2308, 2317 (1994) [hereinafter *Manifesto*].

[90] 35 U.S.C. § 101 (1994).

[91] *Brenner,* 383 U.S. at 531-32, 148 U.S.P.Q. at 694.

[92] *Newman,* 681 F. Supp. at 23, 5 U.S.P.Q.2d at 1885-86.

[93] In contrast, the second requirement does not make sense when talking about the subject matter of copyright law, such as a book or a movie. Computer programs can embody a flawed algorithm, causing them to malfunction. It does not make sense to speak of a book or a movie malfunctioning. Subject matter which is in the domain of copyright law cannot malfunction in the ordinary sense of the term, because copyright subject matter does not "operate" in the patent sense of the term.

[94] *See* Samuelson, *CONTU Revisited, supra* note 21, at 727 ("There is one very simple but important difference between a book which contains a set of instructions about how to do a particular task and a computer program in machine-readable form which contains a similar, if considerably more elaborate, set of instructions on the same subject: The former informs a human being about how the task might be done; the latter does the task.").

[95] Pamela Samuelson, *Some New Kinds of Authorship Made Possible by Computers and Some Intellectual Property Questions They Raise,* 53 U. PITT. L. REV. 685, 688 (1992) ("Computer programs do not seem to me to be 'works of authorship' as that term has been used in copyright law, for the only functions of traditionally copyrightable writings has been to convey information or display an appearance.").

[96] *Manifesto, supra* note 89, at 2320-24.

[97] Importantly, these functions are what a consumer (and society) values in computer programs. *Id.* at 2318-19. People buy computer programs because they have a task that they want their computer to be able to perform. "No one would want to buy a program that did not behave, i.e., that did nothing, no matter how elegant the source code 'prose' expressing that nothing." *Id.* at 2317; *see also* J.H. Reichman, *Electronic Information Tools--The Outer Edge of World Intellectual Property Law,* 17 U. DAYTON L. REV. 797, 831 (1992) ("[A] user's decision to purchase the relevant CAD technology will seldom depend on its embodiment of a programmer's personal expression. Nor will the industrial user normally expect computer-aided design to enhance the imprint of his own personality upon the end product."). In structuring our laws, the fact that society values the functionality of computer programs (and not their expressiveness, if any) cannot be ignored given that the patent and copyright systems are based on economic rationales.

[98] *See supra* notes 21, 45-54, *infra* notes 99-104 and accompanying text.

[99] Even if object code or source code did in some sense communicate (i.e., to a computer programmer), that would not be a reason to protect the functional elements of the code. For example, consider a circuit as embodied in both a circuit schematic and a functioning version of the circuit. The circuit schematic communicates to an electrical engineer and is copyrightable. However, although the two-dimensional circuit schematic is copyrightable, the functioning three-dimensional version of the circuit is not protectable based on the copyrighted circuit schematic. 17 U.S.C. § 102(b) (1994). (As a practical matter, therefore, the copyright

of the circuit schematic is of extremely limited importance.) A computer program might be analogized to the circuit schematic (i.e., since the computer program in effect describes how a computer could be hardwired to achieve the same result). However, just as the functioning implementation of the circuit schematic is not protectable, so too the functioning version of the computer program should not be protectable. Hence, even if we assume that object code and/or source code "communicate," it is impossible to justify protecting anything more than just the "two-dimensional" aspects of the code (i.e., protecting the code against verbatim copying). *See infra* Part III.B.3.

100 *See generally CONTU Report, supra* note 1, at 88-89 (Hersey, Comm'r, dissenting).

101 *See* 17 U.S.C. § 102(a) (1994) ("either directly or with the *aid* of a machine or device.") (emphasis added).

102 *See also,* Samuelson, *CONTU Revisited, supra* note 21, at 738 ("The very purpose of stereo equipment and video equipment is to make these writings audible or visible. This is not the case with computers and computer programs. The purpose of a computer is not to make visible the various sets of program instructions it contains, but to operate as a machine in the manner the program instructions direct; the program or set of programs controlling the computer determines what kind of machine it will be.") *and CONTU Report, supra* note 1, at 89 (Hersey, Comm'r, dissenting) ("The functions of computer programs are fundamentally and absolutely different in nature from those of sound recordings, motion pictures or videotapes. Recordings, films, and videotapes produce for the human ear and/or eye the sounds and images that were fed into them and so are simply media for transmitting the means of expression of the writings of their authors…. But the direct product of a computer program is a series of electronic impulses which operate a computer; the 'writing' of the author is spent in the labor of a machine.").

