

Guidelines for the user interface in multimedia equipment for general purpose use

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National foreword

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

GUIDELINES FOR THE USER INTERFACE IN MULTIMEDIA EQUIPMENT FOR GENERAL PURPOSE USE

FOREWORD

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IEC 61997, which is a technical report, has been prepared by IEC technical committee 100: Audio, video and multimedia systems and equipment.

The text of this technical report is based on the following documents:

Enquiry draft	Report on voting
100/144/CDV	100/249/RVC

Full information on the voting for the approval of this technical report can be found in the report on voting indicated in the above table.

This publication has been drafted in accordance with the ISO/IEC Directives, Part 3.

The committee has decided that the contents of this publication will remain unchanged until 2006. At this date, the publication will be

- reconfirmed;
- withdrawn;
- replaced by a revised edition, or
- amended.

This document which is purely informative is not to be regarded as an International Standard.

A bilingual version of this publication may be issued at a later date.

INTRODUCTION

There is growing use of multimedia equipment of every kind both in society and in the home; huge amounts of information are being exchanged both at the individual level and throughout society. However, as things stand it can easily be imagined that when this equipment is brought into the home, the complex and inconvenient operation seen as characteristic of multimedia equipment featuring electronic functions will make the equipment difficult, inconvenient and unprofitable to use; and incorrect operation may lead to confusion.

If the use of various multimedia appliances is to spread together with technological developments and the more advanced use of information, greater care than ever must be taken in the design of user interfaces that will make the equipment easy to use even by ordinary people who have received no special training in operating the equipment. The situation must not be allowed to arise where a multimedia appliance provokes a negative reaction because it is difficult to understand or difficult to use.

The designer is well acquainted with the appliance, the content of the system, and the peripherals; but a person operating the equipment for the first time starts with no knowledge at all.

The purpose of these guidelines is to take note of those inconveniences in the operation of multimedia equipment observed today, and to specify check-points that should be given primary consideration in the development of good multimedia products and systems that the general, non-professional user can use with confidence.

It is difficult to draw up detailed, concrete standards for products that have yet to be manufactured. In addition, the application to various appliances of standards drawn up over a period of time is impracticable in the field of multimedia, which is developing so rapidly. For this reason we believe it is essential for basic, minimum-level user interface guidelines to be drawn up at an early date, even if such guidelines are incomplete as standards.

The items taken up here are those concerned only with the problems of operation and use characteristic of multimedia equipment and systems, and assume the existence of detailed guidelines or standards for user interface recommended by various international bodies. Accordingly, other standards or guidelines as given in the annex should be consulted with regard to detailed ergonomic design standards and design standards shared with other, ordinary appliances.

Observation of these guidelines will lead to the kind of multimedia appliances that will satisfy user expectations, and at the same time will promote free competition in the development of multimedia equipment and systems.

GUIDELINES FOR THE USER INTERFACE IN MULTIMEDIA EQUIPMENT FOR GENERAL PURPOSE USE

1 Scope

This Technical Report applies to the designing of multimedia equipment such as information and communications equipment or audio-video equipment and systems.

In this report, multimedia equipment (systems) refers to equipment or systems mainly intended for use by the general public, either in the home or in public institutions. It is assumed that these products are meant to be used by anyone, including children, adults and senior citizens, using the equipment for the first time without any special previous training.

The scope of the user interface covered by these guidelines is limited to the problems peculiar to multimedia equipment.

Numerical details regarding user interface ergonomics, such as the size and spacing of switches, the expressive use of letters and pictograms, etc. are the province of the ergonomic standards and guidelines being considered by various organizations and are excluded from this report.

2 Reference documents

IEC 60447, *Man-machine-interface (MMI) – Actuating principles*

ISO 9241-10 to ISO 9241-17, *Ergonomic requirements for office work with visual display terminals (VDTs)*

ISO 13407:1999, *Human-centred design process for interactive systems*

ISO 14915-1 and -3:2000, *Software ergonomics for multimedia user interfaces*

ISO 1503: 1977, *Geometrical orientation and directions of movements*

TRON:1994, Ken Sakamura eds., “TRON Human Interface Standard Handbook”, Personal Media Co., 1994, in Japanese

SIDE: *Structured User Interface Design and Evaluation Method* (Research Institute of Human Engineering for Quality Life User Interface Committee)

3 Definitions

For the purpose of this technical report, the following definitions apply.

