Patentability of Software-Related Inventions

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Abstract

Software technology is at least as expensive to develop as hardware technology but very inexpensive to copy. With the rapidly increasing economic and commercial prominence of software technology it is understandable that software developers are now becoming particularly keen on finding legal frameworks to protect their investments. It is now quite clear that the main mode of legal protection for software technology is copyright, although patents and contracts also play some roles in protecting different aspects of the technology. However, the more absolute nature of protection brought about by patents offers significant attractions to developers seeking to maximise the degree of legal protection for their investment. Further, copyright is intended to protect only the expression of an invention but not the ideas (or application

of ideas) underpinning it. In many cases of software invention, the underpinning applied ideas are the truly inventive elements whereas their concrete expression in the form of program implementation is comparatively routine and trivial. It is therefore interesting to look at whether patents may be used to protect this aspect of software technology.

This paper examines the issue of patent protection for software technology in Europe, and particularly in the UK. By analysing a group of significant cases during the period spanning 1987 and 1990, emerging trends are detected which give indications on the exact scope of patent protection in this area. The period 1987 - 1990 represents a turning point in that cases decided in that period have set the general direction for development even till now. Unlike in the US where this area of the law is relatively well-developed, in Europe (and particularly in the UK) there is still an uncomfortable degree of uncertainty as regards how this area of the law will develop. However, despite the current uncertainty, from the significant cases examined it is now apparently quite clear that evidence of possessing at least one of two characteristics will qualify a software-related invention (when examined as a whole) as patentable subject-matter. These two characteristics are: (1) the invention operates on physical entities forming part of the world outside the computer, and (2) the invention represents a solution to a technical (as opposed to purely intellectual or informational) problem which exists within the computer system (including a network system).

1. INTRODUCTION

It is evident that computer technology permeates every aspect of modern society. The fast pace of advance in this technology is such that a generation[1] spans only 3-5 years. Hardware and software are the two major components of computer technology. The last decade has seen a decisive shift in economic and commercial focus away from the hardware component towards the software component. Nowadays the major cost component of a business computer system is the software and not the hardware as it used to be not too long ago[2]. Indeed, the computer hardware market is fast turning into a commodity market with little product differentiation. Software is now the main component for determining the success of a particular commercial application of computer technology. This shift in focus is reflected by the marketing strategy of most computer vendor companies. They now focus not so much on selling their proprietary hardware but more on providing integrated computing solutions to business problems, of which the software component is a crucial component from the customer point of view.

Hardware consists of all the physical bits that make up a computer, viz., the collection of transistors in groups of integrated circuits (i.e. "micro-chips") and their wired interconnections (i.e. "electronic circuits"). Electronic circuits may be protected by patents and the 3-dimensional topography of "micro-chips" is protected under a specific legal regime[3] which is akin to the protection of industrial design. On the whole, the scope and variety of legal protection for hardware technology is quite adequate.

Algorithms, programs and computer languages are the three main components of software[4] technology. An algorithm specifies (using a procedural or

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1 A generation is characterised by an order of magnitude increase over processing power and storage capacity, or a similar magnitude of decrease over hardware component size and unit cost.

2 For example, the cost of an operating system software license alone is more expensive than the cost of the hardware processor for a typical DEC VAX series mini-computer.

3 e.g. Design Right (Semiconductor Topographics) Regulations 1989 SI 1989 1100 in the UK and the Semiconductor Chip Protection Act 1984 in the US.

4 The term "software" usually has wider connotations which also include operating procedures and associated documentation (such as user and reference manuals) concerning the use of a computerised information system.

mathematical notation) a conditional sequence of steps or operations for solving a class of problems. As such algorithms are abstract procedural entities for accomplishing certain processing goals. Programs are coded instructions for directing and controlling the operations of the computer hardware. These coded instructions are written in specific computer languages that the computer can understand. In a software technology setting, algorithms are expressed by programs which are written in specific computer languages. Computer languages in the main are not afforded any legal protection under intellectual property law. In any case they are invariably in the public domain. Algorithms, whether mathematical or otherwise, are *per se* abstract information relating to mental activities which do not fall within the scope of protection afforded by intellectual property law in general. However, it is the embodiment of algorithms within computer programs that gives rise to tangible economic value. Through such programs, computers can perform useful operations (e.g. controlling a wielding robot) which result in tangible economic benefits. It is therefore reasonable that programs form the focus of attention with regard to the legal protection of software technology.

Software technology is at least as expensive to develop as hardware technology but very inexpensive to copy. With the rapidly increasing economic and commercial prominence of software technology it is understandable that software developers are now becoming particularly keen on finding legal frameworks to protect their investments. It is now quite clear that the main mode of legal protection for software technology is copyright[5], although patents and contracts also play some roles in protecting different aspects of the technology. However, the more absolute nature of protection brought about by patents offers significant attractions to developers seeking to maximise the degree of legal protection for their investment. Further, copyright is intended to protect only the expression of an invention but not the ideas (or application of ideas) underpinning it. In many cases of software

[5] e.g. The Copyrights, Designs, and Patents Act 1988 in the UK has explicitly stipulated that computer programs are protected under copyright law as a species of literary work.

invention, the underpinning applied ideas are the truly inventive elements whereas their concrete expression in the form of program implementation is comparatively routine and trivial. It is therefore interesting to look at whether patents may be used to protect this aspect of software technology.

On the whole, copyright and patent protection may co-exist on aspects of the same piece of software technology. Patent protection will no doubt strengthen the degree of protection enjoyed by the relevant developer. It may be argued that a strengthened degree of protection acts as a stimulus to software invention. This paper will focus on the issue of patent protection for software technology in the UK, especially in cases where an invention is comprised of a mixture of technologies of which software technology is one. The next section will outline the essence of the problem. A number of recent patent cases involving software technology will then be examined. From these cases, emerging trends may be detected which give indications on the exact scope of patent protection in this area. Some of the implications of such trends will be explored in the conclusion.

2. THE CRUX OF THE MATTER

In general, patents are intended for the protection of inventions. However, not all inventions are protectable by patents. The main question in the context of software technology is whether an invention based on or involving software technology is a patentable subject matter. The starting point in answering this question may be found in section 1(2) of the 1977 Patents Act (which corresponds closely to Article 52 of the European Patent Convention) which reads as follows:

It is hereby declared that the following (among other things) are not inventions for the purposes of this Act, that is to say, anything which consists of:

(a) a discovery, scientific theory or mathematical method;

(b) a literary, dramatic, musical or artistic work or any other aesthetic creation whatsoever;

(c) a scheme, rule or method for performing a mental act, playing a game or doing business, or *a program for a computer*;

(d) the presentation of information;

but the foregoing provisions shall prevent anything from being treated as an invention for the purposes of this Act *only to the extent that a patent or application for a patent relates to that thing as such*[6].

It is clear from the above that a computer program as such is not patentable. But it is also clear that an invention involving, *inter alia,* a computer program may be, though not necessarily, patentable. The point at issue is whether in a particular case an application for a software-related invention is to be regarded as a patent application for a computer program as such and therefore not patentable. In such a case the above provisions give no direct help because the word "invention" for the purposes of the 1977 Act is not defined in a positive sense. Section 1(2) only lists some of the cases which are clearly outside the scope of patent protection. The list is not exhaustive. If the facts of a particular case fall outside the list stipulated in section 1(2) it does not necessarily follow that the subject matter is patentable. The situation is particularly problematic when the facts of a particular case (such as a software related invention) seem to lie on the boundary of the provisions. To which side of the boundary will the case fall depends very much on the interpretation of the claim at hand and of the 1977 Act given all the facts in each particular case. In interpreting section 1(2) of the 1977 Act the decisions from the Technical Board of Appeal of the European Patent Office are extremely relevant. Section 130(7) of the 1977 Act contains a declaration to the effect that section 1(2) is so framed as to have the same effects as Article 52 of the European Patent Convention. Decisions on the interpretation of Article 52 under the Technical Board of Appeal are therefore clearly relevant. In the words of Lord Justice Nicholls "It is of the utmost importance that the interpretation given to section 1 of the Act in the UK, and to Article 52 of the

6 Italics are my own emphasis.

Convention by the European Patent Office, should be the same"[7]. Although in theory the decisions of the Technical Board of Appeal are not binding on UK Courts, in practice they are of immense importance in the matter of interpretation of section 1(2).