103 *See Manifesto, supra* note 89, at 2317-18.

104 The protection of computer programs is discussed in greater detail *infra* text accompanying notes 106-144. I eventually acknowledge that, in spite of the theoretical difficulties, it may be appropriate to give copyright protection as against verbatim copying of the program code in addition to protection of the program's audiovisual outputs.

105 *See also,* Karjala, *Copyright and Misappropriation, supra* note 31, at 897 ("[I]ntellectual creativity does not serve well as a dividing line between various types of intellectual property protection…. Einstein's theory of relativity represents one of the high points in the history of human intellectual creativity, but neither patent nor copyright would protect it.").

106 Pamela Samuelson, *Allocating Ownership Rights in Computer-Generated Works,* 47 U. PITT. L. REV. 1185, 1188 (1986) ("Until software was admitted to its realm, copyright law had excluded utilitarian works--that is, works that had functions beyond the conveying of information or the displaying of some sort of appearance--from its domain.").

107 *See* Samuelson, *CONTU Revisited, supra* note 21, at 741 (machine-readable computer programs should be deemed "utilitarian" within the meaning of the copyright laws, and hence uncopyrightable); John P. Sumner, *The Copyright/Patent Interface: Patent Protection for the Structure of Program Code,* 30 JURIMETRICS J. 107 (1989) (concluding that copyright protection should not be available for any aspect of a computer program that is patentable subject matter, patentable subject matter includes any function or machine which can be claimed); *But see* Englund, *supra* note 20, at 879 (concluding that protection of program structure is consistent with the purposes of copyright as long as it is limited by the idea-expression and process-expression dichotomies and the merger doctrine); Arthur R. Miller, *Copyright Protection for Computer Programs, Databases, and Computer-Generated Works: Is Anything New Since CONTU?,* 106 HARV. L. REV. 977 (1993) (arguing for broad protection of computer programs); Julian Velasco, *The Copyrightability of Nonliteral Elements of Computer Programs,* 94 COLUM. L. REV. 242 (1994) (arguing that the *Altai* test, in modified form, is the best test for determining substantial similarity because it most closely adheres to general principles of copyright law).

108 *See, e.g.,* Miller, *supra* note 107, at 986 (referring to fact compilations, dictionaries, code books, encyclopedias, advertising, and "how to" instruction manuals as functional works); Paul Goldstein, *Infringement of Copyright in Computer Programs,* 47 U. PITT. L. REV. 1119, 1121 (1986) (referring to maps, charts, directories, instruction texts, technical drawings, diagrams and models as functional works).

[109]   *Feist Publications,* 499 U.S. at 346, 18 U.S.P.Q.2d at 1278.

[110]   *Id.* at 346-47, 18 U.S.P.Q.2d at 1278-79.

[111]   There are situations in which copyright protects the expressive aspects of objects which are partially functional, namely, in the case of useful articles. Useful articles are partially functional and partially communicative. Therefore, it might be argued that some form of the separability test should be applied to computer programs. However, any analogy of computer programs to useful articles is inapposite. Computer programs are considered to be literary works and not "useful articles." *See* H.R. REP. NO. 1476, 94th Cong., 2d Sess. 54, *reprinted in* 1976 U.S.C.C.A.N. 5659, 5667 (literary works includes computer programs). Second, more fundamentally, even if computer programs were treated like useful articles, they still would not be protectable. Computer programs are pervasively functional. Each instruction, each line of code, each combination of lines of code, each subroutine, and so on, operates to achieve some result. Hence, program code is wholly functional. To separate all functional aspects of code from a program would leave nothing to protect. Karjala, *Copyright Protection, supra* note 21, at 986-87.

[112]   *See* Reichman, *supra* note 97, at 819 ("To the extent that both *Feist* and *Bonito Boats* fail to halt a reckless protectionist trend, manufacturers of electronic information tools stand to obtain patent-like protection [through copyright law] on soft conditions for a very long period of time …."); Alan R. Glasser, *Video Voodoo: Copyright in Video Game Computer Programs,* 38 FED. COMM. L.J. 103 (1986) ("full-blown" copyright protection of computer programs is equal to patent protection because it monopolizes the idea completely); Karjala, *Copyright Protection, supra* note 21, at 933 (computer programs should be protected only against piracy, because greater protection risks giving the copyright owner a patent-like monopoly on the program's functionality).

[113]   *Baker,* 101 U.S. at 102.