3.1 equipment

the term is used here, in general, for the home appliances, home automation systems, audio and video products, office machines, and automotive equipment

3.2

user

a person who operates the equipment

3.3

designer

a person who designs the equipment, and in particular the user interface part

3.4

interaction

bi-directional information exchange between users and equipment

3.5

user interface

software and/or hardware that manages interactions between users and equipment

3.6

invitation

initial feedback in proceeding to users' operations

3.7

operation

information sent by users to equipment or the action by users to send the information when the user extracts functions from the equipment

3.8

feedback

information sent by equipment to users or the action by equipment to send the information when the equipment shows the result of users' operation and/or internal states of the equipment to user

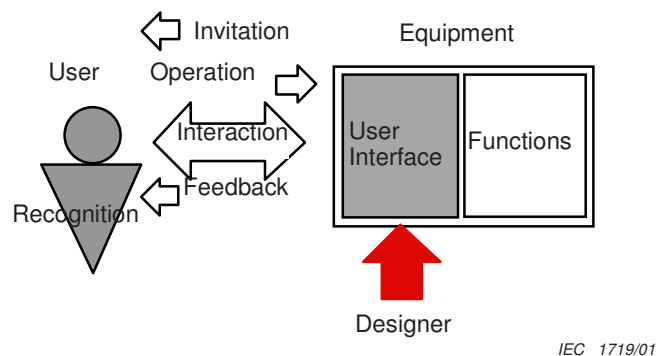


Figure 1 – The whole structure of human-machine interaction

4 Reference model of user interface in multimedia equipment

This clause gives a reference model, called “MAQ model”, which illustrates the whole structure of user interfaces for multimedia equipment. This model is composed of three dimensions: 1) media, 2) abstraction, and 3) QOI (quality of interface).

The media dimension classifies user interfaces by the feedback media of equipment. It consists of visual, audio, mechanical, and others. The abstraction dimension classifies user interfaces by the abstraction of interactions. It consists of the lexical, syntax, and semantic layers. The QOI dimension classifies user interfaces by their quality in the equipment. It consists of the minimum, standard, and excellent levels. Figure 2 shows the MAQ model by a three dimensional figure.

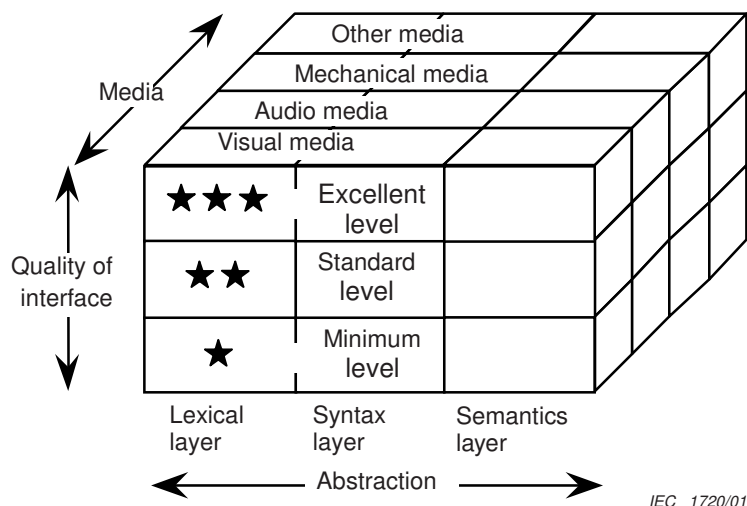


Figure 2 – “MAQ model” – Reference model of user interfaces for multimedia equipment

4.1 Dimension of abstraction

User interfaces can often be divided into three layers: 1) lexical layer, 2) syntax layer and 3) semantics layer. The lexical layer represents primitive operations and their feedback of basic input parts, and output methods of basic output parts. The syntax layer handles the way to compose the basic input/output parts. Concretely, it incorporates with the operation sequences and layouts of these parts. The semantics layer defines the relationship between user interfaces and functions of the equipment.

