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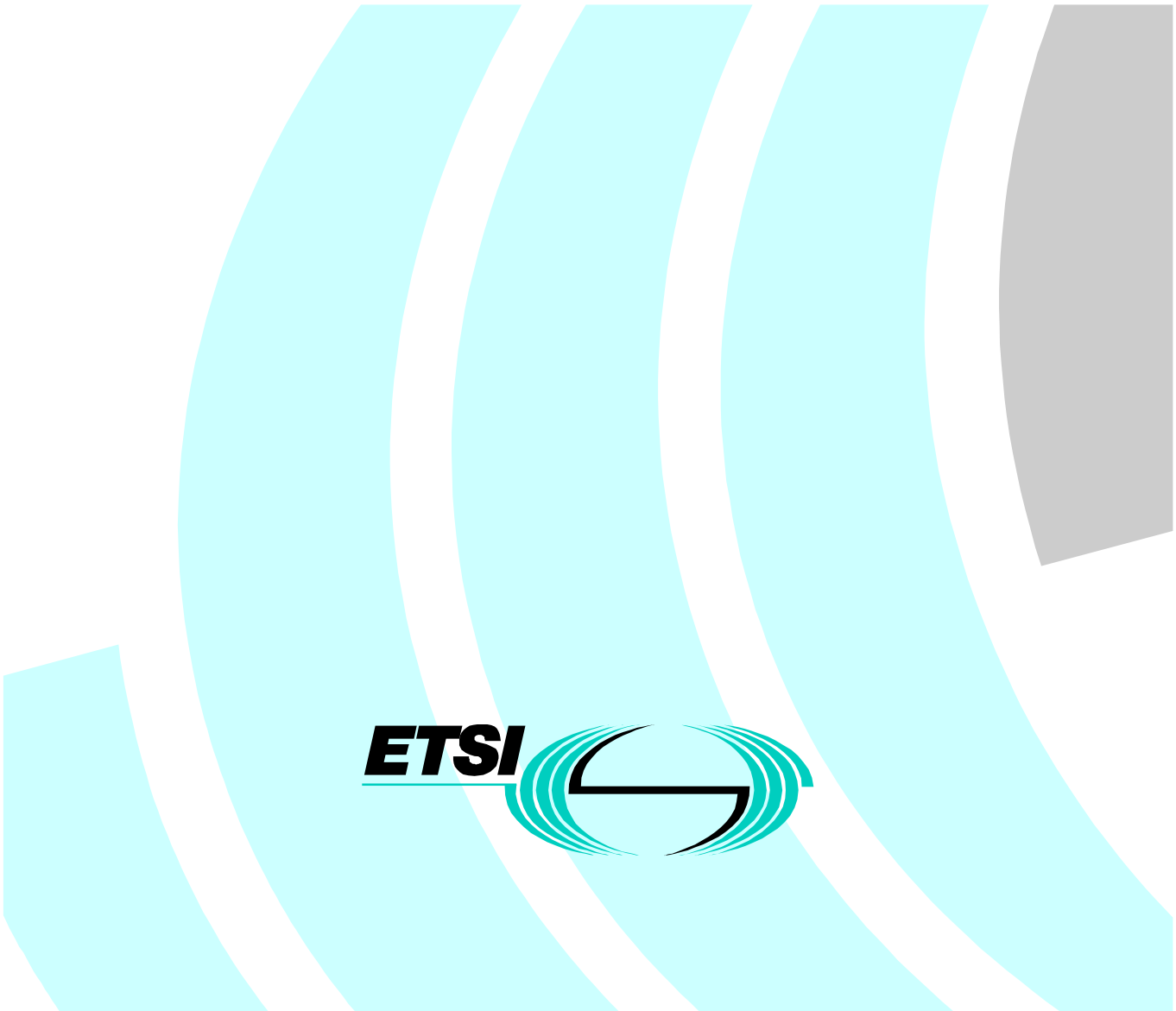
ETSI Guide

Human Factors (HF); Framework for the development, evaluation and selection of graphical symbols



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Contents

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Foreword

This ETSI Guide (EG) has been produced by ETSI Technical Committee Human Factors (HF), and is now submitted for the ETSI standards Membership Approval Procedure.