[114]   In a properly functioning patent system, a computer program that is based on techniques already in the public domain (and trivial variations thereof) will not get patent protection. Therefore, future programmers will be able to imitate the computer program and make refinements on it.

[115]   489 U.S. 141, 9 U.S.P.Q.2d (BNA) 1847 (1989).

[116]   *Id.* at 144, 9 U.S.P.Q.2d at 1849.

[117]   *Id.* at 168, 9 U.S.P.Q.2d at 1859. The precise holding of *Bonito Boats* would not apply to copyright law since both are federal laws and one cannot preempt the other. Arguably, however, the rationale of *Bonito Boats* applies with equal force to any intellectual property law, federal or state. Indeed, in other contexts, the Supreme Court has expressed its concern about inventors obtaining patent-type protection through other federal intellectual property laws. *See* Qualitex Co. v. Jacobson Prods. Co., 115 S. Ct. 1300, 1304, 34 U.S.P.Q.2d (BNA) 1161, 1163 (1995) (discussing with approval trademark law's functionality doctrine which prevents trademark law from granting patent-type protection to product designs); *see also* Vornado Air Circulation Sys., Inc. v. Duracraft Corp., 58 F.3d 1498, 1509, 35 U.S.P.Q.2d (BNA) 1332, 1341 (Fed. Cir. 1995) (permitting defendant to copy plaintiff's product configuration, since not permitting copying would undermine core patent principles, and permitting copying undermines only peripheral Lanham Act principles). *Qualitex* and trademark law's functionality doctrine are discussed in greater detail *infra* note 177.

[118]   *See also,* Karjala, *Copyright Protection, supra* note 21, at 977 n.5 ("The refusal of the Supreme Court to recognize a copyright-like protection for the 'photocopying' of boat hulls …" in *Bonito Boats* "shows that there is more to the actual implementation of the patent/copyright distinction …" than ease of copying); *cf.* Reichman, *Information Tools, supra* note 97, at 819 (*Feist* and *Bonito Boats* suggest that copyright law should never afford borderline factual and functional works more than "thin" protection against wholesale appropriation of surface expression).

[119]   *Feist Publications,* 499 U.S. at 349-350, 18 U.S.P.Q.2d at 1280.

[120] *Bonito Boats,* 489 U.S. at 146, 9 U.S.P.Q.2d at 1850.

[121] Miller, *supra* note 107, at 1010 n.156.

[122] Karjala, *Copyright Protection, supra* note 21, at 998.

[123] *CONTU Report, supra* note 1, at 61. CONTU's conclusions have been criticized. *See, e.g.,* Samuelson, *CONTU Revisited, supra* note 21, at 699-705 (critiquing CONTU's reasoning and arguing that the CONTU final report is misleading).

[124] Karjala, *Copyright Protection, supra* note 21, at 999-1000 ("By emphasizing the need for case-by-case analysis and failing to provide examples of infringing activity not involving direct copying, CONTU evidently expected courts to consider these four policy goals as technology and judicial knowledge concerning computer programs developed …. There is certainly nothing in the CONTU Report, much less any congressional history, to support the kind of broad copyright protection for program structure or interfaces that Professor Miller believes is appropriate.").

[125] *CONTU Report, supra* note 1, at 60.

[126] *Id.*

[127] *Id.* In section V.C, this paper argues that copyright inhibits the rightful use of computer programs because it does not allow copying of novel but nonobvious aspects of the computer program. In patent law, "rightful use" includes the use of any unpatented aspect of an invention.

[128] *Id.* In section VI.C, this paper argues that copyright blocks dissemination of useful knowledge in computer programs because it permits computer programmers to obtain both copyright protection and trade secret protection for their computer programs.

[129] *Id.* In section V.C, this paper argues that copyright in some instances gives computer programmers too much economic power and undermines the patent law incentive system, because copyright protects any computer program without a showing of non-obviousness.

[130] *Id.* at 71.

[131] *Id.* at 78. As Professor Karjala has noted, nowhere does CONTU give an example of copying that involves nonverbatim copying. Karjala, *Copyright Protection, supra* note 21, at 999.

[132] CONTU Report, *supra* note 1, at 78.

