THE RECENT EVOLUTION of copyright law in the United States is particularly rich in contradictions because of the pressure exerted by new information technologies and by the requirements of an information economy— that is, an economy based in the progressive commodification of information. In so far as this process is mediated through the law relating to intellectual property, it exacerbates the contradiction between the principles of limited monopoly rights and the public availability of ideas.

The increasing extension of capitalist relations of production to the forms of intellectual work (both through the integration of workers into an industrial mode of intellectual production, and in the consequent breaking down of an unmediated relation between labour and product) has made ever less tenable those categories of copyright law, such as ‘author’, ‘work’, ‘copy’, ‘expression’, etc, which have been derived from a romantic aesthetic of free creativity. Indeed, there is some pressure now from right-wing jurists for an even fuller integration of copyright law into the service of the market, through a dismantling of the fundamental doctrinal distinction between ideas and expressions. Hopkins argues, for example, that the law at present provides no protection for such things as ‘a game concept, the system that goes into legal papers, or the ideas comprising the methodology or processes adopted within a computer program’¹, and, more generally, that ‘the very fact that ideas are free creates a disincentive to the development of ideas. It is only when people can fully exploit the benefits of their ideas and receive pro-
tection in these endeavours that they will donate the product of their work process to the public domain.\textsuperscript{2}

American copyright law as it now stands protects (1) expressions of ideas in (2) works of authorship fixed in (3) copies or phonorecords. The ‘copy’ thus stands at the end of a double set of substance/expression relations, and it may in turn form the starting point for the production of a further chain of materialisations of the ‘work’.

Title 17 of the US legal code defines ‘copies’ as ‘material objects, other than phonorecords, in which a work is fixed by any method now known or later developed, and from which the work can be perceived, reproduced, or otherwise communicated, either directly or with the aid of a machine or device. The term “copies” includes the material object, other than a phonorecord, in which the work is first fixed.’\textsuperscript{3} In the case of a painting, for example, this object is what we would usually think of as the ‘original’; the ‘original’ – the painting, the manuscript, the master tape – is already a ‘copy’ of the (immaterial) ‘work’. The ‘work’ that is copied thus has no separate material form, and no existence prior to the moment of its fixation in the copy; but as an elaborated expression it is also different in kind from the ‘ideas’ it expresses. It has a peculiar mode of existence which is neither concrete nor fully abstract.

What the disjunction between work and copy here expresses is essentially the existence of two distinct sets of property rights. Rights of ownership in the ‘material object’, which a painter sells to the purchaser of a painting, do not necessarily carry with them the rights to make and sell reproductions of the object. The law does not think the difference between work and copy as a temporal disjunction, because of the legal fiction that the ‘creation of the work takes place at the moment when it is first fixed in a copy or phonorecord’; but the disjunction does mean that the ‘fixing’ of the work need not be singular: ‘the same work may . . . be embodied in a range of “copies” including periodicals, computer punch cards, microfilm, tape recordings, and the like.’\textsuperscript{5}

Neither work nor copy, however, can be defined in terms of material or structural self-identity. Rather, they are defined in relation to an intentional act, an act of human will. Thus proof of copying is not given by the simple identity of two works, since in addition a copyright holder must establish that a deliberate act of copying has taken place, or at least establish its physical possibility and the likelihood of its occurrence. Conversely, if it can be demonstrated that an independent act of creation has taken place, then two identical works may each be entitled to copyright protection. Hence Judge Learned Hand’s famous dictum in 

\textit{Sheldon v Metro-Goldwyn Pictures Corp} (1936):

\textit{Borrowed the work must indeed not be, for a plagiarist is not himself pro tanto an ‘author’; but if by some magic a man who had never known it were to compose anew Keats’s Ode on a Grecian Urn, he would be an ‘author’, and, if he copyrighted it, others may not copy that poem, though they might of course copy Keats’s.}
Although an ‘author’ may not be a ‘plagiarist’, s/he is not defined as a pure originator. The ‘productivity’ component of fair use doctrine clearly recognises that textual production is a cumulative process, necessarily involving a relation to the body of preceding texts; and certain classes of work – such as a ‘translation, musical arrangement, dramatization, fictionalization, motion picture version, sound recording, art reproduction, abridgement, condensation’, or ‘a work consisting of editorial revisions, annotations, elaborations, or other modifications’ may be classified both as a ‘derivative work’ and as an ‘original work of authorship’ with entitlement to copyright protection.