To help in the process of interpretation, the policy guidelines of the European Patent Office are instructive though they have no legal force *per se*. The original pre-1985 guidelines read as follows:

"A computer program may take various forms, e.g. an algorithm, a flow-chart or a series of coded instructions which can be recorded on a tape or other machine-readable record medium, and can be regarded as a particular case of either a mathematical method... or a presentation of information... *If the contribution to the known art resides solely in a computer program then the subject-matter is not patentable in whatever form it may be presented* in the claims. For example, a claim to a computer characterised by having the particular program stored in its memory or a process for operating a computer under the control of the program would be as objectionable as a claim to the program *per se* or the program when recorded on magnetic tape"[8].

A number of observations can be drawn from these early policy guidelines:

(1) There was confusion regarding the use of standard software terminology. Algorithms, flow-charts and series of coded instructions were superficially taken to be the same as programs. However, a closer inspection by anyone skilled in the art of software technology will reveal that there are factual and practical differences among these items. A program is a series of coded instructions which a computer can understand and which may be used to implement an algorithm. An algorithm may be a procedural entity (e.g. a sequence of operational steps) or an abstract mathematical entity (e.g. a series of mathematical equations). Non-trivial skills and significant effort are needed to implement an algorithm using a program. In this

7 IN RE GALE, FT Law Reports, 18 December 1990.

8 Italic emphasis is mine.

sense, an algorithm is akin to concepts and ideas which are not patentable *per se*, whereas a program is more like a practical application of concepts or ideas which might fall within the scope of patentable subject-matter. Flow charts are simply paper diagrams used in depicting aspects of the control and data flows in a program. Flow charts are useful in aiding program design and implementation but they are certainly not programs. This confusion would seem to reflect the relative lack of understanding on the part of the European Patent Office with regard to the nature of software technology.

(2) The guidelines would appear to indicate that an end-product such as a computer controlled process plant or machine could not be patentable subject-matter if the only novel and inventive feature of the invention resided in the program alone. This approach would require the isolation of all the novel features in the end-product first and then deciding whether these isolated features will fall within the excluded categories. The implication of this approach would be to severely narrow the scope of patentability for software-related inventions. Inventive process control mechanisms (e.g. those used in a conventional chemical plant to produce new polymers) that would otherwise be standard patent material would fall outside the scope of patentable subject-matter simply because a program was used in implementing the inventive process control scheme.

However, in response to pressure from the computer industry and trends emerging in the US, the European Patent Office reviewed its guidelines in 1985 resulting in the issuing of revised guidelines which were further confirmed in a supplemental issue in 1989. The essence of the current policy guidelines is as follows:

General:

In considering whether the subject matter of an application is an invention within...Art.52(1), there are two general points the Examiner must bear in mind. First, any exclusion from patentability...applies only to the extent to which the

application relates to the excluded subject matter as such. Secondly, the Examiner should disregard the form or kind of claim and concentrate on its content in order to identify the *real contribution* which the subject matter claimed, *considered as a whole*, adds to the known art. *If this contribution is not of a* ***technical character****, there is no invention within Art.52(1*)... the basic test for patentability, that is whether there is an "invention", is completely separate and distinct from the question of whether there is an inventive step.

Programs for Computer:

The basic patentability considerations here are exactly the same as for the other exclusions listed in Art.52, para. 2. However, a data-processing operation can be implemented either by means of a computer program or by means of special circuits, the choice may have nothing to do with the inventive concept but be determined purely by factors of economy or practicality. With this point in mind, examination in this area should be guided by the following approach:

A computer program claimed by itself or as a record on a carrier, is not patentable irrespective of its content. This situation is not normally changed when it is loaded into a known computer. If, however, the subject matter as claimed makes a ***technical contribution*** to the known art, patentability should not be denied merely on the ground that a computer is involved in its implementation. This means... *program-controlled machines... and manufacturing and control processes should normally be regraded as patentable subject-matter*. It follows... *where the claimed subject matter is concerned only with the internal working of a known computer, the subject matter* ***could be patentable*** *if it provides a* ***technical effect***[9].

These guidelines are indicative of a significant change of position on the part of the European Patent Office in the interpretation of Article 52. First, an invention is to be characterised by its effect and not by its structure or form. Secondly, the

9 My own emphasis added.

invention as a whole[10] should be looked at when characterising its effects. A common thread throughout the guidelines is the emphasis on the technical nature of an invention. The terms "technical effects", "technical characters" and "technical contributions" are mentioned frequently through the guidelines. However, the guidelines give no real help in defining the term "technical". It is by no means clear what being "technical" means; indeed it is not clear what "technology" means. Nonetheless, it is now clear that the question of patentability is distinct from the question of whether there is a sufficient inventive step to warrant the grant of a patent. First, an "invention" for the purposes of Article 52 must be made. Only then will the question of whether the invention is significant enough for patent protection[11] be considered. The central issue in the context of this paper is whether and if so to what extent can software-related inventions be regarded as "inventions" for the purposes of patent applications. The following section will examine 10 recent UK/EPO patent cases in this area. Such an examination will throw light on the way section 1(2) and Art. 52 are being interpreted by relevant authorities. It will be noticed that in many cases the guidelines have been directly or indirectly endorsed.

3. ANALYSIS OF RECENT CASES

(i) Vicom[12]

This is the first of a series of cases heard by the Technical Board of Appeal which has shown a remarkable degree of adherence to the post-1985 European Patent Office guidelines. The matter concerned was a patent application relating to methods and apparati for improving the quality and speed of digital image processing. The image appearing on the face of an electronic display screen was caused by electrical signal represented by a set of numbers inside the memory of a

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10 The pre-1985 guidelines focused on the consideration of isolated features which were supposed to represent the novelty of the invention.

11 e.g. the test for novelty, inventive step, and industrial application.

12 T208/84, [1987] 2 EPOR 74.

computer. The processing and manipulation of the image required corresponding processing and manipulation of numbers representing the image. A lot of calculations would need to be performed in the process according to a mathematical algorithm. The "invention" in this case was in fact a new mathematical algorithm for the manipulation of these numbers. The new algorithm allowed the necessary calculations to be done in a much speedier and more accurate way in comparison with using a traditional algorithm. The Technical Board resolved to allow the patent application even though it was in truth a patent application for a mathematical algorithm. The approach and reasoning adopted by the Technical Board in this case are particularly interesting:

> "There can be little doubt that any processing operation on an electrical signal can be described in mathematical terms... A basic difference between a mathematical method and a technical process can be seen, however, in the fact that a mathematical method or a mathematical algorithm is carried out on numbers (whatever these numbers may represent) and provides a result also in numerical form, the mathematical method or algorithm being only an abstract concept prescribing how to operate on the numbers. No direct ***technical result*** is produced by the method as such. In contrast thereto, if a mathematical method is used in a ***technical process***, that process is carried out on a ***physical entity*** (which may be a material object, or equally, an image stored as an electrical signal) by some ***technical means*** implementing the method and provides as its result ***a certain change in that entity***. The technical means might include a computer comprising suitable hardware or an appropriately programmed general purpose computer.

> The board, therefore, is of the opinion that *even if the idea underlying an invention may be considered to reside in a mathematical method, a claim directed to a technical process in which the method is used does not seek protection for the mathematical method as such"*[13].

The Technical Board characterised the invention as a technical process. It arrived at this conclusion by looking at the effects of the invention. Since the effects were manifested as changes in physical entity (an image), the Board regarded such effects as technical and therefore the process that brought about such effects as a technical process within the scope of patentability. Without directly defining the meaning of "technical", the Board seemed to have characterised a technical process as one which would bring about changes in a physical entity. This approach has raised several problems, the answers to which remain uncertain:

(1) Can it be inferred that if a process does not bring about changes in a physical entity then it can NEVER be regarded as a technical process (and hence not patentable)?

(2) Are changes in a physical entity sufficient <u>in all cases</u> to infer the existence of a technical process? If so, what degree and what type of changes (e.g. atomic, molecular, chemical, magnetic etc.) would be regarded as sufficient?