The present document has been prepared as a framework and set of guidelines for the development, evaluation and selection of graphical symbols for telecommunications terminals and services. The intended users of the present document include:

Table 1: Intended users

	User	EG used for	Potential benefit
1	Manufacturers	Provision of common principles for development, evaluation, and selection of graphical symbols	Improved usability of terminals and services
2	Network operators	Provision of common principles for development, evaluation, and selection of graphical symbols	Improved usability of terminals and services
3	Graphic designers	Provision of guidelines for the design of graphical symbols	Improved design of symbols
4	Standards bodies	Provision of common principles for development, evaluation, and selection of graphical symbols	An agreed framework providing a basis for effective communication within and between Standards Bodies and the assurance of the quality of recommended graphical symbols

Introduction

Graphical symbols can contribute to the usability of telecommunications products and services. However, the inappropriate use of graphical symbols can seriously reduce usability. There is currently a need for new graphical symbols in several areas. The present document responds to this need by providing a framework for creating, selecting, and evaluating graphical symbols. The objectives of the present document are:

- to provide a common framework for developing, evaluating, and selecting graphical symbols;
- to provide access to information on available graphical symbols;
- to ensure that those involved in the development of graphical symbols are aware of the Human Factors (HF) issues to be taken into account;
- to ensure that those involved in the application of graphical symbols are aware of the factors influencing their appropriate use;
- to assure the quality of graphical symbols recommended by standards bodies.

1 Scope

The present document provides a framework for the development, evaluation, and selection of graphical symbols for application within telecommunications on terminals (on telecommunications equipment and for telecommunications functionality of human-computer interfaces, e.g. on keyboards and screens), within telecommunications services (e.g. to denote the availability of and access to a telecommunications service) as well as in printed materials (e.g. user guides and directories).

The present document is applicable to relevant factors including:

- appropriate use of graphical symbols;
- development of new graphical symbols for specific areas;
- evaluation of graphical symbols using the ETSI Multiple Index Approach (MIA).

Symbols for graphical programming or description languages are not included within the scope of the present document.

2 References

The following documents contain provisions which, through reference in this text, constitute provisions of the present document.

- References are either specific (identified by date of publication, edition number, version number, etc.) or non-specific.
- For a specific reference, subsequent revisions do not apply.
- For a non-specific reference, the latest version applies.
- A non-specific reference to an ETS shall also be taken to refer to later versions published as an EN with the same number.

[1] ANSI T1.232 (1993): "Operations, Administration. Maintenance and Provisioning. G-Interface Specification for use with the Telecommunications Management Network".

[2] Böcker, M. (1993): "A Multiple Index Approach for the Evaluation of Pictograms. In Human Factors in Telecommunications, 14th. International Symposium Proceedings. Heidelberg: Decker".

[3] CEPT T/TR 02-04 E: "Graphical symbols to be used for the marking of Telecommunications Equipment".

[4] Dreyfuss, H (1984): "Symbol sourcebook: an authoritative guide to international graphic symbols (Van Nostrand Reinhold, New York)".

[5] ETR 070: "Human Factors (HF); The Multiple Index Approach (MIA) for the evaluation of pictograms".

[6] ETS 300 375: "Human Factors (HF); Pictograms for point-to-point videotelephony".

[7] Gilmore, W.E.; D. I. Gertman and H.S. Blackman (1989): "User-Computer Interface in Process Control. San Diego, California: Academic".

[8] Horton, W (1994): "The icon book (John Wiley & Sons, New York)".

[9] IEC 60416: "General principles for the formulation of graphical symbols".

[10] ISO 3461: "General principles for the creation of graphical symbols".

[11] ISO 7000: "Graphical symbols for use on equipment - Index and synopsis".

[12] ISO 9241-11 (1998): "Ergonomic requirements for office work with visual display terminals (VDTs) – Part 11: Guidance on usability".

[13] ISO 9186: "Procedures for the development and testing of public information symbols".

[14] ISO/IEC DIS 11581-1: "Information technology -- User System Interfaces -- Icon symbols and functions -- Part 1: Icons -- General".

[15] ITU-T Recommendation E.121: "Pictograms, symbols and icons to assist users of the telephone service".

[16] ITU-T Recommendation F.910: "Procedures for designing, evaluating and selecting symbols, pictograms and icons".