These distinctions are already finely drawn; but the development in the twentieth century of mechanical and electronic technologies which multiply the number and form of the mediations involved in reproduction has made the distinction between work and copy even more problematical. One key case, which has had continuing consequences for the status of computer software, is the 1908 White-Smith Music Publishing Co v Apollo Co, where the court refused to recognise player pianos and the music rolls used to reproduce musical compositions as producing a ‘copy’ of those compositions. At issue was partly the question of whether perforations in a music roll could be considered an ‘intelligible notation’, but also the very possibility of distinguishing between a tune (an organisation of sounds) and its physical embodiment in sounds (the ‘copy’). In rejecting this possibility the court found that the organisation of sounds produced by the player piano was the tune itself, the ‘original work of authorship’, rather than a secondary copy or embodiment of it.

Part of the difficulty with the distinction between work and copy is that the categories are purely positional. Thus the performance of a work can in its turn become eligible for copyright – that is, it can itself be considered an original work. One area of particular complexity in this respect is broadcast radio and television, where multiple realisations of a work may occur – in the studio, in transmission, in retransmission, and in the home or other place of reception. It is the retransmission process that has raised the most difficult, because commercially most significant, problems. Cable systems, like VCRs, have the ambivalent status of being both a reception and a retransmission apparatus, and while the 1968 Supreme Court decision on cable television upheld the operators’ claim merely to be enhancing a signal, the imposition of royalties in the 1976 Copyright Act implicitly recognises that an act of reproduction does take place in cable retransmission.

If the fixing of the ‘work’ in the ‘copy’ is capable of taking a number of materially distinct forms, then it may be the case that these forms do not physically resemble each other or the ‘work’. Copying, that is, need not imply iconic likeness. Thus an oral text may be copied in written form; and written texts may be reproduced as a set of electronic impulses, or in the medium of film. It is at this point that the distinction between work and copy shades off into that between ideas and their expression. This is clearly evident in the case of those practical schemata that we might call
scores', where an act of realisation can be thought either as a copy of a work or as a simple use of unprotected ideas. The following of a recipe in cooking a meal, for instance, could be thought of as a performance equivalent in kind to the following of a musical score, but only the latter is protected as a ‘work’; the recipe is unprotected because it is categorised as an ‘idea’ (a ‘method’ or an ‘art’). Similarly, architectural blueprints have an ambivalent status as either ideas or the expression of ideas. In the USA, the construction of a building in accordance with a design is understood as an expression of the ideas contained in the design; there is, therefore, little protection for anything but the material form of the design, except in the case of decorative additions. In the UK, by contrast, the building may be thought of as a copy of the blueprint, and this means that the design is given much greater solidity as an ‘expression’ (and so as a ‘work’ that can be protected).

The basic purpose of copyright law is at once to restrict the completely free circulation of intellectual products, and to ensure the free accessibility of any ‘idea, procedure, process, system, method of operation, concept, principle, or discovery’ – that is, of any ‘intellectual conception apart from the thing produced’. The distinction is clearly problematical, however, both in its attempt to protect expressions of ideas without implicating the ideas themselves, and in its implicit attribution of an ontological status to the two terms. Judge Learned Hand put concisely the dilemma of the necessity and the impossibility of the distinction in his formulation of an abstraction test:

Upon any work, and especially upon a play, a great number of patterns of increasing generality will fit equally well as more and more of the incident is left out. The last may perhaps be no more than the most general statement of what the play is about, and at times might consist only of its title; but there is a point in this series of abstractions where they are no longer protected, since otherwise the playwright could prevent the use of his ‘ideas’, to which, apart from their expression, his property is never extended. Nobody has ever been able to fix that boundary, and nobody ever can.

The corollary that Learned Hand doesn’t draw here is that every level of abstraction functions as the ‘idea’ in relation to all less abstract levels; and that any level can thus function either as that of ‘ideas’ or of ‘expression’, depending on its relation to other levels of abstraction.