(3) The Board regarded images (i.e. light which is in essence electromagnetic radiation) as a physical entity without first defining positively the meaning of a physical entity. Must a physical entity be tangible? What exactly is "tangible" anyway? Is a electromagnetic dipole (used in antenna design) a physical entity? The Board's judgement gives no real help in answering this sort of question.

However, a number of important points may be observed from the Board's judgement as follows:

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[13] My emphasis added.

- A patentable invention is one which is technical in nature;
- A mathematical algorithm is in effect patentable if it is incorporated within a technical process;
- A technical process is one which produces technical results;
- Changes in a physical entity constitute a technical result;
- An image is a physical entity.

Is the situation the same for a computer program? Did the Board draw any distinction between a mathematical algorithm and a computer program embedding the algorithm in this context? The following passage from the Board's judgement is instructive:

> "A claim directed to a technical process which process is carried out under the control of a program (be this implemented in hardware or in software) cannot be regarded as relating to a computer as such within the meaning of Art.52(3) EPC, as it is the application of the program for determining the sequence of steps in the process for which in effect protection is sought".

By focusing on the technical process, the Board had in fact regarded differences between a mathematical algorithm and a computer program as irrelevant. This position remains unchanged even though the only inventive element in the technical process is in essence a mathematical algorithm or a computer program. There is no need to separate out the novel element of an invention for consideration. The invention (or the effects thereof) as a whole should be considered. This position is confirmed by the following passage in the Board's judgement:

> "Generally speaking, an invention which would be patentable in accordance with conventional patentability criteria[14] should not be excluded from protection by the mere fact that for its

[14] i.e. novelty, inventive step, and industrial application.

> implementation modern technical means in the form of a computer program are used. *Decisive is what **technical contribution** the invention as defined in the claim when considered **as a whole** makes to the known art*"[15].

(ii) Kock & Sterzel[16]

This case related to a patent application for a computer-related X-ray apparatus. One of the common operational problems with X-ray apparatus is the optimisation of exposure level, which can result in an increase in the efficiency and effectiveness of the apparatus. An important aspect of optimisation is to ensure that the X-ray tube is not overloaded at any time since overloading will result in the rapid ageing of the tube which is an expensive item of the apparatus. The essence of the invention was a computer program which would lead to periodic adjustment of the controls of the apparatus for optimisation. There was no inseparable or intimate interaction between the x-ray apparatus and the computer program. The controls of the x-ray apparatus were only adjusted periodically at the end of each calculation cycle. It was argued that the computer program (which was novel but non-technical) and the x-ray apparatus (which was traditional and technical) were not "integrated" and therefore they should be looked at separately for patentability. In rejecting this argument and allowing the patent application, the Board gave the following reasons:

> "The European Patent Convention does not ask that a patentable invention be exclusively or largely of a technical nature; in other words it does not prohibit the patenting of inventions consisting of a mix of technical and non-technical elements... ***An invention must be assessed as a whole***. If it makes use of both technical and non-technical means, *the use of non-technical*

15 My emphasis added.

16 T26/86, [1988] 2 EPOR 72.

means does not distract from the technical character of the overall teaching"[17].

The Board reconfirmed the view taken in the Vicom decision that an invention must be looked at as a whole when considering patentability. The optimisation problem of the X-ray apparatus was seen as a technical problem to which the subject-matter of the patent application sought to provide a solution.

(iii) IBM/Semantics[18]

In this case IBM sought to patent a system for automatically generating a list of expressions semantically related to an input linguistic expression and a method for displaying such a list of expressions. The system was in fact a fairly straightforward implementation of a semantic network. A semantic network is in essence a network of conceptual items linked by semantic relationships. For example, "Paul likes Mary" is a semantic expression containing two conceptual items, viz., Paul and Mary, semantically related by the link "likes". Supposing there were other similar expressions such as "Paul likes Janice", "Paul likes Rebecca", etc., then given a partial semantic expression such as "Paul likes", the system would be able to display a list containing the conceptual items "Mary, Janice, Rebecca, etc.". It is obvious that this type of system is useful in database applications.

The IBM system involved two memories, the first holding a vocabulary of linguistic concepts and the second holding all the semantic links. Associated with the linguistic concepts in the first memory were stored the addresses of the related semantic links in the second memory. Associated with the semantic links in the second memory were also stored the addresses of all related linguistic concepts in the first memory. It was a sort of "dual-referencing" set-up. In operation, an input expression was compared with the contents of the first memory to find the

17 My emphasis added.

18 T52/85 [1989] 8 EPOR 454.

corresponding semantic link address in the second memory; from the semantic link so identified in the second memory, the addresses of all the other related linguistic concepts in the first memory could be found. From these addresses, all the related linguistic concepts could be gathered and displayed. In refusing the patent application the Board made the following comments:

> "...semantic relationship is basically not of a technical nature but a matter of the meaning of those expressions, that is, of their abstract linguistic information content; ***it does not relate to any physical entity***... [as to the contributions made by the features of the claim] these features show the following sequence of functions... these functions as such are all conventional: storing data; comparing input data with an index for finding an address location; storing the address; accessing with it a memory; decoding data as an address for accessing another memory; displaying the addressed data... It follows that the functional features of the individual system elements relate to the linguistic evaluation, on the basis of a linguistic relationship, of input linguistic data, for the purposes of displaying a linguistic result, the actual processing involving only conventional techniques... *No contribution is therefore made in a field outside linguistics nor outside the field of conventional computer performance*".

The Board observed that the invention as a whole did not relate to any physical entity. But before rejecting the application outright there and then the Board continued to look at the contributions made by the individual elements of the claim and then concluded that these contributions are either linguistic (which is not a patentable subject-matter) or conventional (i.e. no invention was made). It seems to indicate that the lack of any relationship to a physical entity in itself is not fatal

with regard to a patent application. The Board went on to deduce that the application was in effect a patent application for a computer program as such:

> "Moreover, the functioning of the computer is... under the control of an appropriate program. No contribution is consequently made in a field outside computer programming...".

IBM also argued that the invention was a technical solution to a technical problem. However, the Board took the view that the finding of semantically-related linguistic expressions had to do with the linguistic significance of words and was thus a linguistic problem and not a technical problem (again, without first defining the meaning of "technical" and "linguistic"). No technical problem concerning the computer was to be solved. As regards the solution, the Board regarded what's claimed as a straight-forward automation of a linguistic problem producing no technical effect. The computer was a standard, general-purpose one which did not operate in any unusual way. They accordingly held the claim as one for unpatentable subject-matter. This case differs from Vicom and Kock & Sterzel in that no physical entity or effect outside the computer is involved, even though in all three cases the essence of the inventions are algorithms residing in computer programs.

(iv) IBM/Network[19]

The Technical Board considered a claim for procedures to enable a network of computers to maintain concurrent and automatic connection between a computer of the network and for more than one application program residing on different computers on the network. The procedures would also provide for simultaneous on-line access to and processing of more than one data file residing on different computers on the network. These procedures were implemented using a network

[19] T6/83, [1990] EPOR 91.

supervisory computer running a computer program embedding the procedures. Thus, the claim had (as the basis of the invention) a computer program, but it related to a series of computers connected together. In allowing the claim, the Board made the following observations:

> "The Board holds the view that an invention relating to the co-ordination and control of the internal communication between programs and data files held at different processors in a data processing system having a plurality of interconnected data processors in a telecommunication network, and *the features of which are not concerned with the nature of the data* and the way in which the particular application program operates on them, is to be regarded as solving a problem which is ***essentially technical***. Such an invention is therefore to be regarded as an invention within the meaning of Art.52(1) EPC"[20].

The problem was essentially one of establishing automatic and concurrent connections between programs and data files residing on different computers in a network. The problem was regarded as a technical one because it related to physical resources (establishing virtual connections among the computers on the network) and was not concerned with manipulation of data for the purposes of deriving information thereof. A solution to this problem would enable better utilisation of computer resources in the network. It did not matter to the Board that the solution to this technical problem was implemented using a computer program. The Board were however silent on whether the solution was a technical one. The claim was drafted at a fairly conceptual level (as is common in the case of most software descriptions) but used standard technical terms such as "remote node", "independent control systems", "transaction request", "resource", etc. extensively.