[17] Koffka, K. (1935): "Principles of Gestalt Psychology. New York: Harcourt Brace".

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[22] Ziegler, J. E. and K.P. Fähnrich (1988): "Direct Manipulation. In M. Helander (ed.): Handbook of Human-Computer Interaction. Amsterdam: North-Holland".

[23] Clarke, A.M. (Ed.) (1996): "Human Factors Guidelines for Designers of Telecommunications Services for Non-Expert Users. HUSAT Research Institute LUSI Consortium".

[24] Campbell F. W., & Maffei, L. (1974): "Contrast and Spatial frequency, Scientific American, 231, pp 106-115".

[25] ISO 3864 (1984): "Safety colours and safety signs".

3 Definitions

graphical symbol: a visually perceptible figure used to transmit information independently of language [15]. The term graphical symbol is used here to include symbols for use on equipment and in human-computer interfaces. Graphical symbols may be representational, abstract, or arbitrary [4].

pictogram: representational symbols (or pictograms) present pictures of objects or actions.

icon: a term used within the field of human-computer interaction to refer specifically to a graphic on a visual display terminal that represents a function of the computer system [14].

pixel: smallest picture element of a medium (e.g. of a screen).

4 Overview of the framework

The structure of the present document reflects the symbol selection and design process from the decision to employ symbols to the evaluation of symbol candidates:

Clause 5 of the present document addresses the appropriate use of graphical symbols including the advantages and disadvantages of symbols use, the context of symbol use and specific design issues such as the use of metaphors and symbol size and colour.

Clause 6 deals with the selection of existing symbols and lists various sources of symbol libraries.

Clause 7 addresses the development of new symbols and clause 8 the evaluation of symbols and recommended testing methods.

5 Appropriate use of graphical symbols

5.1 Limitations to the use of graphical symbols

Well-designed graphical symbols can have the following advantages over written commands and labels ([2], [19]). They can be:

- more distinctive;
- more efficient for denoting spatial attributes;
- easier to recognize and remember over long periods of time;
- easier and faster to learn when the size of the symbol set is small; and
- language independent.

In addition they require less space for presenting complex information or elements and their syntax and semantics are generally simpler than text. Therefore, they are particularly suited for representing large quantities of information in a restricted space.

However, some disadvantages have also been found [2], [23]:

- limited capacity for conveying abstract and/or detailed information;
- risk of misinterpretation, which can be dangerous when applications are critical;
- may require prior learning, i.e. first-time users may not understand icons;
- limited number of symbols can appear simultaneously; and
- it takes more time for the user to navigate through menus which contain symbols than menus which contain well-chosen labels.

Because of these limitations, graphical symbols shall be used with care particularly for complex, abstract or ambiguous information, and also in applications in which the misinterpretation of a symbol may lead to hazardous consequences.

Where there is sufficient space and the choice of a single language is not a problem, graphical symbols may be combined with supporting text labels. This reduces the possibility of errors being made by new or infrequent users.

The user's ability to comprehend the meaning of the graphical symbols and to discriminate between them is likely to improve as a result of learning. Where graphical symbols and supporting labels are combined, experienced users may be able to recognize the meaning of the graphical symbols more quickly from the graphical symbol, ignoring the label.

In the case of graphical user interfaces, a good alternative is to provide optional, pop-up labels which appear when the cursor remains above them for more than a certain period of time. This avoids the clutter of additional text on the screen.

5.2 Context of use

The meaning of a graphical symbol should be comprehensible and the symbol should be discriminable from the other symbols with which it is used. This can be seen as a usability issue involving the effective and efficient communication of the message.

Usability is dependent on the specific circumstances in which an activity takes place, i.e. the context of use.
ISO 9241-11 [16] provides a framework for describing context of use in relation to usability. This framework is equally valid for considering the usability of graphical symbols. Before a graphical symbol is designed or a search made for an existing symbol, the following information on the context of use should be available.

Users: Characteristics which may be relevant include knowledge, skill, experience, education, training and sensory capabilities. In particular, it is important to state whether a graphical symbols is intended for the general public or for a group of users with specific characteristics.

Equipment: Relevant characteristics of the hardware, software and/or materials should be described. In particular, it is important to state whether the graphical symbol is intended for general use, or whether it is intended for use on a particular product or in a particular field of application.