This fundamental aporia gives rise to recurrent ambiguities. Musical works, for example, can exist in the form either of written notation or of a ‘phonorecord’, that is, the fixation of a performance. The latter can represent two distinct types of copyrightable work: a musical composition, or a particular embodiment of the musical composition in sound. The performance can thus either be equivalent to a notation, or it can be the realisation of a notation. In the case of the musical composition, what is copyrightable is an organisation of sounds, not a particular realisation of them. ‘Sounds’ are thus understood as immaterial,
abstract, and it is arguable that, in so far as the terms retain any meaning, copyright here resides in an ‘idea’ rather than an ‘expression’. In the case of the performance, by contrast, it is a particular material realisation of these sounds (but not the ‘tangible medium of expression’) which is subject to copyright – and there can thus be multiple copyrights in authorised performances of a single work. The concepts of ‘sound’ and ‘performance’ can therefore represent both a content plane and an expression plane. A similar ambiguity holds in relation to pantomimes and choreographic works, which ‘can be fixed in any tangible medium of expression such as film, video tape, dance notation (Laban system), diagram, or verbal description’¹¹, and where, as well as being equivalent forms of notation of an ‘idea’, any one of these could act as the ‘expression’ or realisation of any other.

Literary works are somewhat more amenable to the distinction between ideas and expressions than are nonverbal scores, since the operations of paraphrase and summary which underlie it originate in literary and philosophical pedagogies. Here the relevant distinctions are between an outline or theme or locale or generic plot structure (the scène à faire), on the one hand, and a ‘distinctive treatment’ of these on the other.¹² Characters may be afforded protection if they exist in visual or graphic form and can be held to embody both physical and conceptual characteristics, but literary characters are usually held to be an abstractable element of content. The test used in the 1954 ‘Sam Spade’ case was that ‘unless the character really constitutes the story being told’ and is not ‘only the chessman in the game of telling the story he is not within the area of protection afforded by the copyright’¹³. In theoretical terms the distinctions being made here are untenable; but what they seem to reflect is an identification of ‘ideas’ with verbal structure and of ‘expression’ with the iconic or the visual.

Copyright doctrine does at times recognise that the distinction between ideas and expression cannot be universally drawn. In cases involving such things as blank accounting forms which are an integral part of a book-keeping system, the principle is that where an ‘art’ (a system, an idea, a method) cannot be used without copying, then copying for such ‘use’ is no infringement (although copying an expression for the purpose of ‘explanation’ would be); ‘where the idea and its expression are indistinguishable, this inseparability will permit copying of the expression. Otherwise “protecting the expression in such circumstances would confer a monopoly of the idea . . . free of the conditions and limitations imposed by the patent law.” ’¹⁴ This should mean, however, that no copyright protection can be afforded where ideas and expression fully merge. Certainly there has been a ruling to this effect in the case of computer software¹⁵; and it is arguable that it would apply to all iconic expressions, and certainly to those which are non-figurative (this is perhaps the reason why such expressions can receive additional protection as ‘works of art’).

The case of cartography can usefully help extend the analysis of these
categories. Here the problem is that the more accurate maps become, the more they will resemble each other, and it would seem, on the face of it, difficulty to grant copyright to two more or less identical maps. A number of court decisions since the last war therefore began to introduce the criterion of novelty in order to deny copyright to maps.  

Copyright doctrine requires, however, only that works of authorship be original; and this is explicitly distinguished from novelty. The criterion of originality demands no more than that the work display 'something irreducible, something which is one man's alone.' This means that what is protected is not distinctiveness of expression – not an inherent difference from other expressions – but only (as with the text that reproduces, without copying, the 'Ode on a Grecian Urn') whatever distinctiveness derives from the originality of an act of authoring.

Authorship as origin is, then, the most fundamental category of copyright law, in relation to which all other categories are secondary. It is the principle that founds both the work and the copy in their respective acts; both the idea and its expression. But this principle in turn requires further analysis.

The concepts of work and author are in a tautological relation to each other. A work of authorship is anything which is the product of an author, whereas "author", in a constitutional sense, means "he to whom anything owes its origin; originator; maker." This tautology is not purely uninformative, however, because it means that a work can always be traced back to an originary principle, and that it is this principle which defines the specificity of the work. Thus various judicial decisions have held that authorship implies that there has been put into a production something meritorious from the author's own mind; that the product embodies thought of the author, as well as the thought of others; and that it would not have found existence in the form presented, but for the distinctive individuality of mind from which it sprang.