[20] Emphasis is my own.

Through the extensive use of technical terms in the claim, an impression was conveyed that the invention, though abstract on its own, was nonetheless applied in a technical setting involving physical entities. The same invention could indeed be described as a routing algorithm without any express reference to any physical computer systems (and thus would be unpatentable). This was a case where skilful and thoughtful drafting did make a decisive difference in the outcome of the application.

(v) IBM/Document Abstracting and Retrieving[21]

This application was for a system (comprising a conventional computer and a specific program developed for this purpose) which could automatically derive an abstract for any given document, store the abstract in computer memory, and retrieve the required abstracts in response to input queries. Relying on the decision in Vicom, the claim was drafted in such a way as to convey the impression that it was an invention which operated on electrical signals (which were regarded as a physical entity in Vicom). However, the Board had no difficulties in rejecting the analogy with Vicom:

> "...electrical signals processed according to the [T22/85] (i.e. present) application were not of this kind, but represent (part of) the ***information content of a document***, which could be ***of any nature"***[22].

Perhaps the most crucial difference was that the claimed activity (of deriving document abstracts) in this case did not bring about any physical change in the thing operated upon (i.e. the document to be abstracted). The only result was in the form of new information (i.e. the abstracts) to be stored. The Board did not even

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21 T22/85, [1990] 1-2 EPOJ.

22 My emphasis added.

need to consider whether the invention as claimed was of a technical character. Once it became clear to the Board that the contribution made by the invention fell neatly within the excluded categories, there was no further need to characterise whether the invention was technical in nature. In the words of the Board:

> "The claims effectively seek protection for systems and methods in which conventional computer means are controlled by a program so as to carry out abstracting, storing or retrieving of documents in accordance with the said set of rules [in the claim]. *The new contribution* to the art made in the present case, however, *lies clearly* essentially *in the provision of this set of rules*, in so far as the claims have to be regarded as being *related to subject matter which is excluded under Art. 52(2) and (3) of EPC as such"*[23].

The use of technical terminology and focus on manipulation of electrical signals did not change the overall picture. The Board looked at the content and true nature of the claim, disregarding its form:

> "The contribution to the art and the effects obtained are only in the area of the excluded activity and the true nature of the invention remains the same, whether or not a technical terminology is used in expressing it... In the opinion of the Board it cannot have been intended by the Contracting States to the EPC that express exclusions from patentability could be circumvented simply by the manner in which the invention is expressed in a claim".

[23] Italic emphasis is mine.

The Board took the view (which was also expressed in Koch & Sterzel) that while an ordinary computer program used in a general-purpose computer certainly would transform mathematical values into electrical signals with the aid of natural (i.e. electromagnetic) forces, the electrical signals concerned amounted to no more than a reproduction of information and cannot in themselves be regarded as a technical effect. The Board further made the assertion that in general a computer program used in a general-purpose computer would be considered as a computer program as such and thus excluded from patentability UNLESS the functions of the general-purpose computer were altered in a technical sense under the control of the program; in such case, the unit consisting of program and computer combined might be a patentable invention. Nonetheless the Board did not elaborate further on the meaning of "technical sense". It is not clear, for example, whether a terminal emulator program which directs a conventional general-purpose computer to behave like a dedicated proprietary computer terminal would be regarded as technically altering the functions of the computer and hence patentable.

In this case (as in many others) the invention was an algorithm (for abstracting documents) embedded in a computer program which was used to drive a conventional computer. However, this particular use of the algorithm involved no physical entity other than the conventional computer running the program and the computer was still operating as a conventional general-purpose computer. The invention was therefore clearly within the scope of the excluded categories.

(vi) IBM/Message-display[24]

In this case the Board allowed a claim to a method of decoding and displaying one of a set of pre-determined messages relating to events occurring in a text processing system. The Board did so notwithstanding the fact that the invention involved only conventional hardware and a new computer program and thus the invention must be held to reside entirely in the computer program. It is difficult to

[24] T115/85, [1990] EPOR 107.

understand the full reasoning of the Board without recourse to the specification. Briefly, the specification outlined a method (an algorithm) which could be used to give a visual indication (in the form of displayed messages) of events (or history of events) occurring in the input/output device of a text-processing system. The claim could be construed as being wide enough to cover a method in which a computer is consulted to ascertain whether a user has typed in the answer "Yes" or "No" (or indeed any one of a set of pre-determined words or phrases). In allowing the claim, the Board had characterised the method as relating to a technical problem since it related to physical entities in the form of events and displayed messages (i.e. visual indications):

> "Generally the Board takes the view that giving visual indications automatically about conditions prevailing in an apparatus or system is basically a technical problem... The application proposes a solution to a specific problem of this kind, namely providing a visual indication about events occurring in the input/output device of a text processor".

The Board further observed that the claim was expressed in functional terms, and that it must be understood as referring to the technical means necessary for carrying out the functions. It was sufficient for the Board to find that the inventive idea was used in devising the means which provided a solution to the technical problem at hand. It was immaterial to the Board that the embodiment of the solution happened to take the form of a computer program entirely. Indeed, it would not matter even if a computer program was the only practical form in which the solution might take (as in this case). The following passage from the Board's judgement is instructive:

> "The solution includes the use of a computer program and certain tables stored in a memory to build up the phrases to be displayed... Even if the basic idea underlying the present invention might be considered to reside in that computer program and the way the tables are structured, a claim directed to its use in the solution of a technical problem cannot be regarded... as seeking protection for the program as such within the meaning of Article 52(2)(c) and (3) EPC".

In this case an algorithm in effect was held to be patentable. It was so because what was claimed was not an abstract mathematical algorithm but one which was specifically created as a solution to solve the technical problem at hand. The Board concluded that the invention was more than a computer program, in that it related to a machine (i.e. a text processor) which carried out a function useful for industrial application, by providing a visual indication of conditions prevailing in the machine.

(vii) Merrill Lynch Inc.'s Application[25]

This is a most interesting case in that for the first time the English Court of Appeal has explicitly endorsed the Board's decision in Vicom (and hence implicitly the European Patent Office's issued Guidelines, discussed earlier in this paper, on computer-related inventions, based upon which the decision in Vicom was made). The patent application was basically one for a computerised system for automated trading in securities. The claim was drafted in a technical/procedural language with terms such as "system apparatus", "retrieve/store", "execution", "monitors", "improved... system" etc., which was similar in style to the IBM/Network claim. The claim was drafted as follows:

[25] Merrill Lynch's Application [1989] RPC 561 CA.

"...business systems: a computerised system for arranging, analyzing and dealing in customers' stock and shares: an improved data processing based system for implementing an automatic trading market for one or more securities. The system retrieves and stores the best current bids and asked prices; qualifies customer buy/sell orders for execution; executes these orders; and reports the trade particulars to customers and to national stock pricing report systems. The system apparatus also determines and monitors stock inventory and profit for the market maker".

The case was heard at first instance by Falconer J. who refused the application. He maintained that in examining an application it was necessary to separate out the inventive element of the application for consideration and see if it fell within the excluded categories. If so, the application would be refused. This approach was clearly out of line with that taken in Vicom and the EPO since 1985. The EPO and the Board would consider the invention as a whole without first separating it into different elements; the question of an inventive element would only be looked at during the stage of considering whether there was a sufficient inventive step. Examining whether an application related to patentable subject-matter and deciding whether an application contained a sufficient inventive step were different issues in the minds of the Board and the EPO. The Court of Appeal, though reaffirming Falconer J's rejection of the claim, disapproved of his reasoning. The Court of Appeal concurred with the test used in Vicom, namely that it was the technical contribution the invention as a whole made to the known art that was decisive. Fox LJ said:

"...it cannot be permissible to patent an item excluded by section 1(2) under the guise of an article which contains that item - that is to say, in the case of a computer program, the patenting of a conventional computer containing that program. Something further

> is necessary. The nature of that addition is, I think, to be found in the Vicom case where it was stated. Decisive is what technical contribution the invention makes to the known art'. There must, I think, be some technical advance on the prior art in the form of a new result...".