Environments: Aspects which may need to be described are the wider technical environment, the physical environment, and the social and cultural environment. In particular, limiting factors such as the size of reproduction or size of the pixel matrix should be specified. In order to be able to judge the comprehensibility and discriminability of a graphical symbol, it is necessary to specify the other graphical symbols with which it will be used.

Goals and tasks: It is necessary to be aware of the goal of the user and the details of the task during which the symbol is used. This information is particularly critical when a new symbol is being designed.

The relevant information should be registered with the graphical symbol so that the person searching can judge whether the symbol is suitable for use in a particular context.

5.3 HF design issues

Essential human factors principles for use of symbols in these interfaces are:

Feedback: Always provide feedback, as soon as possible, so that the user can always see the effect of his or her actions.

Consistency: The meaning of a particular element should be consistent throughout the interface.

Clarity: The function or state shall be represented without ambiguity.

Simplicity: Symbols should contain at most two or three ideas. When it is important that users remember and make associations with a visual pattern, keep the pattern simple.

Univalency: Symbols shall represent only one object or action.

Perceptual similarity: Symbols that are meant to act as buttons should look like buttons.

5.4 Use of metaphors

Whenever possible, the idea for a symbolic representation for a particular application should be based on the user's mental picture for that application.

Abstract actions, or objects which do not have not counterparts in real life are more difficult to represent with graphical symbols, because there is no familiar symbol that corresponds to the meaning of the concept. In some such cases, an appropriate task metaphor may be found, to map the objects of the application or problem domain on a visual world which is familiar to the user. It is sometimes impossible to find a coherent metaphor that covers all aspects of the system. Other problems associated with the use of metaphors are for example that not all users may be familiar with the system the metaphor draws on, and that the user may derive inappropriate expectations from the real-life system. Metaphors should therefore be avoided if self-contained symbols of equal usability can be designed.

5.5 Presentation of symbols

5.5.1 Symbol size

No general recommendation can be given on the minimum acceptable representation size of an icon. This is inter alia because what is acceptable depends on a number of parameters (see also [8]):

- User: see subclause 5.2.
- Viewing distance: this differs widely between applications: a desktop telephone with a display may be used with a distance of up to 1 m, a PC up to 1 m and more, while the display of a cellular telephone may be viewed from a distance as close as 30 cm, a public information symbol e.g. at an airport should be recognized from up to 50 m and more.

- The complexity of the symbol: a simple symbol with one or two elements (e.g. the ISO/IEC symbol for on/off) can be reduced to a very small size and still recognized by most people while a complex one may not. Current functional models of the Human Visual System (HVS) describe its operation as being a function of the spatial frequencies of the image received on the retina [24]. The spatial frequency from a functional point of view is a mathematical representation of the number of edges in an image. The ability of the HVS to process a given spatial frequency is dependent upon the contrast of the image.

- The display qualities of the medium including: the resolution, e.g. paper, a high-resolution PC monitor, or a crude LCD on a telephone display (i.e. a "pixel" has a different dimensions depending on the medium), the contrast, the focus (e.g. colour monitors may drift out of focus), and glare.

- The viewing conditions including environmental factors such as poor illumination, and physiological and psychological factors such as fatigue and workload.

For this reason, the best way to assess the minimum acceptable symbol size is to design the symbol and test it with test subjects from the relevant user target population, using the intended medium, under different environmental conditions, etc.

5.5.2 Symbol shape

On some equipment, particularly small machines, special manufacturing considerations or lack of space preclude the use of graphical symbols of the exact recommended shape. In such cases, the design of the graphical symbols used may be modified provided that their pattern differs as little as practicable and still conveys clearly the intended meaning.

5.5.3 Contrast between symbol and background

Adequate contrast between symbol and background is essential. Some authors [21] recommend that some type of border should always be used around a symbol to prevent it from blending with background images. The visual system organizes the visual field into figure (or "Gestalt" - organized whole) and ground, separated by a contour belonging to the figure. According to the key principle of Gestalt, psychological organisation will always be as good as the prevailing conditions allow [17]. Effort should therefore be made to facilitate the perception of components of a symbol as a whole. For example, visual elements tend to be grouped together if they are close to each other (Gestalt law of proximity) or if they are similar to each other (Gestalt law of similarity). For this reasons, symbols should also be a "closed figure" i.e. with boundaries as this supports the perceptual process [23].