Authorship is thus a general principle of differentiation; but because this principle can only readily be grasped in terms of differentiations between works, the concept of originality has been defined in two slightly different ways. In the first, the 'something irreducible' that marks originality is located in the work itself; the law is interpreted as making a minimal demand for something more than 'merely trivial' variation to distinguish the work from other works. Because this is a minimal requirement, however, 'copyrighted matter need not be strikingly unique or novel, and any distinguishable variation resulting from an author's independent creative effort will suffice.' Thus slight changes in appearance from the products of competitors have been held sufficient to attract copyright protection to dolls or stuffed animals, or to a sketch based on Paddington Bear. Moreover, the 'distinguishable variation' need not even be perceptible to an untrained observer. The Court in Gracen v Bradford Exchange (1983) commented that 'artistic originality may inhere in a detail, a nuance, a shading too small to be apprehended by a judge'; and further that
since a contemporary school of art known as ‘Super Realism’ attempts to make paintings that are indistinguishable to the eye from colour photographs, and these paintings command high prices, buyers must find something ‘original’ in them. The court further noted that since much Renaissance painting is meticulously representational, it is therefore in a sense (but not an aesthetic sense) less ‘original’ than Cubism or Abstract Expressionism.  

But of course the concept of originality does not depend on the relation between signifier and signified; and this reading seems to me to demonstrate the limits of this first line of argument.

The second way of defining originality is without reference to the status of the product. Whale puts it this way: ‘Originality is not to be equated with the creation of something which had not hitherto existed; it is the word used to describe the causal relationship between an author and the material form in which a work is embodied.’ This definition of originality as a causal relationship has the advantage of being able to explain certain apparent anomalies in copyright law, above all the importance given to the moment and the process of fixation – of material realisation – rather than the moment and process of creation. (Thus, for example, ‘the “author” of a photograph is the owner of the film upon which it is taken; and if a musician composes an impromptu tune which another records, it is the person upon whose tape the recording is made who becomes first owner of copyright in the sound recording.) It helps explain, too, the distinction made in relation to the separate copyright category of the ‘work of art’, which requires both originality and ‘some creative authorship in its delineation or form’, where, as Nimmer puts it, ‘creativity refers to the nature of the work itself, originality refers to the nature of the author’s contribution to the work.’

This conception of originality is at once broader, in that it refers to persons other than the ‘creator’ of the work, and narrower, in that it excludes the nature of the work itself from consideration except in so far as this is the effect of its origin. Again, however, the concept can be understood in two rather different ways, reflecting a fundamental ambiguity in the social function of copyright law. These are, briefly, in terms of an investment of capital, or of an investment of labour.

On the one hand, ever since its origins in the 1709 Statute of Queen Anne, which protected the commercial exploitation of printed books, copyright law has vested the right of reproduction in copyright owners rather than directly in authors. With the industrialisation of the production of information the non-coincidence between the two has become commercially crucial. Cornish notes that the British Copyright Act of 1911 gave the producers of sound recordings their own exclusive right to prevent reproductions of their recordings (and, as the courts later held, also to prevent public performances of them). The right was indiscriminately labelled copyright, even though it was conferred, not upon the executant artist whose per-
formance was recorded, but upon the business which organized the recording.\textsuperscript{27}

And Brecht has written extensively on the subordination of the ‘author’ and the author’s property rights to the economic requirements of the film industry, in such a way that the representative of capital, the producer, effectively takes over the author function for legal purposes.\textsuperscript{28}

On the other hand, copyright doctrine has often taken the approach of directly protecting an investment of labour rather than the work which is the ostensibly protected object. This has been the case, for example, with works such as computer databases and compilations where there is no ‘organisation of ideas’ to protect. Thus the Court in National Business Lists v Dun and Bradstreet, Inc (1982) decided that compilations such as Dun and Bradstreet’s have value because the compiler has collected data which otherwise would not be available. The compiler’s contribution to knowledge normally is the collection of the information, not its arrangement. If his protection is limited solely to the form of expression, the economic incentives underlying the copyright law are largely swept away.