While adopting the more liberal approach of the Board towards patentability, the Court of Appeal cautioned against taking form over substance (using a language similar to those found in the IBM/Document Abstracting and Retrieving case discussed above. Thus it was made clear that if a computer program as such would not be patentable the situation could not be improved by the mere fact that a patent application was for a floppy disk containing the program or an ordinary general-purpose computer loaded with the program. Focusing on the result of the invention as a whole, it was held that the new result or contribution in this case was no more than a method of doing business and thus was excluded for patentability by section 1(2)(c). The manner or mode of bringing about the result was irrelevant in deciding on patentability once it was clear that the result would fall within the excluded categories. It was also made clear that a data processing system operating to produce a novel technical result would normally be patentable (though the exact meaning of a "technical result" was not elaborated upon in the judgement). Thus a computer program as such is not patentable; but if it is run by a computer (albeit a conventional general-purpose one) to produce a novel technical result (bearing in mind that a result prohibited under section 1(2) cannot be a technical result) then the combination is normally patentable.

The position of the Court of Appeal is consistent with the Technical Board of Appeal in concentrating on the whole content of the invention as claimed and on the nature of effect or result produced by the invention. However, the way in which the Court of Appeal applied this stated position was rather dubious. It could be argued that the result of the invention was not only a scheme for doing business *as such*,

but a computer system which implemented the scheme in a technical way. The automatic trading system could easily incorporate communications hardware for the purpose of reporting the results to a national stock pricing system and that would result in more than just a claim for a conventional general-purpose computer running an ordinary program. The Court in fact did not feel it was necessary to examine the nature or meaning of a technical result. The claim was simply characterised as no more than a scheme for doing business and hence fell foul of the exclusions under section 1(2) of the 1977 Act. If the same case were to be examined by the Technical Board of Appeal, it would be possible that the a different characterisation would be adopted which could lead to the conclusion that the claim was patentable, even though exactly the same position (i.e. focusing on the whole content approach and technical effect) was used as criteria. It is interesting to note that the claim was eventually allowed after an extensive re-draft. A similar claim was also allowed earlier by a US Court[26]. It is not difficult to imagine cases in which new technical effects are produced because a computer is used in performing a well-known process. For example, in some chemical processes it is well known in theory that certain new compounds will result if the process reactions are controlled in a certain fashion. However, the practical control of these well known reactions may not be possible without using a computer (e.g. to provide the necessary monitoring and control functions in micro-second time intervals). These types of inventions are patentable because new technical results or effects are in fact produced using the computer as an enabling device in the process. The computer may be a general-purpose one running a specific reaction process control program. Whether the invention is novel and whether it contains a sufficient inventive step are separate issues from the basic question of whether it can be patentable subject-matter. This situation is analogous to Merrill Lynch Inc.'s Application here. The scheme of securities trading was well-known and not patentable as such. But the claim in

[26] *Paine, Weber, Jackson, Curtis Inc. v Merrill Lynch, Pierce, Ferner, Smith Inc*. 564 F. Supp. 1358 (D.Del. 1983).

question was more than that. It represented a computer implementation of the scheme in such a way that it could be argued technical results were produced (e.g. the national stock pricing report computer at a remote site would be dialled and connected to automatically in the course of using the system - these effects previously had to be performed by the human operator (using his hands to dial up the national computer and press the right function keys - an undisputed physical, and hence technical, effort).

(viii) Wang Laboratory's Application[27]

The application in this case was for an "expert system" and an "expert system shell", both of which took the form of computer programs running on conventional general-purpose computers. The claim was a piece of elaborate draughtsmanship full of technical jargon but devoid of any mention of the term "computer program" or "algorithm":

> "Claim 1 is for a digital computer system operable as an expert system, the said computer system comprising: storage means which stores a knowledge base including hierarchically-defined terms and their definitions, the corresponding definition of each term defining its respective term using the value of one or more terms, each of whose definitions is at a lower level of the hierarchy, and/or using one or more external values external to the knowledge base; and processing means programmed to receive commands from a user of the system, to produce inference commands in response to user commands, to interrogate the said storage means in response to the said commands to obtain the definition of a given term, and to compute the value of the said given term from its corresponding definition by obtaining the value of any term and any external value in the corresponding definition, the

[27] Re Wang Laboratories Inc, unreported, Patents Court transcript, 21 March 1990.

said system employing the said computer value to produce an expert response to the said user".

Removing the inessential details, the claim was one simply for an "expert system" comprising a conventional computer operating in the normal way with an expert system program, the knowledge base of which was in the form of hierarchically defined terms and their definitions. In artificial intelligence parlance, the invention was simply an expert system computer program with a non-conventional knowledge representation scheme (i.e. hierarchically-based rather than the traditional rule-based or frame-based). Claim 21 related to the "expert system shell" which was drafted in an equally lengthy and convoluted way. In essence, claim 21 was for an "expert system shell" comprising a computer operating in the normal way with an expert shell program which could be developed into an expert system of the kind defined in claim 1. After reviewing a number of EPO cases, Aldous J. refused the application. Claim 21 (i.e. the "expert system shell") was considered first in his judgement. He looked at the *result* of using the invention which would be an expert system of the type described in claim 1 whereby expert advice might be obtained. For Aldous J. the contribution to the known art provided by the invention was a computer program which would enable a human expert to store his knowledge in a particular way. He further characterised the invention as a conventional computer and a computer program which would enable expert knowledge to be incorporated in a systemised way. To his mind it was no more than a claim for a computer program as such. Aldous J. also rejected the argument that the invention had a technical effect because it resulted in a new machine ready to be used in a novel way. For him the computer and the expert system program did not combine together to produce a new computer. They remained separated and, in Aldous J's words, amounted to a collocation rather than a combination making a different whole.

In rejecting claim 1 (i.e. the "expert system"), Aldous J took the view that it related to no more than a computer program implementing a method for performing a mental act, namely, producing expert advice. The view was taken that a method for solving a problem such as giving expert advice was basically a mental act (and hence unpatentable) whether or not the computer adopted steps that would not ordinarily be used by the human mind. This seems an interesting view because it implies that once a problem is characterised as non-technical (e.g. performing mental acts), then there is no need to enquire further as to whether the solution is technical or has any technical effect: it is simply not a patentable subject matter. This proposition will have an interesting consequence in the field of intelligent robotics where a great deal of resources is being spent on producing intelligent robots which may be able to think or learn by themselves to some extent. Inventions in this field will *prima facie* not be patentable because the problem to be solved can be characterised as mental in nature (i.e. mimicking the processes of learning and reasoning). However, in practice, this difficulty and apparent absurdity can be resolved by incorporating the invention in a robot in such a way that a technical effect is produced. For example, a robot that uses a novel learning algorithm which enables it to learn by itself the best way of picking up an object is patentable because picking up an object is a technical effect. However, the same novel learning algorithm when incorporated into a chess playing robot which has no movable parts (but is connected to a video screen) might be held unpatentable because the result or effect of the invention could be characterised as mental in nature (i.e. that of playing chess). This scenario seems intuitively odd because in both cases the results are different but the essence of the invention is exactly the same; it is only the characterisation which differs. However, this seems to be an unavoidable consequence of focusing on the (effect or result of the) invention as a whole without separating out and analyzing its elements individually. The inventive element may be the same, but it can be incorporated into different settings to produce quite different effects some of which may be unpatentable or otherwise.

(ix) Hitachi Ltd's Application[28]

In this case Hitachi applied for a patent for a special type of compiler. A compiler is a computer program whose function is to translate a computer program from a high-level "source" code (in which it can be more conveniently written by the human programmer) into a low-level "object code" (which can be executed by the computer). The particular compiler in question was a "vector" compiler which could detect scalar instructions contained in ordinary source code program and compile those instruction into "vector" object code for the direct execution of a new class of very powerful "vector" super-computers. The end effect of such a compilation was that the computer program could be executed substantially faster in these "vector" super-computers. Hitachi relied on the decision in Vicom, arguing that their claim was for a method of operating on a physical entity, namely the source code, to produce another physical entity, namely the object code. Thus there was a technical effect because one physical entity had been transformed into another physical entity. Hitachi further argued that these entities were analogous to the image before and after processing (in Vicom) and hence their invention was not for a computer program as such merely because the best way of carrying out the invention was in the form of a computer program.