5.5.4 Principles for coding information

For adding other meanings different than the basic one suggested by one symbol, different possibilities exist, such as geometric shapes, shape coding, size coding or colour coding.

Geometric shapes should be considered for discriminating different categories of data on graphic displays where rate of comprehension and detection is important [7]. In some cases it may be possible to select a common geometric shape (i.e., circle, square, triangle, etc.), and create an alphabet by varying some of its characteristics (e.g., the height to width ratio of a rectangle). Letters may be used for coding if it is not possible to find appropriate characteristics.

Interpretation of shape codes will generally rely on learned association as well as immediate perception [7]. Existing standards, and user stereotypes, **shall** be taken into account.

Size coding can also be used to indicate different values of a variable. Size coding should be used only when displays are not crowded. When symbol size is used for coding, the intermediate symbols should be spaced logarithmically between the two extremes (largest and smallest). A larger symbol should be at least 1,5 times the height of the next smaller symbol.

Coding through emphasizing (e.g. of line thickness) can be employed to denote importance / warnings or that a current symbol is selected.

For colour coding, follow the usual meanings of colours in the user population. For example, red is usually identified with danger or stop and green, with open or safe [8], [23], [25]. In particular given that about 8% of the population are either colour blind or having problems distinguishing red and green, colour should be used as redundant coding, rather than a basic information element for a graphical symbol.

6 Selection of graphical symbols

6.1 General

As mentioned already earlier, the users' characteristics and context have to be taken into account when selecting symbols. If users are familiar with an existing symbol for a function or object, then it should be used. Effort should be made to determine what symbols potential users are familiar with (for example in existing support systems and documents), what standard symbols are available and what symbols can be found in source books or symbol libraries.

6.2 Sources

6.2.1 International and national standards

A list of some available standards is presented below, with a brief description of the contents:

ANSI T1.232-1993

Operations, Administration. Maintenance and Provisioning: G-Interface Specification for use with the Telecommunications Management Network

> Includes a section on symbols with general criteria for use of symbols - appearance, size and supplementary information - and recommended symbols for classes of TMN elements.

CEPT T/TR 02-04 E

Graphical symbols to be used for the marking of Telecommunications Equipment

> A catalogue of graphical symbols recommended by CEPT for use on various types of telecommunications equipment, based on IEC and ISO recommendations.

ETSI ETS 300 375

Human Factors (HF): Pictograms for point-to-point videotelephony

> Defines pictograms for eight point-to-point videotelephony functions and is based on an empirical study of several pictogram sets carried out in eight European countries.

IEC 60617-9

Graphical symbols for electrical power, telecommunications, and electronics diagrams. Part 9: Telecommunications: Switching and peripheral equipment

> Includes recommended symbols for switching systems and equipment, telephone, telegraph and data equipment, transducers, recorders and reproducers.

IEC 60617-10

Graphical symbols for electrical power, telecommunications, and electronics diagrams. Part 10: Telecommunications: Transmission

ISO 7000

Graphical symbols for use on equipment - Index and synopsis

> Presents a number of graphical symbols for use in different technical fields in order to instruct the persons handling the equipment as to its use and operation.

ITU-T Recommendation E.121

Pictograms, symbols and icons to assist users of the telephone service

Includes recommended symbols for telephone, emergency services, graphical representation of audible tones, symbols for supplementary services and symbol of access for the physically handicapped.

6.2.2 Sourcebooks for graphical symbols

A number of books presenting a wide range of symbols from a variety of international sources are available. These include [4], [8] and [18].

6.2.3 Other sources of graphical symbols

Many software graphics products also include symbol libraries.

7 Development of new graphical symbols

In order to design effective graphical symbols it is necessary to have an understanding of the communications processes involved. All graphical symbols provide the user with a message. The content of this message has to be identified to ensure effective communication.

It is useful to distinguish the following types of message:

- to denote the availability of the function of a service or equipment;
- a prompt to perform a specific action, e.g. "lift handset";
- indication of a status or setting, e.g. "call forwarding selected";
- identification of the result of actuating a control, e.g. "videophone microphone on".