[133] Congress passed without debate the amendments to the Copyright Act that CONTU recommended. The copyright amendments proposed by CONTU were added to H.R. 6933, 96th Cong., 2d Sess. (1980), AN ACT TO AMEND THE PATENT AND TRADEMARK LAWS, which became Pub. L. No. 96-517, 94 Stat. 3028 (1980) (codified at 17 U.S.C. §§ 101, 117 (1994)); *see* H.R. REP. NO. 1307, 96th Cong., 2d Sess. pt. 1 at 23 (1980), *reprinted in* 1980 U.S.C.C.A.N. 6460, 6482. *But see* Midway Mfg. Co. v. Strohon, 564 F. Supp. 741, 750 n.6 (N.D. Ill. 1983) ("it is fair to conclude, since Congress adopted [CONTU's] recommendations without alteration, that the CONTU report reflects Congressional intent"). *See generally* Samuelson, *CONTU Revisited, supra* note 21, at 694 (questioning whether Congress was fully informed of the implications of the decision to make computer programs copyrightable and whether Congress might have acted differently if the information provided to it had been more complete and if other alternatives had been explored by CONTU).

134 17 U.S.C. § 102(b) (1994). *See* Goldstein, *supra* note 108, at 1125 (the presence of section 102(b) in statute implies that courts should only hold liable defendants who have literally copied software and should not hold liable defendants who have only copied functional elements of the software); *see generally* Note, *The Nature of Copyright Analysis for Computer Programs: Copyright Law Professors' Brief Amicus Curiae in* Lotus v. Borland, 16 HASTINGS COMM/ENT L.J. 657 (1994) (Brief Amicus Curiae of copyright law professors in Lotus Dev. Corp. v. Borland Int'l, Inc., 49 F.3d 807, 34 U.S.P.Q.2d (BNA) 1014 (1st Cir. 1995)); Pamela Samuelson, *Computer Programs, User Interfaces, and Section 102(b) of the Copyright Act of 1976: A Critique of* Lotus v. Paperback, 6 HIGH TECH. L.J. 209 (1991) [hereinafter, Samuelson, *Critique*].

135 H.R. REP. NO. 94-1476, 94th Cong., 2d Sess. 52-53 (1976), *reprinted in* ROBERT A. GORMAN AND JANE C. GINSBURG, COPYRIGHT FOR THE NINETIES, 93-94 (1993).

136 *See* David D. Friedman, *Standards As Intellectual Property: An Economic Approach,* 19 U. DAYTON L. REV. 1109 (1994) (copyright paradigm is applied when copying is easy, easily recognized, and independent invention unlikely).

137 Andrew Johnson-Laird, *Reverse Engineering of Software: Separating Legal Mythology from Actual Technology,* 5 SOFTWARE L.J. 331 (1992).

138 The issue of whether verbatim copying should be prohibited is not critical to this paper. This paper is arguing only about the non-literal elements of computer programs; a reader can completely agree with everything this paper argues and still come out one way or the other on the issue of verbatim copying.

139 *See* Karjala, *Copyright Protection, supra* note 21, at 975 ("Initial reservations as to the appropriateness of applying copyright protection to functional works gave way in the 1970s to the view that computer programs … need protection from piracy. Because copyright law protects against copying, copyrights were a reasonable choice for the protection of programs, especially in view of the deficiencies of patent and trade secret law.").

140 This argument is much weaker, however, in the case of non-literal copying. *See* Karjala, *Copyright Protection, supra* note 21, at 985 ("Beyond the vulnerability of code to piracy, no convincing argument has yet been made that distinguishes computer programs from other technological products and leads to a broad scope of copyright protection."); Menell, *supra* note 14, at 1080-81 ("At a minimum, economic analysis calls for protection against literal copying of significant portions of application program code. Otherwise, an imitator could immediately enter the first programmer's market at much lower product development costs. This prospect would discourage innovation and reward waiting. On the other hand, protecting code much beyond prohibiting literal copying would impose significant monopoly costs and inhibit the development of subsequent innovations …. The costs of extensive protection further suggest that the line should be drawn close to literal copying."). Oddi, *supra* note 14, at 396 (beyond literal copying, a narrow scope of protection is economically justified, because non-literal copying is difficult, time-consuming, and expensive).

141 *See* Oddi, *supra* note 14, at 450 ("A word of caution may also be voiced concerning the adoption of sui generis systems of protection for so-called hybrid technologies, if anything is to be learned for the less-than-inspiring history of the Semiconductor Chip Protection Act."). The merits of passing a sui generis form of protection for computer programs have been hotly debated. For articles in favor of sui generis protection, see *Manifesto, supra* note 89. For articles against sui generis protection, see Oddi, *supra* note 14, at 444-53 ("hybrid" nature of computer programs means they should be protectable by both patent and copyright); *see also* Paul Goldstein, *Comments on A Manifesto Concerning the Legal Protection of Computer Programs,* 94 COLUM. L. REV. 2573 (1994) (anticipating and critiquing possible attacks on *Manifesto)* and Peter S. Menell, *The Challenges of Reforming Intellectual Property Protection for Computer Software,* 94 COLUM. L. REV. 2644 (1994) (challenging the Manifesto's proposals on three separate grounds).