Input operation rules -rules for input parts -meaning of actions (direction, timing) -meaning of input values -default values Output operation rules -rules for output parts -rules for display (symbol shape and colour) -rules for sound expression -rules for actions	Operation sequence -standard operation sequences -standard macro operations -guidance for operation sequences -interlock sequences for safety -fault tolerance in operation sequences Layout of parts -parts layout of primitive operations -standard position of standard function switches	Meaning of function -command -recognition Function calling rules -structure of function -parameter of function -function call sequence
Lexical layer Primitive operation	Syntax layer Combined operation Dialogue control	Semantics layer Function callings Application interface

Primitive operation ← Abstraction → Command

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Figure 3 – Dimension of abstraction

4.2 Dimension of media type

Usually, multimedia equipment provides a function to exchange multimedia information with users. This capability is often used for user interfaces of the equipment, i.e. multimedia user interfaces. This means that user interface of multimedia equipment is often rich in its media. The MAQ model classifies user interfaces of multimedia equipment by its media types of feedback from the equipment.

NOTE Here, we do not refer to the types of media used for the operation, which is often called the “mode” of user interface. This guideline incorporates only mechanical types of operation.

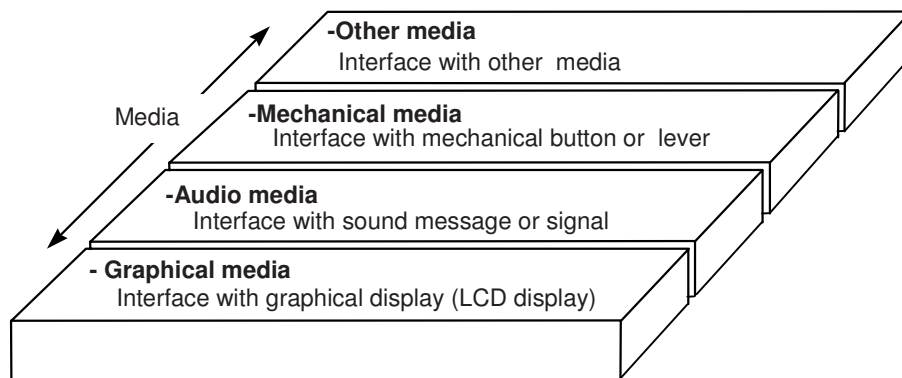
This dimension classifies the media type into four:

- a) visual media;
- b) audio media;
- c) mechanical media, and
- d) other media.

Visual user interfaces use special devices specialized for visual feedback. Examples are LCD displays, plasma displays, and so on. They show users visual information such as texts, graphics, animation, and video.

Audio user interfaces use sound for feedback. They include both speech sound and non-speech sound such as beep, buzzers, chimes, bells, and music.

Mechanical user interfaces use mechanical devices for feedback. Users can obtain information by viewing the mechanical devices and sometimes by touching them. Examples are physical buttons, slide bars, rotating volumes, and tilting levers.



IEC 1722/01

There are other media for feedback such as smell and flavour. These media are classified into other media, but these guidelines do not handle this class of media.

Figure 4 – Dimension of media

4.3 Dimension of QOIs (Quality of interfaces)

The MAQ model classifies user interfaces by their quality. It consists of

- a) minimum level,
- b) standard level, and
- c) excellent level.

Multimedia equipment of minimum quality level (represented as “★”) allows users’ operations with a minimum level of skills. This assures even first-time users of being able to control basic functions of the equipment.

Multimedia equipment of standard level (represented as “★★”) considers capability of operations for the equipment. This assures even first-time users of being able to control every function of the equipment. Users can understand operation sequences to extract desired functions, and also the way to return from misoperation.

Multimedia equipment of excellent level (represented as “★★★”) assures users of anxiety-free operations. This assures even first-time users of being able to control every function without anxiety and to feel comfortable.

Please refer to the next clause “Quality of interfaces (QOI) in multimedia equipment”, for a more precise definition of each level.

