Learning path for patent examiners

Programs for computers:
Advanced level

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Introduction

This publication, "Programs for computers, Advanced level", is part of the "Learning path for patent examiners" series edited and published by the European Patent Academy. The series is intended for patent examiners at national patent offices who are taking part in training organised by the European Patent Office (EPO). It is also freely available to the public for independent learning.

Topics covered include novelty, inventive step, clarity, unity of invention, sufficiency of disclosure, amendments and search. Also addressed are patenting issues specific to certain technical fields:

- patentability exceptions and exclusions in biotechnology
- assessment of novelty, inventive step, clarity, sufficiency of disclosure and unity of invention for chemical inventions
- the patentability of computer-implemented inventions, business methods, game rules, mathematics and its applications, presentations of information, graphical user interfaces and programs for computers
- claim formulation for computer-implemented inventions

Each publication focuses on one topic at entry, intermediate or advanced level. The explanations and examples are based on the European Patent Convention, the Guidelines for Examination in the EPO and selected decisions of the EPO's boards of appeal. References are made to the Patent Cooperation Treaty and its Regulations whenever appropriate.

The series will be revised annually to ensure it remains up to date.

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All references to natural persons are to be understood as applying to all genders.

Contents

Legal references

1. Learning objectives

Participants to this course will:

- Understand the second hurdle for a computer program according to the practice of the EPO.

2. Applying the second hurdle to programs: suitable/unsuitable criteria

In order to assess whether a computer program produces a "further" technical effect, the boards of appeal have defined criteria which are presented as suitable or unsuitable criteria.

The suitable criteria include a set of questions, namely:

- Does the method corresponding to the computer program produce a technical effect?
- Does the computer program control the functioning or operation of the computer?
- Does the design of the computer program rely on specific technical considerations regarding the internal functioning of the computer?

If the answer to any of those questions is yes, the computer program produces a further technical effect.

Some other criteria however are indecisive or not sufficient to establish if a computer program produces a further technical effect.

The fact that a computer program requires computing resources is a consequence of the "normal" physical interactions between program and computer and not a further technical effect. This does not change whether or not a prior-art document exists. Therefore, the **absolute or relative use of computer resources is not sufficient on its own to acknowledge a further technical effect**.

The presence of a further technical effect is **assessed without reference to the prior art,** i.e. the determination of the claimed features which contribute to the technical character of the invention is made without reference to the prior art. It follows that the mere fact that a computer program serving a non-technical purpose requires **less computing time than a prior-art program** serving the same non-technical purpose, does not on its own establish the presence of a further technical effect (T 1370/11).

Likewise, **comparing a computer program with how a human being would perform** the same task is **not a suitable** basis for assessing if the computer program has technical character (T 1358/09).

If a further technical effect of the computer program has already been established, the computational efficiency of an algorithm affecting the established technical effect contributes to the technical character of the invention and thus to inventive step (e.g. where the design of the algorithm is motivated by technical considerations regarding the internal functioning of the computer; see also GL G-II, 3.6).

A computer program **cannot derive technical character from the mere fact that it has been designed such that it can be automatically performed** by a computer. "Further technical considerations", typically related to the technical considerations of the internal functioning of the computer, going beyond merely finding a computer algorithm to perform a task are needed. These have to be reflected in claimed features that cause a further technical effect (G 3/08).

Legal references:
G-II, 3.6

3. Applying the second hurdle to programs: technical efficiency of a program

As noted above when discussing the non-suitable criteria, the technical efficiency of a computer program is not **sufficient on its own to establish a technical effect**. **Any computer program** implementing a method will, by definition, **need a particular amount of computing resources**, in particular **time**. This is merely a consequence of the **"normal" physical interactions** between program (software) and computer (hardware). According to established case law of the boards of appeal, the computer program would thus be found not to comply with Article 52(2)(c) and (3) EPC for lack of a "further" technical effect. And because the computing time does not contribute to the technical character of the computer program, it could not support the presence of an inventive step of a corresponding computer-implemented method.