Similarly, in the case of cartography the possibility of protection of virtually identical maps is seen to reside in the labour of production which has gone into them. There is indeed debate about whether consulting and conflating a number of previous maps constitutes an appropriate kind and degree of work, or whether a cartographer must actually undertake research in the field; but in either case the category of originality is reduced to labour. As Whicher writes: ‘when the creative process is re-examined by the wisdom of judicial hindsight, it is, like a conjuror’s trick that has been explained to the children, almost always a disappointment. There is, we discover, no magic to it after all. It’s only work’.\textsuperscript{29}

What this might mean is that the concept of originality, this most fundamental category of the copyright system, can be rethought in materialist terms. The ‘causal relationship between an author and the material form in which a work is embodied’ would be an investment of labour power. Understood as work, the concept of authorship could then be freed of its exclusively individualistic connotations: the author function (which would be a moment in a system of production) could equally be performed by a team, by a production crew, by a group of collaborators; and the ideology of free creativity could be displaced, but in terms that are derived internally (if critically) from the existing structure of copyright law.

\textbf{II}

That a set of economic categories, and the ideological contradictions attendant upon them, can so readily be derived from the structure of copyright doctrine bears witness to its practical closeness to economic


\textsuperscript{29} John F Whicher, op cit, p 295.
processes and economic contradictions. The specificity (the ‘autonomy’) of copyright doctrine is not opposed to, but is precisely the effect of, its continuous mediation of antagonistic economic and social interests.

The most acute provocation to the coherence of copyright theory has come in the last two decades from the development of electronic information storage and retrieval systems which, in vastly multiplying the possibilities of deployment of complex bodies of information, have similarly expanded the industrial importance of the control of information and have increased the stakes in its ownership and protection.

There are significant difficulties, however, in applying traditional conceptions of intellectual property to electronic systems. Most information stored electronically may, for example, never be expressed in a permanent fixed form but will be used and stored in a form which, like a television display, is transient and would therefore not attract copyright protection. Information stored and modified within an electronic network with multiple access may be shaped and reshaped in such a way that it is difficult to determine an ‘author’. Programs may exist in a form which is not intelligible to a human user, but is designed only for interaction with a machine (and machines may in turn have the capacity to modify the program). And information in electronic form may be ‘stolen’ by means of a transfer which involves no alienation of property; proof of theft may therefore be extremely difficult, or it may be trivial, if what is stolen is deemed to be, say, a print-out rather than the information it contains – which may in any case have no easily assignable value. Moreover, there is a problem with the apparent solution to this, which is (as Posner and other ‘law and economics’ theorists do) to understand intellectual property and its protection by direct analogy with tangible property. Any such solution plays down the contradiction between rights of exclusive use and the social interest in keeping information in the public domain.

Some of these difficulties are resolved by the 1976 Copyright Act’s careful wording of the fixation requirement to protect ‘original works of authorship fixed in any tangible medium of expression, now known or later developed, from which they can be perceived, reproduced, or otherwise communicated, either directly or with the aid of a machine or device’ and by the amendment of the Act’s definitional section in 1980 by the Computer Software Protection Act to include a definition of a computer program as ‘a set of statements or instructions to be used directly or indirectly in a computer in order to bring about a certain result’. In addition, the House Report on this legislation made it clear that, as provided for in Section 102(b), which bars copyright protection for ideas, procedures and methods of operation, ‘copyright in a computer program does not extend protection to the methodology or processes adopted by the programmer. Only the expression adopted by the programmer is protectible, and not the methods or processes embodied in the program.’
Nevertheless, these stipulations still leave a number of obstacles to interpretation. These concern, in particular, the question of whether protection should be available for programs in object code (that is, programs written in a form which translates a programming language, or source code, into a machine-readable form), and for the operating programs which control the hardware functions, and which would, therefore, seem to be equivalent to machine parts and so eligible for patent rather than copyright protection; but which are in practice often hard to distinguish from the application programs that produce copyrightable output.

There are two contradictory arguments, which don’t quite meet head-on, in play here. On the one hand, programs in object code and application programs are thought to be fully protected by the Act’s use of the word ‘directly’ to describe the use of instructions in a computer. On the other hand, it is argued that it is not possible to differentiate ‘ideas’ from ‘expressions’ at the level of the object code, and that either the present Act, or present interpretations of the Act, have gone too far in restricting the availability of information. A couple of key cases may serve to illustrate what is at issue here.