In the case of a prompt, the message is intended to trigger a particular response , i.e. it has a more active function while in the last two cases, the response is at the discretion of the user and the message has a passive, supporting function.

The type and content of the message to be communicated are a major determinant of the graphical content of the symbol. However, the details of the specific context of use shall also be taken into account in a systematic way during the design and development process - see subclause 5.2.

It should be noted that graphical symbols for telecommunications products often form a set or family. The graphical content of individual symbols should therefore be developed in a way which contributes to the effectiveness of the total set. It is also important to take account of internationally accepted design principles such as those in ISO 3461 [10] parts 1 and 2, and IEC 60416 [9].

The following challenges have been identified in symbol design [20]:

- appropriate affect, or all the subjective and emotional impact that different graphics can convey. For example, symbols can be designed to look corporate, professional, secure and solid, lucid, or simple;
- match the medium;
- consistent graphic vocabulary: inventing a set of objects that are appropriate to the intended application and representing them in a convincing way;
- visual order and user focus;
- create the illusion of manipulatable objects. It should be clear that they can be selected and how to select them. It should also be obvious when they are selected, and that they will be the object of the next action; and
- revealed structure.

Graphical symbols should accomplish the objective of presenting functions as simplified visual representations, keeping the main features, and distinguishing the different ones of different objects.

Graphical symbols should be constructed with as few graphical components as possible, usually not more than 2 or 3 components [22]. Too much detail obstructs perception rather than facilitating it.

In graphical user interfaces, symbols usually represent classes of objects, actions, or functions rather than individual ones. To distinguish different symbols of the same class, additional labels are usually needed. If many objects of the same type are displayed in a windows, alphabetic or sequential lists may be used to direct the user to a specific symbol. It should be possible to switch between symbolic and textual representations.

Generality and consistency principles mean that it is preferable to use only one symbolic representation, with appropriate labels, for different devices performing the same function (i.e. printers). This way, the user can associate the symbol meaning with the device whatever is the particular implementation of it in his system.

The following symbol design guidelines are extracted from [23]:

- Beware of cultural and language dependencies.
- Avoid using images to portray abstract concepts.
- Symbol should always be presented upright.
- Make the symbol stand out from the background.
- Ensure that each icon is distinct from, and clearly visible within, a surrounding group of symbols.
- Try to make each symbol as distinct from the others as possible.
- Symbols should be designed according to a grid, or a basic pattern as human perception is sensitive to optical weight. Thus symbols sharing the same pattern are more easily recognized, and provide a feeling of unity and of consistency.
- Angles smaller than 30° as well as filled areas should be avoided in symbol design.
- Provide redundancy when distinguishing between two symbols (e.g. a child depicted not just as a smaller person by showing it using a skipping rope).

Object features which **shall** be taken into account when designing graphical symbols are:

- Form: the symbol can either portray certain characteristics of the object or it can suggest some of the cognitive characteristics of the task.
- Type: static and dynamic objects, or functions or status indications can be distinguished [18].

As a general rule, the last step of the process is the testing and evaluation of the proposed symbols. The apparent meanings of all candidate pictorial codes should be tested for a sample of the user population.

8 Evaluation

8.1 Factors of importance in evaluating graphical symbols

Human factors evaluation is a crucial step in the development process. Its objective is to know whether the proposed symbols are easy to understand, recognize, and remember, that they produce a low error rate, and that they are clearly perceived under the usual task conditions. It is assumed that consistency and feedback principles are accomplished in previous steps of the design process.

The following are characteristics of graphical symbols that should be addressed in symbol evaluation:

Comprehensibility: the ease with which the meaning of a symbol is understood.

Discriminability: the ease with which a given symbol can be distinguished from other symbols that might occur in close spatial, temporal or contextual proximity.

Learnability: the ease with which the meaning of a symbol can be recalled after it has been understood.

Legibility: the ease with which the graphic detail of a symbol can be discerned.

Recognizability: the ease with which it is possible to identify a symbol, based on previous experience with the same or similar symbols.

The evaluation can be made by means of experiments or with questionnaires. The former are more costly and specific, but provide more conclusive information; the latter are cheaper and can be very general, but the information obtained can be less valid.