These findings cannot be changed by a document which discloses an alternative, earlier non-technical method which takes longer to carry out on a computer. In other words, **it cannot be argued that a computer program must be regarded** as an invention in the sense of Article 52(1) EPC, i.e. **as a technical invention, for the sole reason that there happens to be an earlier computer program which solves the same, non-technical problem more slowly**. Otherwise, the exclusion of computer-implemented methods under Article 52(2) and (3) EPC would become meaningless because for any given computer program a less efficient one is either known or conceivable. As a consequence, a computer-implemented method cannot be found to show an inventive step for the sole reason that a slower computer-implemented method exists in the prior art.

Hence, if a computer program ***lacks a further technical effect****, and is thus a computer program as such, a "faster" computer program (faster meaning in comparison to existing programs, prior art) where reducing computing effort is only attributed to an algorithmic change is still a computer program as such.* For instance, a reduced computational effort by re-using an intermediate result produced by an earlier algorithmic step is insufficient to acknowledge a further technical effect.

However, where a ***further technical effect is already recognised in the computer program****, e.g. since the method steps executed serve the purpose of controlling the rotors of a helicopter, then an improvement in the speed of the program would count as a technical contribution – e.g. faster, more reactive controlling of the rotor.* Therefore, if it is established that a computer-implemented method or a computer program **has a "further" technical effect and solves a technical problem independently of its absolute or relative computing time**. Only then – and only if the alleged faster speed affects an established technical effect – can it be argued that the faster speed contributes to a technical effect and thus to inventive step.

This line of reasoning relates to alleged improvement regarding performance measurements alone; it is insufficient to establish technical character.

In general, to decide **whether any such improvement is a technical effect, it has to be further determined how the improvement is achieved**, for instance whether it is the result of **technical considerations** regarding the functioning of the technical context of the invention (e.g. computer, system, process, transmission channel). Features that purposively use technical means to achieve any such improvement are technical. In other words, features make a **technical contribution if they result from technical considerations** on how to, for instance, improve processing speed, reduce the amount of memory required, improve availability or scalability or reduce network traffic when compared with the prior art or once added to the other features of the invention, and if, in combination with technical features, they help achieve any such effect. In particular, this kind of effect on computing efficiency is considered to correspond to a physical effect or a change in a physical entity.

Consequently, a further technical effect can be recognised **if the program's efficiency is due to specific technical considerations of the computer's internal functioning**, such as faster execution by storing data in a fast page cache in RAM to avoid repeated accesses to a slow peripheral hard disk.

Efficient use of resources may also contribute to an already established further technical effect and become relevant in the inventive-step assessment, such as an improvement in the speed of a computer program restoring distorted digital images.

On the other hand, these effects and the respective features are **non-technical if the effects are achieved by non-technical modifications to the underlying non-technical method or scheme** (for example, a change of the business model or a "pure algorithmic scheme", i.e. an algorithmic scheme not based on technical considerations).

Where mathematics is used for a business purpose like calculating price, since both mathematics and the business method are excluded, i.e. non-technical, subject-matter, an improvement in speed does not necessarily make the mathematics a technical feature. If the mathematics is improved to calculate the price faster, it still has a business effect. However, if there is an already established technical effect, e.g. mathematics is used for image processing, then making this faster is also a technical effect and can be used in the formulation of the objective technical problem.

Examples

T 2418/12:

The consideration that an intermediate result produced by an earlier algorithmic step may be re-used in a later step is an algorithmic rather than a technical consideration, as it does not require considerations about the internal functioning of a computer, e.g. how memory is managed. Algorithmic efficiency is not a technical effect.

T 1370/11:

Speeding up an entirely abstract method is insufficient to establish that the claimed computer-implemented method solves a technical problem.

Legal references:

G-II, 3.6

4. What is information modelling – technical character

Information modelling is an intellectual activity devoid of technical character and typically carried out by a systems analyst in a first stage of software development, to **provide a formal description of a real-world system or process**.

The following information modelling activities have non-technical character unless a technical effect is produced in the context of the invention:

- **Specifications of a modelling language**, the **structure of an information modelling process** (e.g. use of a template) or the **maintenance of models** have no technical character either (T 354/07).
- **Properties inherent to information models**, like reusability, platform-independence or convenience for documentation, are not regarded as technical effects (T 1171/06).
- **Conceptual methods describing the process of software development** (meta-methods) normally have no technical character. For example, in a computer-implemented method for generating program code for a control task, a feature specifying that a platform-independent model is converted to a platform-dependent model, from which program code adapted to the target platform is derived, makes no technical contribution insofar as the performance of the control task itself is not affected.