*Synercom Technology, Inc v University Computing Co* (1978, 1979) involved a suit for copyright infringement of instruction manuals and input formats used with a computer program designed to solve certain engineering problems. The central question in the case, relating only to the input formats, was ‘whether [the defendant] plagiarized Synercom’s idea or its expression. If the idea is the sequence and ordering of data, there was no infringement. If sequencing and ordering of data was, however, expression, it follows that [defendants’s] preprocessor program infringed. . . .’ This raises the further problem that ‘if sequencing and ordering is expression, what separable idea is expressed?’ The court
finally held that the input format was in fact the expressed idea, which could, therefore, be freely copied.

Data Cash Systems, Inc v JF and A Group, Inc (1979, 1980) followed this ruling to hold that an object code could not be copyrighted. The case involved a computer program that instructed a computer how to play chess. The instructions were translated into programming language (the source program) and then into machine language (the assembly program). The assembly program in turn was used to generate the object program, or Read Only Memory (ROM), which directly commands a series of electrical impulses and which is integrated with the computer's circuitry. The Court held that the ROM was 'a mechanical tool, or a machine part, or the mechanical embodiment of the source program, but not a copy of it', and so not a 'writing'. The copyright protection afforded by the 1976 Copyright Act was therefore held to apply to computer programs in their flow chart, source, and assembly phases, but not in their ROM or object phase.35

What is in question in these and similar cases is the process of translation between different levels of the computational process, and hence the more general problem of distinguishing ideas and expressions. Let me define these translation processes schematically:

(1) from one high-level language to another. Here, the judge in Synercom ruled that 'it is as clear an infringement to translate a computer program from, for example, FORTRAN to ALGOL, as it is to translate a novel or play from English to French. In each case the substance of the expression (if one may speak in such contradictory language) is the same between original and copy, with only the external manifestation of the expression changing.'

(2) from flow chart to source code. The same judge felt that this would equally constitute an infringement of copyright; but he drew the line at granting protection for

(3) translation from a general statement of the program to a source code:

Here the similarity to literary translation ends. The preparation of a computer program in any language from a general description of the problem to be solved ... is very dissimilar to the translation of a literary work, or to the translation of a program from one language to another. In most cases, the formulation of the problem in sufficient detail and with sufficient precision to enable it to be converted into an unambiguous set of computer instructions requires substantial imagination, creativity, independent thought, and exercise of discretion, and the resulting program can in no way be said to be merely a copy or version of the program statement. The program and the statement are so different, both in physical characteristics and in intended purpose, that they are really two different expressions of the same idea, rather than two different versions of the same expression.

(4) from source code to object code. Perhaps the most forceful arguments here are those made in 1979 by Commissioner Hersey in his
dissenting report to the National Commission on New Technological Uses of Copyrighted Works (CONTU). Hersey’s view is that, unlike sets of instructions, ‘in the case of computer programs the instructions themselves eventually become an essential part of the machinery that produces the results’\(^{31}\) and ‘a program, once it enters a computer and is activated, does not communicate information of its own, intelligible to a human being. It utters work.’\(^{35}\) The proper analogy for a computer program is not with a film or a phonorecord, but with such things as magnetised bank cards, or a cam (a gearing device) that instructs other machinery. Above all, Hersey stresses that programs are neither ‘works’ nor ‘copies’: ‘a program, when keyed or run into a computer, is transformed by a compiler program into a purely machine state. The term *copy* is meaningless for the reason that in this transformation the means of expression of the original work become totally irrelevant. All that matters is the program’s functional use.’\(^{36}\) If this is arguably true of a source program or code, it is *a fortiori* arguably true of an object code. Thus the judge in *Data Cash* argued that, ‘by analogy with a building constructed from architectural plans, object code constituted the physical embodiment of a computer program. Just as, under American law, a building is not a “copy” of its plans, so too a ROM is not a copy of a source program’, and so does not qualify for the status of a ‘writing’.\(^{37}\)