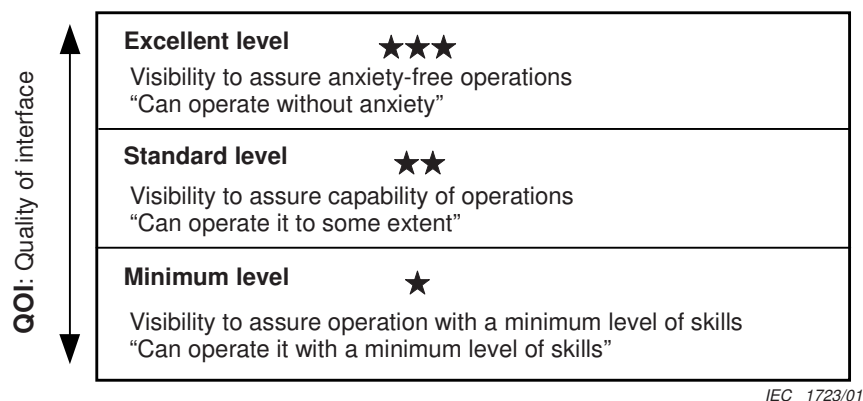


Figure 5 – Dimension of quality of interface

5 Quality of interfaces (QOI) in multimedia equipment

The main purpose of this guideline is to improve quality of interfaces (QOI) of multimedia equipment. Quality is a very difficult concept because it contains several criteria such as efficiency, easiness, and beauty. Which criteria are important depends on user classes, applications, environments for use, and so on.

5.1 Definition of QOI (Quality of interfaces)

The main difference between multimedia equipment and others is “invisibility” of its internal behaviour. The “invisibility” is the essential point that makes it difficult to use multimedia equipment. This invisibility has two causes. First, users cannot see the action of multimedia processing in the equipment. Second, users cannot see user interfaces and functions because of the complexity of multimedia equipment. Thus, user interface designer of multimedia equipment should pay attention to giving users simple and consistent “model” of systems or their behaviours. Of course, the model need not always be the same with its internal physical mechanisms. User interface should show some consistent models to users. From the above observation, these guidelines give a grade of user interfaces in terms of “how visible the multimedia equipment is”.

Here, we recall the definition of three levels of QOI (quality of interfaces):

- a) can operate with a minimum level of skills (minimum level);
- b) can operate to some extent (standard level), and
- c) anxiety-free operation for users (excellent level).

In the following clauses, we re-define these three levels of QOI in terms of “visibility” of system models.

NOTE Here, the term “visibility” means “*recognizability*” by any of the senses including seeing, hearing, touching, and so on. It does not necessarily mean recognizability by visual information.

5.2 Function level

To make precise definitions of QOI (quality of interfaces) below, here we define two levels of functions of equipment:

- a) basic functions, and
- b) optional functions.

Basic functions are functions which satisfy the primary requirements of the equipment. For example, basic functions of a CD player are to turn the power on/off, to play, stop, pause, skip forward/backward, and eject. For a telephone, they are only to make and to receive calls.

Optional functions are all functions other than the basic functions. For a television set, wake-up and sleep timer settings, brightness and/or contrast adjustment, and channel reservation are examples.

5.3 [★] Visibility to enable operation with a minimum level of skills

The first level requires visibility for the basic functions and visibility for lexical level of the basic and optional functions. This assures first-time users of being able to control basic functions of the equipment. The following statements are examples of this level of user interfaces.

5.3.1 “Easy to understand the purpose of the equipment”

- Any person seeing a piece of equipment for the first time should understand what it is for.
- Any person seeing a device should understand without difficulty that it is equipment for copying or printing, or that it is equipment that combines both functions. The purpose of the machine should be easily understood by any person who wishes to accomplish a task (send a facsimile or duplicate a document, for example). We have to anticipate such needs as the need to quickly identify the air-conditioner controller when it is hot or cold.

5.3.2 “Any person using equipment for the first time can easily start and stop it”

- A situation may occur when a person unfamiliar with equipment has to start or stop its operation. If a machine must be stopped because its continued operation may cause danger, or if a situation may be improved by the starting operation of a machine, any person should be able to quickly locate and use the start and stop buttons.
- The last person to leave the work place at the end of the work day, or someone at home, often has trouble with turning off the power to the equipment because they might spend much time in finding the on-off switch. So, any person seeing a piece of equipment for the first time should easily be able to switch the power on and off.

5.3.3 “A person unfamiliar with equipment can none the less operate it”

- Many devices whose emergence is envisioned will be designed to offer the convenience of multi-functionality. They will be difficult to use for people unfamiliar with their operation. This may result in an inability to operate them in a way that meets user requirements.
- Taking the facsimile as an example, the primary requirement is that anybody using it for the first time can perform the basic operation of transmitting a document without any need to refer to the manual. With a TV set, the primary requirement is that it can be used to watch programs of major TV channels.