On the other hand, if an information model is **purposively used in the context of an invention to solve a specific technical problem by providing a technical effect**, **it can contribute to the technical character** of the invention (see also GII, 3.3.2 and 3.5.1). An example of a purposive use of the information model is provided in G-II, 3.5.1:

A computer program for optimising the amount of energy that a reactor core generates by modelling an arrangement for loading nuclear reactor fuel bundles into a reactor core (T 914/02).

However, merely limiting the claim to modelling physical or technical systems (such as a "physical system" (T 49/99), "control algorithms" (T 354/07), or a "mechatronic system in a car" (T 1171/06)) in generic terms is not sufficient for that purpose.

Features specifying how the model is actually stored (e.g. using relational database technology) can also make a technical contribution.

Legal references:
G-II, 3.6.2

5. Technical character of programming

The activity of programming, in the sense of writing code, is an intellectual, non-technical activity, to the extent that it is not used in the context of a concrete application or environment to contribute in a causal manner to the production of a technical effect (G 3/08, T 1539/09).

For example, reading a data type parameter from a file as an input to a computer program rather than defining the data type in the program itself is merely a **programming option** when writing code, which per se has no technical character. The same applies to **naming conventions** for object names for facilitating the intelligibility and the management of program code.

Defining and providing **a programming language**, or a programming paradigm such as object-oriented programming, does not per se solve a technical problem, even if its particular syntax and semantics enable the programmer to develop a program with greater ease. **Easing the intellectual effort** required from the programmer is per se not a technical effect. Since programming is an intellectual activity, if the sole effect on a human programmer is to make them understand, think or envisage how to program in an easier way, it does not qualify as a technical effect.

However, effects such as allowing an input mechanism, e.g. entering text by a particular user interface mechanism, are technical effects (G-II, 3.7.1).

When assessing an invention relating to a programming environment, the **features pertaining to the programming language normally do not contribute** to its technical character. For example, in a visual programming environment, providing specific graphical building blocks is part of the programming language and makes no technical contribution if the only effect is easing the intellectual effort required from the programmer. Providing particular programming constructs may enable a programmer to write shorter programs, but that does not qualify as a technical effect since any resulting reduction in program length ultimately depends on how a human programmer uses the programming constructs. In contrast, automatically processing machine code by dividing it into an instruction chain and an operand chain and replacing repeating instruction sets with macro-instructions to generate optimised code of reduced memory size makes a technical contribution. In this case, the effect does not depend on how a human programmer makes use of the macro-instructions.

Features of a programming environment that relate to its graphical user interface, e.g. visualisations and data input mechanisms, are to be assessed as indicated in G-II, 3.7 and 3.7.1.

Examples

T 1370/11:

The independent claims of the auxiliary request differ from those of the main request in that they specify a number of details regarding the implementation of objects, properties and expressions.

In particular, they indicate that for each property of an object a "property identifier field" and an associated "expression field" are provided, the latter storing an "expression object" created from an "expression class" and providing two methods: one for evaluating the property on the basis of the source property and one for invalidating dependent properties on the basis of separately defined "relationships".

In the board's view, these features were merely particular choices a computer programmer might make when implementing the method according to claim 1 of the main request, namely choosing an object-oriented language for this purpose and coding the specific functions required in terms of the programming language chosen. Choices of this type form part of the art of computer programming and cannot in themselves be adduced as an indication of "technical" activity (see T 2048/07, Reasons 7.3, and G 3/08, OJ EPO 2011, 10, Reasons 13.5).

Legal references:
G-II, 3.6.2

6. Technical character of data structures

A **computer-implemented data structure** or data format embodied on a medium or as an electromagnetic carrier wave **has technical character** as a whole and thus is an invention within the meaning of Article 52(1) EPC.