The Patent Office rejected the application on two grounds. First, the Patent Office regarded the decision in Vicom as having established the rule that operation on a physical entity was a necessary *but not sufficient* requirement for a technical process. That is to say, a technical process must involve operation on a physical entity but not vice versa (i.e. a method that operates on a physical entity is not necessarily a technical process). Secondly, it was pointed out that while in the Vicom case the numbers on which the method operated represented a physical entity in the form of an image, in the case of a compiler, the program on which it operated was not a physical entity but merely numbers or code representing nothing

[28] In the matter of Application No.8700138 by Hitachi Limited, The UK Patent Office, 22 May 1990.

but a program. That is to say, a computer program is not regarded as a physical entity! This conclusion seems counter-intuitive because a computer program is a physical thing (which exists in the real world as a tangible property) valued not for its aesthetic or academic qualities but for its practical effects on a computer[29]. However, the conclusion is a sensible one from the policy and implication point of view. For a policy point of view the result of using the invention is a computer program (in object code) which falls within the excluded categories and hence the process producing this unpatentable result cannot be a patentable subject-matter. This view is supported by the reasoning in Wang Laboratory's Application discussed earlier. From an implication point of view, if a compiler is patentable then a whole range of other software development tools such as editors (used in editing programs), interpreters, assemblers, and even wordprocessors would be patentable because they could operate on some form of programs and modify or transform them into a different form or version. Such a result would completely defeat the purpose of Section 1(2) or Art.52 because these tools are in fact no more than computer programs alone. Hitachi have not appealed against the rejection although some commentators hold[30] the view that the Patent Office was wrong in viewing a computer program as a non-physical entity and in not equating "technical effects" with "changes in a physical entity".

(x) Gale's Application[31]

The subject-matter of this application was a ROM (Read-Only-Memory) chip embodying an object code program. The program implemented a new algorithm for finding the square root of a number in such a manner that the calculation could be performed much quicker than with other algorithms (by eliminating the division stage

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29 Bohm N & Ryan C, "Are computer programs patentable", Computer Law & Practice, May/June 1991, pp213-216.

30 *Ibid.*

31 Gale's Application, CA transcript, 13 December 1990, also in RE GALE, FT Law Reports, 18 December 1990.

necessary in other square root algorithms). The claim was drafted so as to relate to a physical product (electronic circuitry) as follows:

> "...electronic circuitry in the form known as 'ROM', to provide controlling means whereby...'registers' shall derive the square root of an arbitrary number...".

Encoding a program in a ROM chip results in a piece of "firmware" in the phraseology of the computer industry. The Patent Office initially turned down the application on the basis that the only inventive element in it was the algorithm which could not be patented. But then the Patent Court allowed the appeal on the basis that the Patent Office was erroneous in isolating out the inventive element for consideration. The invention as a whole (following the reasoning in Vicom and in a subsequent English Court of Appeal case Genentech v Wellome[32]) should have been considered in answering the question of patentability. Aldous J stated that:

> "...the first task of the court is to construe the claim as that is where the invention is defined. If the claim properly construed is drafted so as to relate to any of the matters disqualified by section 1(2) then the invention is not patentable. If however the claim is drafted to a process or a technique or a product and the basis of [which]...is a disqualified matter, then the court should go on to consider whether the claimed invention is in fact no more than a claim to an invention for a disqualified matter. It is a question of fact to be decided in each case, but if the claimed invention is more than a claim to an invention for a disqualified matter then it qualifies as a patentable invention... In deciding that question of fact it is always important to consider whether the claimed

[32] [1989] RPC 147, 240 (CA).

> invention is ***part of a process*** which is to be used in ***providing a technical result***. If it is, then the claim cannot be said to be an invention relating to no more than one of the disqualified matters. Similarly, where the claim is directed to a product, it is important to consider whether the product claimed is a ***new technical product*** or merely an ordinary product programmed in a different way as in the latter case the claim is in reality to the program and therefore could not relate to a patentable invention"[33].

The reasoning and the language used are closely in line with those used by the Technical Board of Appeal. This case however differs from the many of the other software-related cases in that the claim related to a product (i.e. the ROM chip) rather than a process or method, and that the judgement concentrated on the structure of the product rather than its technical effect. In allowing the appeal, Aldous J. took the view that the physical structure of the ROM was altered resulting in a new technical product (hence patentable). This conclusion was reinforced by the fact that if the ROM was inserted into a computer this would lead to a technical change resulting in a different computer (i.e. a computer with a hardware component changed - the ROM chip). Aldous J. further took the view that there was a difference between a claim which related to a disc containing a program and a ROM with a particular circuitry. He maintained that in the former the disc carried the program (and therefore was a claim relating to a program), whereas in the latter, the program or method was used as the basis for altering the structure of the ROM which then became a dedicated piece of apparatus which could be used to carry out the program or method.

However, the Court of Appeal later reverted the decision of the Patent Court and held that the ROM chip was not patentable because it was an entirely conventional type of ROM chip distinguishable from other ROM chips only by the

[33] *Normal Henry Gale*, unreported, Patent Court transcript, 22 January 1990. My own emphasis added.

program embodied in its circuitry and hence the contribution was no more than a computer program. The fact that the program was embodied in the microscopic circuitry of a chip rather than in the magnetic characteristics of particles in a disk was immaterial to the court. If a floppy disk containing a computer program was not patentable, it would be nonsensical that a ROM chip containing the same program should be patentable. Drawing an analogy from the IBM/Document Abstracting and Retrieving case discussed earlier, the Court characterised the contribution made by the invention as an improved set of procedures for calculating the square root of a number. These procedures had no technical character but were of a purely intellectual nature.

A number of important observations were made by the Court of Appeal in this case. First, a computer program was positively defined as a series of instructions capable of being followed by a CPU to produce a desired result. So now there is a working definition of a computer program for the Courts to work on while previously there was none. Secondly, it was confirmed in no ambiguous terms that the interpretation given to section 1 of the 1977 Patents Act by the UK Courts should be the same as Article 52 of the European Patent Convention by the European Patent Office. It thus ended all doubts as to whether there would be consistency in the treatment of software-related inventions in the UK and the EPO. It seems that the formulation of Aldous J. on patentability was correct (since it closely followed the Technical Board of Appeal's approach) but that he erred only in the process of applying the formulation to the facts of the case in point. Indeed, the ROM chip was not a new product because it was in all technical aspects still a ROM chip. The fact that a program was encoded in it did not change the technical nature of the ROM chip.

4. DISCUSSIONS AND EMERGING TRENDS

Patentable Subject-Matter

From the detailed examination of the above cases, a number of important trends may be identified. First, there is now a general congruence in attitude between the English Courts and the European Patent Office towards the scope and nature of patentability in the area of software-related inventions. Secondly, in determining the patentability of a claim, the emphasis is now firmly on looking at the invention as a whole. Previously (prior to 1985), the emphasis was on either excluding the non-patentable ingredients of an invention for examination or isolating the novel element for examination. There is now no need to break up an invention into its constituent elements in the examination process. If an invention as a whole can be characterised as technical then it qualifies as a patentable subject-matter. The key to deciding whether an invention has a technical character is to look at the effect, result, or contribution that the invention makes relative to the prior art. If the effect, result or contribution made is physical in nature or involves changes in physical entities then it is likely (but not necessary[34]) that the invention has a technical character and hence is patentable. Thirdly, substance has started to triumph over form. If the substance of a claim is unpatentable then it is now more unlikely than before that the situation can be improved by changing the form of the claim. This is perhaps best illustrated by the case of Gale's Application where the substance of the claim was a mathematical algorithm but the form of the claim was skilfully drafted so as to relate not to an algorithm but to a radically different entity, namely, the structure of a physical product (the ROM chip). This handy work on drafting did not manage to fool the Court of Appeal however.

[34] See the Hitachi case discussed above.