The relations at work in these four instances are those between expressions; between ideas and expressions; and between abstract and concrete forms of an expression (with the complication of a Hjelmslevian distinction, in (1), between the form and the substance of an expression). It is clear that it is the fourth class, the relations between source code and object code, that resists explanation in terms of the traditional categories; and subsequent rulings have tended either to extend a blanket protection to object code, or to draw the line between idea and expression pragmatically, taking into account the balance between competition and protection. *Apple Computer, Inc v Franklin Computer Corp* (1980, 1982) is a particularly interesting example of the interpretive dilemma posed to the courts, since it produced diametrically opposed readings in the district court hearing and on appeal. The district court found that ‘it is not clear whether the program-designer’s idea of the operating system program, the source program, or the ROM is the “original work of authorship.” It is not surprising that this should be hard to determine, because at each stage major transformations in the structure of the “program” take place.’ The judge decided that, rather than understanding object code as a ‘language of description’, ‘it may be more accurate to say that operating systems are an essential element of the machine, if not an essential part of the machine that makes it work. Similarly, it may be more accurate to say that object code in its binary form or chip form is a useful version of the machine’s electrical pulse.’ The Court of Appeals reversed this decision, however, to hold that object code could be afforded protection as a ‘literary work’: ‘The court rejected the defendant’s argument that the ROM-embedded object code
was an uncopyrightable idea, noting that since other object code programs could be written to perform the same functions, Apple's object code was merely an expression of the idea... "38

Cornish has suggested that 'the computer's work of "translating" the program from a high-level to a machine language is a separate copyright activity'. 39 An Australian court, dealing with a parallel case, decided that object codes are protected as 'adaptations of the protected source codes', that is, as 'translations'. 40 And some recent findings in relation to video games have concluded that ROMs constitute a 'tangible medium' for the fixing of expressions of ideas. 41 This plethora of different solutions perhaps indicates that there is no good solution to the problem. That it is not a marginal problem but absolutely central to the question of protection of computer software is indicated by the argument made in Williams v Artic (1982) that to exclude object code from protection 'would afford an unlimited loophole by which infringement of a computer program is limited to copying of the computer program text but not to duplication of a computer program fixed on a silicon chip'. In practical terms this means that the protection extended to one level of coding can be thwarted simply by copying directly from the level of the object code.

It is in line with this that MacGrady argues for the inadequacy of existing copyright protection for computer programs, pointing out that 'there is a crucial distinction between the design or algorithm of a program and the coding of a program. Copyright law will protect only the particular code expression chosen by the coding programmer or a coding expression substantially similar thereto; it will not protect the design itself.' 42 Others, however, have warned against a tendency on the part of both legislators and courts to afford precisely such a protection to design or 'ideas'. In his concurring opinion for the CONTU report Nimmer wrote: 'What is most troubling about the Commission's recommendation of open-ended copyright protection for all computer software is its failure to articulate any rationale which would not equally justify copyright protection for the tangible expression of any and all original ideas'; and Hersey bluntly stated that the Commission 'may well have opened the way for covert protection, in the name of copyright, of the underlying mechanical idea or ideas of a program, rather than of its original means of expression'.

There is another dimension to the question of object code, however, which may be equally significant; it concerns its status as a non-human communication. Since computer programs are usually written in a source code and then compiled by means of a separate program into object code, there is a question as to whether the program is in fact authored by a person rather than by a machine. Computers have been used extensively in graphic design, in musical composition, and in the production of written texts. In the case of minimal human intervention, who should be considered their 'author' for copyright purposes? More importantly, by what criteria do we distinguish between human and
'The PUZ': program for an Atari ST computer game.

artificial intelligence for copyright purposes?

Millard points out that, not only can computers produce output which is unpredictable and which can thus to some extent 'emulate the
vagaries and spontaneity of the human brain\textsuperscript{45}, they can also simulate ‘free will’ in their ability to avoid predictability and determinism – for example, by selecting random numbers in an infinite progression, and using these (for example) for the production of musical texts. Millard follows Butler in suggesting four possible responses to this question. They are:

(1) disallow copyright completely; (2) give authorship and copyright to the computer and its software or find authorship ‘shared’ between the Artificial Intelligence software and a human; (3) settle copyright upon the owner of the underlying AI software or the machine owner; or (4) create a fictional human author and assign its copyright to the AI software owner, the problem-specifier or the computer owner either individually, jointly or in part.\textsuperscript{46}

To these, Millard adds the option favoured by the 1976 UK Whitford Committee, of granting copyright to the person who provides the data, alone or jointly with the owner of the AI software; and the option favoured by the 1981 Green Paper Reform of the Law Relating to Copyright, Designs and Performers’ Protection, of granting copyright to the person responsible for running the data through the programmed computer.