A data structure or format contributes to the technical character of the invention if it has an **intended technical use** and it **causes a technical effect when used according to this intended technical use**. Such a potential technical effect related to an implied technical use is to be taken into account in assessing inventive step (G 1/19). This may happen if the data structure or format is **functional data**, i.e. if it has a technical function in a technical system, such as controlling the operation of the device processing the data. Functional data inherently comprise, or **map to**, the corresponding **technical features of the device** (T 1194/97). **Cognitive data**, on the other hand, are those data whose content and meaning are only relevant to human users and do not contribute to producing a technical effect (see however, G-II, 3.7 for presentation of information to a user in a continued and/or guided human-machine interaction process).

Cognitive data however is not the only type of non-technical data. A data structure or a data format may have features which may not be characterised as cognitive data (i.e. not for conveying information to a user) but which nevertheless do not make a technical contribution. For example, the structure of a computer program may merely aim at facilitating the task of the programmer, which is not a technical effect serving a technical function purpose. Furthermore, data models and other information models at an abstract logical level have per se no technical character (see G-II, 3.6.2).

Functional data would be for instance a record carrier for use in a picture retrieval system which stores coded pictures together with a data structure defined in terms of line numbers and addresses which instruct the system how to decode and access the picture from the record carrier. This data structure is defined in terms which **inherently comprise the technical features of the** picture retrieval **system**, namely the record carrier and a reading device for retrieving pictures from it in which the record carrier is operative. It thus contributes to the technical character of the record carrier, whereas the **cognitive content** of the **stored pictures** (e.g. photograph of a person or landscape) does not.

Similarly, an index structure used for searching for a record in a database produces a technical effect since it controls the way the computer performs the search operation (T 1351/04).

Another example is an electronic message with a header and a content section. Information in the header contains instructions which are automatically recognised and processed by the receiving message system. This processing in turn determines how the content elements are to be assembled and presented to the final recipient. Providing these instructions in the header contributes to the technical character of the electronic message, whereas the information in the content section, representing cognitive data, does not (T 858/02).

Digital data is used to control devices in additive manufacturing (AM), which is the general term for technologies manufacturing physical objects by successive addition of material based on a digital representation of the geometry of the object. If the data defines the instructions for operating the AM device, it makes a technical contribution as illustrated in the following example:

A computer-readable medium storing data which defines both a digital representation of the product of claim 1 and operating instructions adapted to control an AM device to fabricate the product using the digital representation of the product when said data is relayed to the AM device.

Remarks

A computer-readable medium is a technical object, so no objection under Art. 52(2) and (3) arises.

Since the data comprises both a digital description of the (physical) product of claim 1 and associated operating instructions adapted to control an AM device, it is intended to be used to control an AM device to fabricate the product. This technical use of the data is implied across substantially the whole scope of the claim. Construing the present claim to encompass a non-technical use of merely visualising the data would be artificial. The technical effect of fabricating the physical product defined in claim 1 that is achieved when the data is used according to its intended use is thus a potential technical effect that is to be taken into account when assessing inventive step. The digital representation of the product makes a technical contribution to the extent that it defines technical features of the fabricated physical product. However, if such a technical use of the data were not implied by the claim, the potential technical effect of the data of fabricating the physical product could not be taken into account when assessing inventive step as it would not be implied across substantially the whole scope of the claim. This would be the case, for instance, if the data defined only a digital description or 3D model of the product that is not adapted to additive manufacturing of the product and could be used to merely visualise the product in a CAD software tool. Abstract descriptions or models are not considered technical even if the described entities are technical (see G-II, 3.3.2). In such a case, the stored non-technical data would not make a technical contribution.

Legal references:
G-II, 3.6.3

7. Database management systems and information retrieval

This section discusses the distinction between database management systems and information retrieval.

Database management systems are technical systems implemented on computers to perform the **technical tasks of storing and retrieving data** using various data structures for **efficient data management**. A method performed in a database management system is thus a method which uses technical means and is therefore not excluded from patentability under Article 52(2) and (3) EPC. **Features specifying the internal functioning of a database management system** are normally based on technical considerations. Therefore, they contribute to the technical character of the invention and are taken into account for the assessment of inventive step. For instance, technical considerations are involved in improving system throughput and query response times by automatically managing data using various data stores with different technical properties, e.g. different levels of consistency or performance (T 1924/17, T 697/17).