142 Miller, *supra* note 107, at 1004.

143 *See* Karjala, *Copyright Protection, supra* note 21, at 1001-03 (criticizing the logic of Professor Miller's comment).

144 The reason that judges and juries are willing to give broad protection to the nonliteral elements of the program code may be related

to the fact that most of the work of creating a program goes into its nonliteral elements. *See Whelan Assocs.,* 797 F.2d at 1231, 1237, 230 U.S.P.Q. at 487, 491 ("The evidence in this case shows that Ms. Whelan spent a tremendous amount of time studying Jaslow Labs, organizing the modules and subroutines for the Dentalab program, and working out the data arrangements, and a comparatively small amount of time actually coding the Dentalab program …. The rule proposed here, which allows copyright protection beyond the literal computer code, would provide the proper incentive for programmers by protecting their most valuable efforts ….").

[145]   Computer Assocs. Int'l, Inc. v. Altai, Inc., 982 F.2d 693, 712 (2d Cir. 1992).

[146]   Additional theories include the "reward-by-monopoly" theory (which views patents as prizes rather than as economic incentives) and the "natural law" theory. STUDY OF THE SUBCOMMITTEE ON PATENTS, TRADEMARKS AND COPYRIGHTS OF THE SENATE JUDICIARY COMMITTEE, 85th Cong., 2d Sess., AN ECONOMIC REVIEW OF THE PATENT SYSTEM, STUDY NO. 15, 21 (Comm. Print 1958) (written by economist Fritz Machlup). Additionally, Edmund Kitch has also explained patent law in terms of a "prospecting theory." Edmund W. Kitch, *The Nature and Function of the Patent System,* 20 J. LAW & ECON. 265 (1977). The most prominent theories, however, are the monopoly-profit incentive theory and the exchange-for-secrets theory. *See* Kewanee Oil Co. v. Bicron Corp., 416 U.S. 470, 480-81, 181 U.S.P.Q. (BNA) 673, 678-79 (1974); Robert P. Merges, *Uncertainty and the Standard of Patentability,* 7 HIGH TECH. L.J. 1, 65 (1992) [hereinafter Merges, *Uncertainty*].

[147]   Robert P. Merges, *Commercial Success and Patent Standards: Economic Perspectives on Innovation,* 76 CALIF. L. REV. 803, 811 (1988) [[[hereinafter Merges, *Commercial Success*].

[148]   Merges, *Uncertainty, supra* note 146, at 65.

[149]   Machlup, *supra* note 146, at 21. Many commentators have distinguished between inventions and innovations (i.e., practical development of inventions). I will not draw this distinction, since it does not affect my basic argument.

[150]   Edmund W. Kitch, Graham v. John Deere Co.: *New Standards for Patents,* 1966 SUP. CT. REV. 293, 301.

[151]   Machlup, *supra* note 146, at 21.

[152]   *Id.*

[153]   *Id.*

[154]   Kitch, *supra* note 150, at 302.

[155]   Machlup, *supra* note 146, at 21.

[156]   *Id.*

[157]   Kitch, *supra* note 150, at 302-03.

[158]   Machlup, *supra* note 146, at 21.

[159]   *Id.*

[160]   The natural rights and rewards rationales are more important in copyright than in patent, nevertheless, they are still secondary. *Feist Publications,* 499 U.S. at 349, 18 U.S.P.Q.2d at 1279 ("The primary objective of copyright is not to reward the labor of authors, but [t]o 'promote the Progress of Science and useful Arts.'").

[161]   *See* William M. Landes and Richard A. Posner, *An Economic Analysis of Copyright Law,* 18 J. LEGAL STUD. 325 (1989).

[162]   *Id.* at 328-329.

[163]   *See* John S. Wiley, Jr., *Copyright at the School of Patent,* 58 U. CHI. L. REV. 119 (1991) (patent and copyright law share the common objective of rewarding innovation to encourage the creation of new information).

[164]   35 U.S.C. § 102 (1994).

[165]   35 U.S.C. § 103 (1994).