All of these options are problematical. The first leaves the work unprotected. The second (machine or shared human and machine ownership) ‘would necessitate absurd legal gymnastics to accommodate established copyright principles. For example, how long should a computer be deemed to live for the purpose of fixing the term of protection for a work? Moreover, how could a computer assign or otherwise administer its rights and how should it be rewarded for its “creative effort?”’ \textsuperscript{47} The third option of awarding copyright to the owner of the software or hardware ‘might be effectively to grant a monopoly over a process for producing a vast number of different works’, but also, like the last two options, it might fail to establish a ‘creative link’.\textsuperscript{48}

It is the legal fiction of the fourth option, then, that Millard concludes by finding most attractive. This option, of ‘creating a fictional author and assigning his or her copyright to other parties’, has the advantage that it ‘both ensures protection without violating the concept of creativity as a distinctively human endeavour, and awards copyright protection to human beneficiaries’\textsuperscript{49}.

Clearly it takes some rather hard work to preserve the conceptual priority of human creativity here. In fact, unlike most European law, where authors must be natural persons, Anglo-American law allows legal entities (corporations or partnerships, for example) to hold copyright as an author. The legal and commercial conditions for dropping the insistence on individual human creativity as the source of copyright are fully in place, and the fiction is fully recognisable as such.

What the fiction screens is the fact that copyright is part of a system of
commodity production in which reproduction rights play a major part; and that computer software is a significant component of this system. One commentator put the number of programs written daily in the United States at 15,000\(^{50}\), and the International Data Corporation estimated that in 1980 there were more than 4,300 companies in the software industry, with revenues of 13.14 billion dollars rising to 33.8 billion dollars in 1984.\(^{51}\) This market is increasingly coming to be dominated by large corporations. Hence Commissioner Hersey's expression of concern at the pressures for an extension of the copyright: 'Is it not evident', he wrote, 'that the big companies want, by availing themselves of every possible form of protection, to lock their software into their own hardware, while the independents want to be able to sell their programs for use in all the major lines of hardware'?\(^{52}\) And in fact there have been significant extensions of the copyright and kindred areas of law as a result of such pressures in recent years, not only to protect computer software but to protect such things as the mask-work used in the production of silicon chips, or new plant varieties. At the same time, the possibilities of computer crime – embezzlement, piracy of software and data, theft of computer time, and sabotage – have increased exponentially, and in ways that existing intellectual property law is not fully adequate to prevent. De Sola Pool and Solomon identify the dilemma as this: 'what protects the author or publisher is physical control of the text, for there is no count of its reproduction once it is out of his hands.'\(^{53}\) The problem of control is exacerbated in the international marketplace, and it is with the question of transborder data flows that some of the most severe contradictions in the commodification of information come to light. Paradoxically, these involve a commitment to 'free trade' on the part of the countries and the transnational corporations with dominance in the international information industry, and a commitment to protectionist policies (privacy regulation, import controls, customs tariffs on data) on the part of Third World countries.\(^{54}\) The struggle is one for control of a scarce commodity; but the concept of scarcity is inherently contradictory in this context.

The contradiction arises from two features of an economy which is increasingly based on the commodification of information. The first is the augmented importance of information as a resource input to production – that is, the increase in the share of cultural and especially scientific capital in the organic composition of capital. Information technology, says Locksley, 'enables a greater commercialization of culture where culture is not only a commodity but reinforces the conditions of general commodity production',\(^{55}\) and it 'is the instrument that allows the resource and commodity of information to be developed and gain ascendency. The current phase of capitalist development is one characterized by the elevation of information and its associated technology into the first division of key resources and commodities. Information is a new form of capital.\(^{56}\) As such, it is characterised by a transition from open,
'library' systems to a closed system of private ownership. The second feature, however, is the application of the principle of indefinite repetition that emerges from the technologies of mass production to the technologies of production and reproduction of information.

The copyright is one of the central mechanisms used by both capitalist and state capitalist systems to try to reconcile the contradiction between these two principles. It is a drive to signature which seeks to limit repetition – that is, to limit the potentially infinite iterability of writing and of all its technological extensions. But this is doubly impossible. In the first place, there is the impossibility of enforcing an artificial scarcity imposed on a technology of proliferation. In the second place, there is the practical and philosophical impossibility of separating ideas from expressions in such a way that private ownership would be extended only to the latter without touching the expressed ideas. Copyright doctrine relating to computer software dramatises the contradictions involved in the attempt to privatise information, and indeed it demonstrates the impossibility of any coherent doctrine of private property in intellectual productions.