It is convenient at this point to summarise the cases examined so far using the following table:

CASE	SUBJECT MATTER	HELD	MAIN REASONS GIVEN
Vicom [1987]	image processing algorithm	Patentable	operation on images (a physical entity) is a technical process
Kock & Sterzel [1988]	X-ray machine optimisation procedures	Patentable	machine optimisation problem is technical in nature
IBM/Semantics [1989]	semantic network implementation	Unpatentable	the nature of the problem is a linguistic one
IBM/Network [1990]	virtual network connectivity procedures	Patentable	a solution to a technical problem in computer networking
IBM/Abstract [1990]	documentation abstraction & retrieving algorithm	Unpatentable	the result of the invention is purely intellectual in nature
IBM/Display [1990]	visual indication of equipment condition	Patentable	visual effects are physical and hence technical
Merrill Lynch [1989]	expert system for securities trading	Unpatentable	the invention is a scheme for doing business
Wang [1990]	novel expert system shell and expert system	Unpatentable	the results of the inventions are either a program or simply a mental act
Hitachi [1990]	vector compiler	Unpatentable	The invention operates on and produces programs which are unpatentable
Gale [1990]	ROM chip embedding a new square root algorithm	Unpatentable	contribution is simply a better algorithm; the ROM chip remains unchanged technically

Interpretation of "Technical Effect" etc

The recent cases, as examined, have shown a remarkable trend in the interpretation of patent claim from a strict literal interpretation on the matter as drafted in the claim to a more perspective approach emphasising not so much the structure and wording of the claim as drafted but more on the characterisation of the invention which the claim represents in terms of its effect, result, contribution to the art, or role as a solution to a problem. In all cases the presence of technical character is of crucial importance to patentability. Despite the importance of the

term "technical character", its precise definition has never been elaborated upon by the authorities in the UK or in the EPO. The crux of the matter relates to the meaning of the term "technical". The answer to this question depends on the precise meaning of "technology". The Collins English Dictionary defines technology as the application of practical or mechanical sciences to industry and commerce. The same dictionary defines sciences as the systematic study of the nature and behaviour of the physical universe, based on observation, experiment, and measurement. It is difficult to give a precise definition to the term "technology", because its interpretation depends on the context in which the term is used. However, it seems it has the attributes of being practical, mechanical and physical. Practical and mechanical are adjectives similar to physical. It appears reasonable therefore to relate (but not equate) the term "technical" mainly to the term "physical". Given the difficulties in providing a literal and positive definition of the term technology, another approach is to define the term "in use". For example, instead of defining the term in isolation, its meaning is revealed by examining the way it is used in practice. This seems to be a sensible approach since the meaning of technology is not absolute but rather it depends on the context in which the word is used. This approach to the meaning of technology is indeed the one favoured by the Technical Board of Appeal which, instead of defining the term "technical" in isolation, maintains that an invention is technical if it provides or leads to a concrete, causal, non-abstract result or change in things (see the Vicom case above). Being concrete, causal, and non-abstract are all manifestations of being physical. Hence the linkage between "technical" and "physical" is quite obvious. So, if an invention results in (or has the effect of) changes to physical entities (i.e. a physical change) then the invention is normally characterised as technical.

Shifting the focus from the meaning of the term "technical" to the term "physical effect" or "physical change" renders the problem of interpretation easier because "physical change", though difficult to define precisely using linguistic techniques, is a term which can be comprehended with a lesser degree of difficulty

in practical usage. The Collins English Dictionary defines the term "physical" as "of material things or nature as distinguished from the mind or spirit". Thus "physical change" relates to change in material things which can exist naturally and independently in nature. Change in information content is therefore clearly not a physical change. Change in some physical entities such as electrical signals representing nothing more than the corresponding change in information content is also not a physical change. This view is supported by the decision in the IBM/Document Abstracting and Retrieving case discussed above. However, it is possible that physical change can occur in intangible things such as images (see the Vicom case). Another similar example is voice. A novel algorithm which enables a human voice to be synthesised in a better way is likely to be patentable even though the algorithm is embedded in a computer program which drives conventional speech synthesis hardware. In the same way, changes in numbers or electrical signals representing physical objects such as images and voice may be regarded as physical changes. The crucial distinction is whether the "thing" to be changed is or represents a real-world object. If so, the change is physical and hence the process which brings about the change is technical in character.

However, it is not exactly clear whether the UK will adopt the same attitude as the EPO towards the interpretation of the word "technology". The question of the meaning of technology has never arisen in the cases so far. For example, in the Merrill Lynch Inc.'s Application discussed above, the Court of Appeal simply characterised the invention as a method for doing business which fell neatly into one of the excluded categories in section 1(2) of the 1977 Act. Once this stage of reasoning was reached, the conclusion was drawn that the invention was for a unpatentable subject-matter. There was no further need to examine whether the invention had a technical character. A similar style of reasoning was used in the Wang Laboratory's Application discussed earlier. Once the effect of the invention was characterised as either a mental act (for the expert system in operation) or a computer program (for the expert system shell which would produce expert systems)

the conclusion of unpatentability was immediately drawn because the effect as characterised fell neatly once more into an excluded category. There was no question of having to examine whether there was a technical effect. Nonetheless, the Court of Appeal *in obiter* did use a language similar to that used by the Technical Board of Appeal. Thus, in these cases, references were made to technical advances, new results (see the Merrill Lynch case), and changes to a physical entity (see Gale's Application).

Novelty, Inventive Step, and Industrial Application

Establishing that a software-related invention is a patentable subject-matter is only the first of a number of hurdles that will have to be surmounted before a monopoly right to the exploitation of the invention in the form of a patent can be granted. For a patent to be granted, in additional to the requirement that the invention is a patentable subject-matter, it must also be novel (i.e. new), involve an 'inventive step' (i.e. not obvious), and be capable of industrial application[35].

An invention is regarded as novel if it is new in the sense that it is not part of the "state-of-the-art" existing at the "priority date"[36] (which is usually taken as the date on which the patent application is made). The "state-of-the-art" comprises the sum total of human knowledge made available to the public in any form anywhere in the world at a given point in time. Moreover, an invention is considered as an implicit part of the "state-of-the-art" if it can be "anticipated" thereof[37]. The standard of novelty required is therefore quite high. The majority of software-related applications (e.g. database, spreadsheet, transaction processing, etc.) in the commercial world can hardly be regarded as novel in this sense. Most of them address well known (though important) business problems and the solutions to them are also generally well known or may be anticipated from existing solutions. This situation is not changed by the fact that in most cases enormous effort has to be

35 Patents Act 1977, section 1(1), which closely corresponds to Art. 52(1) of the European Patent Convention.
36 Patents Act 1977, section 5.
37 e.g. see *Molins v Industrial Machinery Co Ltd* (1938) 55 RPC 31.

spent in carrying out the often laborious and labour intensive steps necessary to produce the software required for a specific environment even though the nature of the software itself is not much different from other similar types of software already in use.

The requirement of a sufficiently inventive step means that the invention must not be obvious to a person skilled in the art[38]. The relevant objective standard is that of a competent skilled worker who understands all the relevant technical literature in his speciality and knows the details of all the latest developments but yet lacks any ability to invent. An invention does not possess a sufficiently inventive step if it is obvious to such an artificial person. The standard required appears to be quite high because of the level of knowledge and competence required of the artificial person. Despite the appearance of objectivity this artificial person is in fact subjective in nature. Since this artificial person does not exist in real life, it is up to the relevant authorities (in the Patent Office and in the Courts) in each case to say how this person will decide on the question of obviousness. Thus it can be said that the standard of a sufficient inventive step, though framed in an objective manner, has to be interpreted subjectively by the relevant authorities in each case. The courts have put forward a variety of guidelines in the form of rebuttable presumptions of sufficient inventiveness[39], some of which are listed below.

An invention is presumed to be not obvious if:

- its likelihood of success is low before the invention is tried out, or
- it involves a substantial advance in the state-of-the-art, or
- it satisfies a long-felt want, or
- it is commercially successful.

38 Patents Act 1977, section 3.

39 e.g. see "Introduction to Intellectual Property Law", J. Phillips & A. Firth, 1990, (Butterworth).

However, any of the above presumptions may be rebutted by, *inter alia*, showing that the invention is merely:

- the application of a well known product (or process) for a well known purpose, or
- a collocation of features which already exist in the prior art.