[166]   *Graham,* 383 U.S. at 11, 148 U.S.P.Q. at 464 (nonobviousness solves the problem of identifying inventions that would have been disclosed or devised but for the inducement of a patent); Kitch, *supra* note 150, at 301, 303.

[167]   Kitch, *supra* note 150, at 301.

[168]   *Graham,* 383 U.S. at 11, 148 U.S.P.Q. at 465.

[169]   Kitch, *supra* note 150, at 301 (a patent should not be granted for an innovation unless the innovation would have been unlikely to have been developed absent the prospect of a patent, and the non-obviousness test makes an effort to sort out those innovations that would not have been made absent a patent system); *see also* Atlantic Works v. Brady, 107 U.S. 192, 200 (1882) ("It was never the object of [the patent] laws to grant a monopoly for every trifling device, every shadow of a shade of an idea, which would naturally and spontaneously occur to any skilled mechanic or operator in the ordinary progress of manufactures.").

[170]   Merges, *Uncertainty, supra* note 146, at 33.

[171]   Kitch, *supra* note 150, at 303.

[172]   An alternative explanation for the nonobviousness requirement under the exchange-for-secrets rationale is that the nonobviousness requirement "guarantees that a minimum quantum of information is disclosed in exchange for a patent." Merges, *Uncertainty, supra* note 146, at 2. This explanation shares the same common theme that society does not want to award patents for trivial inventions.

[173]   Kitch, *supra* note 150, at 302-303.

[174]   *Id.* at 303.

[175]   *Id.* at 301, 303.

[176]   *Id.* at 301.

[177] The close link between functionality and effective competition (and therefore between functionality and the high social cost of granting patents) is also demonstrated by the functionality doctrine in trademark law. The functionality doctrine prevents trademark law from inhibiting legitimate competition by allowing a producer to control a useful product feature. *Qualitex,* 115 S. Ct. at 1304, 34 U.S.P.Q.2d at 1163. According to the doctrine, trademark law will protect only product features which are not functional. *Id.* A product feature is functional, and therefore unprotectable, "if it is essential to the use or purpose of the article or if it affects the cost or quality of the article." *Id.* The rationale of the doctrine is that "[i] t is the province of patent law, not trademark law, to encourage invention by granting inventors a monopoly over new product designs or functions for a limited time …, after which competitors are free to use the innovation." *Id.* The concern is that if a product's functional features could be used as trademarks, a monopoly over such features could be obtained without regard to whether they qualify as patents and could be extended forever. *Id.*

[178] In a properly functioning patent system, the costs to society of these anticompetitive effects are offset by the benefits of the new invention.

[179] *See* Wiley, *supra* note 163, at 143 ("If a patent is not necessary to induce an invention, it can harm consumers. If adequate substitutes are not available, an unneeded patent causes the price of its subject good to rise from a competitive cost-based level to a monopolistic one. The patent gives its owner the power to avoid competition and to charge what the traffic will bear."). For example, assume that there are an infinite number of methods for a device to achieve some result. However, there are only one or two "best" methods. After these two best methods, each subsequent method gets progressively less effective and less efficient. The tenth method is the last method that is commercially practicable; a manufacturer cannot use the eleventh best method and compete effectively with the competitor who is using the best method. Of these ten methods, five are patented (or are patentable once discovered) and five are in the public domain. As to the five that are patented, society has already decided that knowing about these inventions and eventually having access to them is worth the temporary reduction in competition. As to the five methods that are unpatentable, however, it is especially important to keep these in the public domain, since there are only a limited number of commercially practicable methods available. If the five alternative methods are taken out of the public domain, there will be a reduction in competition without an adequate offsetting benefit in the form of an invention. *Cf. In re* Morton Norwich Prods., Inc., 671 F.2d 1332, 213 U.S.P.Q. (BNA) 9 (C.C.P.A. 1982) (in determining whether a product feature is "functional," and therefore unprotectable under trademark law, a court should consider inter alia the availability of alternative designs and the cost of manufacturing those alternative designs as compared to the applicant's feature).

[180] *See Mitchell Bros.,* 604 F.2d at 859-60, 203 U.S.P.Q. at 1048-49 ("Congress has power to grant copyrights even for individual works that cannot be shown to promote the useful arts so long as Congress in its exercise of its copyright power generally promotes the constitutional goal…. [U]nlike patents, the grant of a copyright to a nonuseful work impedes the progress of the sciences and the useful arts only very slightly, if at all ….").