8.2 ETSI's Multiple Index Approach (MIA)

The Multiple Index Approach was developed by the Human Factors Technical Committee of ETSI [5] on the basis of the above considerations. It is the test method recommended by ETSI. It enables the evaluator to collect data on seven indices on which his final selection of symbols can be based and which are presented in the following:

1) Hit rate: is the main parameter of performance and it is equivalent to the score of correct associations between referent and symbol.

2) False alarm rate: indicates in how many cases a symbol has been associated to the wrong referent.

3) Missing values: indicates in how many instances a respondent did not answer a question presumably because he did not know the answer. Missing values represent usage situations in which the user does not know which control to use to bring about a certain effect.

4) Subjective certainty: indicates how certain the respondents feel in their association between symbol and referent. If the users of a device are extremely uncertain about the effects of the controls of a device, they may decide not to use it at all which in turn may seriously hamper the uptake of the device.

5) Subjective suitability: (in addition to making the association between symbol and referent, and to indicating how certain they are in this association) the respondents can tell their subjective impression as to how well a symbol represents its referent.

6) Pictogram Preference: The respondents indicate, which of the candidate symbol for one referent represents best the referent in question. In this, it is unknown which criteria (aesthetic or functional) the respondents apply.

7) Pictogram Set Preference: is an indicator for which symbol set is preferred in total on aesthetic grounds.

The seven indices are collected by means of a questionnaire that is organized in three tests (it is also possible to implement the test on computers with sufficiently high resolution screens):

- Test of pictogram associativeness (Hit rate, False Alarm Rate, Missing values, Subjective certainty and Subjective suitability). In this part of the questionnaire, one referent (name and description of a function) is presented at a time with all symbols of one set. The respondent's task is to choose the appropriate symbol for the function in question. In addition, subjective certainty and suitability ratings are required for each rating.

- Test of pictogram preference: During this test, the respondent is asked to give preference ratings on the level of function, i.e. all candidates for one function are shown and the respondent indicates the most suitable one.

- Test of pictogram set preference: Preference ratings are requested on the level of sets, i.e. all symbol sets are displayed and the respondent indicates the preferred one.

The results of the test of pictogram associativeness are the main indicator for the usability of the sets to be tested. The tests of pictogram preference and of pictogram set preference are used mainly to verify that a symbol set fulfils not only the associativeness criterion but also aesthetic criteria. Furthermore, these indices can be used in cases in which there are competing sets with similar results for associativeness.

Finally, order and learning effects should be controlled for by employing versions of the questionnaire with a different presentation order of the symbols.

8.3 Other standard evaluation methods

A number of symbol evaluation methods are available some of which are restricted to certain applications only while others have considerable methodological drawbacks. In the following, two methods proposed by standardisation bodies (ISO [13] and ITU [16]) will be reviewed.

8.3.1 ITU-T Recommendation F.910

The evaluation section of ITU-T Recommendation F.910 [16] is harmonized with ETSI's Multiple Index Approach [5]. It collects more subjective measures than the MIA (e.g. "Do you think that the appearance of this symbol will be easy to remember") and in addition to a recognition test which corresponds to the MIA's Test of Associativeness, it includes a recall test. The choice between the MIA and ITU-T Recommendation F.910 depends inter alia on the number of symbols tested. While a small number of symbols can be tested easily using the more comprehensive ITU-method, the expenditure for testing several sets of symbols can become too time-consuming and exhausting for subjects even if the slimmer MIA is used.

8.3.2 ISO 9186

The ISO 9186 Procedure describes a methodology for the development and test of public information symbols that results in a verbal description of the image content of the symbol to be tested [13].

The current ISO procedure describes five separate tests: a production test, an appropriateness ranking test, a comprehension / recognition test, a matching test and a legibility test. Of these, the only required test is the comprehension test, where one symbol is presented on a card together with information on the context in which it will be used, and the respondent is asked to supply the meaning of the symbol.

As ISO 9186 is currently being revised, no conclusive recommendation can be given.

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The following material, though not specifically referenced in the body of the present document (or not yet publicly available), gives supporting information.

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IEC 60617-9: "Graphical symbols for electrical power, telecommunications, and electronics diagrams. Telecommunications: Switching and peripheral equipment".

IEC 60617-10: "Graphical symbols for electrical power, telecommunications, and electronics diagrams. Telecommunications: Transmission".

History

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