In general, a simple amalgam of different existing technologies is not sufficient to satisfy the requirement of an inventive step, nor is the mere use of an old thing in a new way unless new technical effects are obtained. This seems to have the effect of ruling out most software-related inventions, since most of them rely on straightforward technology integration or are simply applications of well-known programming techniques for well-known purposes (such as developing a transaction processing system). For example, the claim in the Merrill Lynch case describes the application of a well known product (i.e. a general-purpose computer running a conventional sequential program) for a well-known propose (i.e. securities trading) and thus it is likely to fail in the test for inventiveness even if the invention were to be regarded as a patentable subject-matter. The incorporation of conventional communications hardware in the system will not change the picture because the resulting system is simply a collocation of two well-known technologies (of computer and communication). No new technology is produced.

The requirement of susceptibility to industrial application means an invention cannot be patented unless it is a thing which can be made (i.e. a product) or a means of making a thing, or of achieving a concrete end result. This requirement presents few problems in relation to software-related inventions. There is no doubt that in general a software-related product is a thing which can be made (or manufactured). Indeed the software industry is playing a very significant and vibrant role in most of the developed economies.

It is possible that the requirements for novelty and sufficient inventiveness will present an ever greater degree of difficulty than the requirement of patentable subject matter as regards the granting of a patent for software-related invention. If this is the case, then it will further reduce the scope and relevance of patent protection for software-related inventions in a very significant way. There is, however, no case law on this point at the moment.

5. CONCLUSIONS

By focusing on the effect or contribution of an invention as a whole, instead of looking at individual elements, the current approach taken in the UK/EPO towards patentability of software-related inventions has the effect of widening the scope of protection for such inventions. Inventions regarded as outside the scope of patent protection prior to the 1985 EPO guidelines might now become patentable subject-matter using the current approach. The position is getting closer to (but not quite the same as) that in the US where virtually all algorithms are protectable by patents if accompanied by some non-token post-solution activity[40]. It is perhaps interesting to note that only 4 out of the 10 cases reviewed in this paper were held as relating to patentable subject-matter. It is likely that most of these cases would be regarded as relating to patentable subject-matter in the US. Whether the current trends in the UK/EPO will develop in the same increasingly liberal way as in the US remains to be seen.

Even though it has not been stated explicitly in either the 1977 Patents Act or the European Patent Convention, the presence of technical characters is in most cases crucial for patentability. These characters may refer to the process concerned, its effect, result or contribution. Indeed it has been held sufficient that if an invention represents a solution to a technical problem then the invention qualifies for protection[41]. However, the term "technical character" has never been

[40] Diamond v Diehr, 450 US 175 (1981) was the major turning point towards a liberal approach.

[41] e.g. see the IBM/Network case discussed in an earlier section.

positively defined in any of the cases. Interpretation of the term "technical character" is left to the Courts and the Technical Board of Appeal given the facts in a particular case. No doubt this approach allows for flexibility in that the interpretation used in each case can easily be adjusted to deal with the effect of the fast pace of change in computer technology, which would otherwise render a concrete, positive definition obsolete in a short span of time. However, the consequence of this approach is to increase the level of uncertainty as regards the exact scope of patentability since there is one variable in the formula which remains unknown and changing, i.e. the meaning of technical character. It is questionable whether the right balance between flexibility and uncertainty has been achieved using the current approach. In fact, very often the pace of change in computer technology has been exaggerated. Most of the computers in use today still work on the same principles governing the von-Neumann computer organization[42] invented over 50 years ago. Similarly, the nature of computer programs has not changed much over the last 50 years. Most programs in use nowadays are still in the form of a sequence of coded instructions which can be executed by a computer sequentially to produce some desired effects.

Even though the meaning of "technical character" has become clearer in recent years, and both the EPO and courts in the UK are likely to apply a similar approach in its application, there is still a significant element of uncertainty arising from the way a claim is characterised given the facts of a particular case. A claim may be characterised according to its effect, result, contribution to the art, or its role as a solution to a problem. Despite the emergence of a more uniform approach to the interpretation of "technical character", it is still by no means certain that each of these different characterisations will always result in the same answer. An invention may be a solution to a non-technical problem but yet it may produce physical

[42] The "von-Neumann" model is one in which data passively resides in store while instructions are executed one-at-a-time according to a defined sequence controlled by a "computer program". See, for example, M.J. Flynn, "Some Computer Organisations and their Effectiveness," IEEE Transactions on Computers C-21(9), p.948, Sept 1972.

effects. For example, a self-learning robot embodies a non-technical solution (say, a self-learning neural network algorithm) to a non-technical problem (i.e. self-learning) but it may nonetheless produce a new physical effect in that it enables the robot to pick up difficult objects gradually by trial and error. Despite the fact that section 1(2) of the 1977 Act only prevents the patenting of inventions related to the excluded categories *as such*, it does not follow that inventions relating to more than just the excluded categories are necessarily patentable. The words "only if" must not be read into the meaning of the excluded categories. Instead, the "whole-content" and "technical character" approaches should come into play in such circumstances (with all its attendant inevitable uncertainties). The case in Merrill Lynch Inc.'s Application has firmly established this point.

In practice, even if the scope of patentable subject-matter were to be enlarged to include computer programs *per se*, most of them would still fail to get patent protection because of the lack of a sufficient inventive step in most cases[43]. It has been suggested that to include computer programs as such in the scope of patentable subject-matter will give rise to enormous problems in its practical implementation because of the lack of available systematic information on the prior art in this area[44]. Patent protection is only one of a number of modes of protection (e.g. copyright, contract, trade secret) available for software. In many cases other modes of protection may be more suitable and economical. The importance of patent protection for software-related inventions should therefore be viewed within the appropriate context.

Despite the current uncertainty as to the exact meaning of technology (which is likely to remain for some time to come), it is now quite clear from the recent cases examined herein that evidence of possessing at least one of two characteristics will qualify a software-related invention (when examined as a whole) as patentable

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43 Commercial application software which constitutes the major part of all software in use today (in monetary terms) performs mostly data handling and manipulating tasks which are no doubt valuable (and tedious) but routine in nature.

44 Jack E Brown, "The Protection of High Technology Intellectual Property", Computer Law & Practice, March/April 1991.

subject-matter. These two characteristics are: (1) the invention operates on physical entities forming part of the world outside the computer, and (2) the invention represents a solution to a technical (as opposed to purely intellectual or informational) problem which exists within the computer system (including a network system). As regards the former characteristic, a physical entity is to be understood in a broad sense to include both tangible matters that we can feel and touch and intangible matters (such as image and voice) that we can nonetheless sense or perceive using our physical senses so long as these matters can exist naturally and independently in the real world. Roughly speaking, technical effect is a physical (real world) effect. Thus a conventional system incorporating a novel computer program for the manipulation of text (i.e. a non-physical object) is not patentable. However, a conventional system incorporating a novel computer program for speech processing is patentable because speech is physical in character. This is so even if in both cases the novel computer program implements exactly the same algorithms (for example, data-compression and linear-predictive-coding). As regards the latter characteristic, the position is slightly more complicated. Computers in use today generally work in the same technical way according to the sequential von-Neumann model[45]. However, computers can operate according to other technically different models such as data-flow models and massively parallel neural models[46]. Although these computers may be constructed using digital circuitry, it is also possible to make an ordinary general-purpose computer behave exactly like these new computers by means of a specific computer program. The general-purpose computer in combination with the program is likely to be patentable because a technical effect is produced in the sense that the general-purpose computer, when programmed in such a way, behaves and operates in a technically different way. This view is supported by the IBM/Network case discussed earlier. In

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45 refer to note 42 above.

46 e.g. see Matthew Lee, "Neural Networks: rationale, history, technology and applications", in E.Scharf (ed.), The Computer Engineer's Reference Book, Dec 1989, (Butterworth); and Matthew Lee, "A packet-based demand/data driven computational model", Lecture Notes in Computer Science , Vol.237, pp.214-221, 1986, (Springer-Verlag).

that case, the network hardware was entirely conventional, but it was programmed in such a way that new technical effects in the sense of improved virtual network connectivity were produced. However, a conventional computer running a program (however novel) in an ordinary way does not normally qualify as a technical contribution. This is illustrated in the case of Wang Laboratory's Application discussed above. In that case, a conventional computer was running a novel expert system program in a conventional way. The computer behaved and operated in the same conventional way. There was thus no new technical effect produced which would otherwise qualify the claim for patentability[47].

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[47] e.g. see Note 46 above.