[181] *See* Wiley, *supra* note 163, at 147 (copyright has correctly rejected simple importation of patent law's requirement of nonobviousness, because copyright does not aim to stimulate the creation of things that are not conceptually obvious).

[182] *Graham,* 383 U.S. at 17, 148 U.S.P.Q. at 467.

[183] The secondary factors include commercial success, long felt but unsolved needs and failure of others. *Id.*

[184] *See* Bleistein v. Donaldson Lithographic Co., 188 U.S. 239, 251 (1903) (finding it dangerous for persons trained only in the law to be final judges of art).

[185] 35 U.S.C. § 101 (1994).

[186] *Bonito Boats,* 489 U.S. at 146, 9 U.S.P.Q.2d at 1850.

[187] *See* Karjala, *Copyright Protection, supra* note 21, at 979-80 ("In the case of technological products, society has drawn the social policy balance at a different point than it has for traditional works of authorship. Society believes that to grant intellectual property rights in ordinary engineering advances would hinder the development of more products than it would encourage. Hence the

'nonobviousness' requirement of patent law … furthers the social policy goal of promoting both original and improved technological products.").

188   *Bonito Boats,* 489 U.S. at 151, 9 U.S.P.Q.2d at 1852.

189   *Id.*

190   *Id.; see also* Aronson v. Quick Point Pencil Co., 440 U.S. 257, 262, 201 U.S.P.Q. (BNA) 1, 4 ("[T]he stringent requirements for patent protection seek to assure that ideas in the public domain remain there for the free use of the public").

191   *Bonito Boats,* 489 U.S. at 149, 9 U.S.P.Q.2d at 1851 (holding creation of a monopoly in publicly available knowledge, or trivial extensions thereof, injures the public by removing existing knowledge from public use); *see also* Kenneth W. Dam, *The Economic Underpinnings of Patent Law,* 23 J. LEGAL STUD. 247 (1994) ("[T]he nonobviousness requirement plays an important prophylactic role. It sharply limits littering of the innovation landscape with land mines consisting of patents on what those skilled in the trade would assume to be in the public domain.").

192   *Bonito Boats,* 489 U.S. at 146, 9 U.S.P.Q.2d at 1850.

193   *See Bonito Boats,* 489 U.S. 141, 9 U.S.P.Q.2d 1847.

194   Merges, *Uncertainty, supra* note 146, at 14 (nonobviousness requirement designed to "maintain a *penumbra* around the stock of known devices, techniques, etc., insuring that trivial extensions from what is known will not be granted property rights") (emphasis added).

195   *Computer Assocs.,* 982 F.2d at 721 (The *Altai* test is at 706-11).

196   *Id.* at 710.

197   *Bonito Boats,* 489 U.S. at 150, 9 U.S.P.Q.2d at 1852.

198   *Id.*

199   35 U.S.C. § 112 para. 1 (1994).

200   *Id.*

201   Under the monopoly-profit incentive rationale, society still gets the benefit of the invention. But *both* rationales are important in patent law, and allowing the computer programmer to get trade secret protection while also giving her a property right thwarts a primary goal of patent law--disclosure-- as embodied in the section 112 disclosure requirements.

202   Spectra-Physics, Inc. v. Coherent, Inc., 827 F.2d 1524, 1532, 3 U.S.P.Q.2d (BNA) 1737, 1742 (Fed. Cir. 1987).

203   *See* 35 U.S.C. § 112 para. 1 (1994).

[204]   *See* CHISUM, *supra* note 64, § 7.05[1][a] (1994) (court decisions explain the best mode requirement in terms of a disclosure exchange or "quid pro quo" theory).

[205]   *See In re* Nelson, 280 F.2d 172, 184, 126 U.S.P.Q. 242, 253 ("There always exists, on the part of some people, a selfish desire to obtain patent protection without making a full disclosure, which the law … must guard against. Hence section 112 … does not permit an inventor to disclose only what he knows to be his second-best embodiment, retaining the best for himself.").

[206]   In spite of the fact that society will not have access to the invention itself for twenty years, society still wants to know how the invention works *today.* This is because the underlying knowledge embodied in the invention may be put to use in other applications which the inventor did not think of and did not claim. Hence, aside from the fact that the patent disclosure teaches how the invention works, the disclosure also has independent research value today. At least one commentator views the latter benefit as the more important of the two. *See* CHISUM, *supra* note 64, § 7.05[1][a].