The Boards of Appeal decision T 1924/17 summarised the current examination practice with respect to the technical character of query processing in database management systems, as follows:

"Structured declarative **queries**, which are used for retrieving data managed in a relational database management system, normally have **precise, formally defined semantics**, i.e. the query precisely describes the data that is to be retrieved, and the database management system then retrieves the specified data set as a result. Relational database management systems typically execute such queries by determining an **efficient query execution** plan based on cost estimates for the necessary internal operations of the computer system (e.g. in terms of main memory accesses, hard disk accesses, central processing unit resources). Such database management systems are software platforms for the centralised control of data ("central database"). Features of these platforms often have a technical character, as they have been designed based on engineering considerations concerning the efficient exploitation of the computer system as a technical system."

Database management systems execute structured queries, which formally and precisely describe the data to be retrieved. Optimising the execution of these structured queries with respect to the computer resources needed (such as CPU, main memory or hard disk) **contributes to the technical character of the invention since it involves technical considerations concerning the efficient exploitation of the computer system**. However, not all features implemented in a database management system necessarily make a technical contribution by virtue of this fact alone. For example, a feature of a database management system for accounting costs related to the use of the system by different users may be regarded as not making a technical contribution. **Data structures**, such as an index, hash table or a query tree, **used in database management systems to facilitate access to data or for executing structured queries contribute to the technical character** of the invention. These data structures are functional since they purposively control the operation of the database management system to perform said technical tasks. Conversely, data structures defined solely by the cognitive information they store are not considered to contribute to the technical character of the invention beyond the mere storage of data (see also G-II, 3.6.3).

T 1924/17 also reviewed cases related to information retrieval, arriving at the following conclusion:

"**Information retrieval systems** typically have to formally **calculate a semantic similarity of documents**, which is typically regarded as involving non-technical considerations and being based on subjective criteria and the content (semantics) of the documents to be retrieved."

In general, a distinction is drawn between information retrieval and executing structured queries by a database management system. Information retrieval includes searching for information in a document, searching for documents themselves and also searching for metadata that describe data such as texts, images or sounds. The query may be formulated by the user in need of information, typically informally using natural language without a precise format. The user may enter search terms as a query in web search engines to find relevant documents or submit an example document to find similar ones. If the method of estimating relevance or similarity relies solely on non-technical considerations, such as the cognitive content of the items to be retrieved, purely linguistic rules or other subjective criteria (e.g. items found relevant by friends in social networks), it does not make a technical contribution.

Merely indicating that the mathematical method for calculating relevance has been automated using a computer does not make the mathematical model (or the linguistic model it uses) technical. If the mathematical model for estimating the relevance is designed in a particular way to take advantage of the technical features of a computing system on which it is implemented, then it makes a contribution. However, the claim must specify how said underlying system is exploited to generate a technical effect of e.g. better use of computer resources.

Translating linguistic considerations into a mathematical model to allow a computer to perform the linguistic analysis automatically can be seen as involving technical considerations, at least implicitly. However, this is not enough to guarantee the technical character of the mathematical model. Further technical considerations such as those relating to the internal functioning of the computer system are needed.

The argument that "more relevant search results are retrieved" does not lead to the acknowledgement of a technical effect since "more relevant" depends on the content of the information and on a user's subjective preferences.

For example, a mathematical model for calculating the probability that a given term is similar in meaning to another term by analysing the co-occurrence frequency of the two terms in a collection of documents does not make a technical contribution per se since it is based on considerations of a purely linguistic nature (i.e. based on the assumption that related terms are more likely than unrelated terms to occur in the same documents). The search results produced using this method of similarity calculation would differ from prior art that adopts another mathematical model only in that information with different cognitive content would be retrieved. This is a non-technical distinction and does not qualify as a technical effect. In this context of retrieval based on similarity of meaning of terms, the concept of "better search" is subjective (T 598/14). In contrast, optimising the execution time of structured queries in a database management system as discussed above is a technical effect.

European Patent Academy
European Patent Office
Munich
Germany

Responsible for the content
European Patent Academy
academy@epo.org