[207]   Higgins, *supra* note 1, at 69 (quoting Committee Reports, 1989 A.B.A. Sec. Pat., Trademark & Copyright L. 394-96).

[208]   Samuelson, *CONTU Revisited, supra* note 21, at 710 (until computer programs, copyrighted works that were sold to the public communicated the ideas they contained, and the value of the work was in its expression).

[209]   Karjala, *Copyright Protection, supra* note 21, at 944 ("All other copyright-protected works [besides computer programs] carry their ideas and other unprotected elements on their face."); Samuelson, *CONTU Revisited, supra* note 21, at 711 (an explicit statement by the Constitution and the federal copyright statute that "disclosure is either a prerequisite to, or a goal of, federal copyright protection" was not necessary until computer programs). Note that patent claims are another disclosure requirement. 35 U.S.C. § 112 (1994). In patent law, claims serve to reduce the high social cost of granting patents, i.e., because claims give the public notice regarding the scope of the inventor's rights, and facilitate copying of unpatented or unpatentable features by requiring the inventor to distinguish the patentable from the unpatentable. Copyright lacks this disclosure as well, however. Of course, part of the reason is the prohibitively large number of works that would have to be reviewed. However, the fact that the subject matter of copyright is not functional, and therefore the social cost of granting copyrights is low, certainly also plays a role.

[210]   Samuelson, *CONTU Revisited, supra* note 21, at 705 ("A computer program in machine-readable form is simply a bewildering string of thousands or millions of high and low voltage electrical impulses. Machine-readable programs reveal neither the ideas they embody, nor the manner in which the ideas are expressed."); *see also CONTU Report, supra* note 1, at 28 (Hersey, Comm'r, dissenting) ("[A]dmitting [computer programs] to copyright would mark the first time copyright had ever covered a means of communication, not with the human mind and senses, but with machines.").

[211]   *See* Samuelson, *CONTU Revisited, supra* note 21, at 710 ("The problem is a new one. Until the advent of computer programs, copyrighted works that were sold to the public communicated the ideas they contained. Unpublished works that might have claimed copyright protection had little or no commercial value. Now it is possible both to publish a work and keep it secret, and keeping it secret is part of the way the commercial value of the work is maintained. Computer programs in machine-readable form are the first type of copyrightable work to have a major commercial value *without* disclosure. With computer programs, unlike traditional copyrighted works, the value of the program is not in its expression but in the underlying code."). *Id.*

[212]   Oddi, *supra* note 14, at 370-71 ("Copyrighted computer programs may be made publicly available only in object (machine readable) code…. [The object code] provides limited information concerning the underlying program ideas even to those skilled in the art. Indeed, it may require considerable time, effort and expense to decompile object code to source code by reverse engineering ….") (footnotes omitted). *See also* Daugherty, *supra* note 4, at 152 ("Reverse engineering of software is not a routine conversion; rather, it is a very laborious, additive process that requires programmers to supply their own explanatory information because no higher-level information remains in the executable version of the program …. Reverse engineering and analysis of a computer program essentially require the reinvention of parts of the wheel. This process often is more difficult than writing a program from scratch."). *Id.*

[213]   Mark Gebhardt, Comment, *Patent Law--Patent Law Policy and the Best Mode Requirement:* Randomex, Inc. v. Scopus Corp., 14 J. CORP. L. 1015, 1025 (1989) ("The inventor must not conceal the best mode, because concealment prevents the public from taking advantage of the undisclosed information. The public should not be asked to engage in 'tedious and expensive

experimentation' to get the information that should have been disclosed initially. This concealment would not be consistent with the full disclosure required to promote the progress of the arts as mandated by the Constitution."). *Id.*

[214]   37 C.F.R. § 202.20(c)(2)(vii)(A)(*1*) (1994).

[215]   37 C.F.R. § 202.20(c)(2)(vii)(A)(*2*) (1994). The availability of both trade secret protection and copyright protection for the same computer program is not accidental. CONTU explicitly contemplated that the fact that a computer program is copyrighted should not affect whether it is also protectable by trade secret law. *CONTU Report, supra* note 1, at 70.

[216]   *Spectra-Physics,* 827 F.2d at 1537, 3 U.S.P.Q.2d at 1746.

[217]   Consolidated Aluminum Corp. v. Foseco Int'l Ltd., 910 F.2d 804, 809, 15 U.S.P.Q.2d (BNA) 1481, 1484 (Fed. Cir. 1990).

[218]   *Id.* at 810, 812, 15 U.S.P.Q.2d at 1485, 1487.