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ETSI

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Foreword

This ETSI Technical Report (ETR) has been produced by the Human Factors (HF) Technical Committee of the European Telecommunications Standards Institute (ETSI).

ETRs are informative documents resulting from ETSI studies which are not appropriate for European Telecommunication Standard (ETS) or Interim European Telecommunication Standard (I-ETS) status. An ETR may be used to publish material which is either of an informative nature, or which is immature and not yet suitable for formal adoption as an ETS or I-ETS.

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1 Scope

The situation of standardisation in the field of Human Factors is a rather confusing one for which an overview is difficult. The experience of users of standards shows that it is very difficult, sometimes even impossible, to find out where various standards for specific design questions relating to "Human Factors" can be obtained.

This ETR is intended to serve as a guide through the world of Human Factors standards for those unfamiliar with the area. It aims to help the user to answer questions such as:

- why do Human Factors standards exist?
- what is their purpose?
- which committees work on which fields of Human Factors and user interfaces?
- what are the relations between different bodies and committees?
- what standards already exist or are foreseen and for which applications?
- where can such standards be obtained?

The aim of this ETR is to contribute towards a better dissemination and understanding of the standardisation work in the field of Human Factors and user interfaces, in particular with reference to telecommunications applications.

2 References

For the purposes of this ETR the following references apply:

[1] "Age and Design for New Technology". (Published by Age and Cognitive Performance Research Centre, University of Manchester, 1990).

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[4] "The AT&T User Interface Architecture", author: James M. Faber, AT&T Technical Journal (Sept/Oct 1989, Volume 68, Number 5).

[5] "Human Interface Guidelines, the Apple Desktop Interface" (Published for Apple Computers by Addison Wesley, 1988, ISBN 0-201-17753-6).

[6] "Issues in Telecommunications and Disability", S.V. Tetzchner (Ed), 1991, EUR 13845 EN, ISBN 92-826-3128-1.

[7] "RACE' 90 and RACE' 91 Programme" (RACE Central Office, Brussels).

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[9] "Usability Now - HCI Standards and Regulations", author: Tom Stewart, Brochure for DTI, London, March 1991.

[10] "System Application Architecture: Common User Access. Advanced Interface Design Guide" (IBM, June 1989).

[11] "System Application Architecture: Common User Access. Advanced Interface Design Reference (IBM, October 1991)".

[12] "System Application Architecture: Common User Access. Guide to User Interface Design (IBM, October 1991)".

3 Abbreviations

For the purposes of this ETR the following abbreviations apply.

CCITT: Comité Consultatif International de Télégraphique et Téléphonique

CD: Committee Draft

CEC: Commission of the European Community

CEN: Comité Européen de Normalisation

CENELEC: Comité Européen de Normalisation Électrotechnique

COST: European Co-operation in the field of Scientific and Technical research

CPN: Customers Permanence Network

CR: Compliance Rate

CUA: Common User Access

DE: Draft European Telecommunications Standard

DIS: Draft International Standard

DTR: Draft ETSI Technical Report

ECMA: European Computer Manufacturers Association

ETR: ETSI Technical Report

ETS: European Telecommunications Standard

ETSI: European Telecommunications Standards Institute

IBC: Integrated Broadband Communication

IBCN: Integrated Broadband Communication Network

IEC: International Electrotechnical Commission

IS: International Standard

ISDN: Integrated Services Digital Network

ISO: Organisation for International Standardisation

ITU: International Telecommunications Union

JTC: Joint Technical Committee

MMI: Man Machine Interface

MML: Man Machine Language

MST:	Multi-Service Terminal
OSI:	Open Systems Interconnection
Q:	Study Question (CCITT)
PC:	Personal Computer
PSN	People with Special Needs
PSTN:	Public Switched Telephone Network
RACE:	Research and Development in Advanced Communications Technologies in Europe
SG:	Study Group (CCITT)
SPC:	Stored Programme Control
SC:	Subcommittee
TC:	Technical Committee
TC-HF:	Technical Committee Human Factors (ETSI)
TIDE:	Technology for the Socio-Economic Integration of Disabled and Elderly People
TMN:	Telecommunications Management Network
UNO:	United Nations Organisation
VDT:	Visual Display Terminal
VDU:	Visual Display Unit
WG:	Working Group

4 Introduction

4.1 What are Human Factors standards?

The growing variety and complexity of telecommunications products results in arbitrary differences in the user interfaces. Users also encounter other problems, based on culture, on services and products originating from different companies that pose difficulties to the user in fulfilling their tasks and goals in an open environment. This situation has resulted in activities at many levels in the area of Human Factors standards, from internal company standards and guidelines to international standards that apply to products and services offered by manufacturers of equipment and by providers of services and networks.

Human Factors encompasses an area where a user may interact at differing levels of communication, provided by different vendors in any given communication. This complex situation places further demands on the Human Factors standards activities that are taking place. This has triggered a great deal of activity aimed at tackling the problems involved by means of unification, i.e. through the development of guidelines and standards.

Human Factors guidelines and standards have two fields of application. One is the user's "own world", i.e. in his workplace, his home or his country. The other deals with aspects of global use, particularly in telecommunications.

Various approaches can be seen to harmonise and unify the user interface in the user's "own world". User interface standards for software applications are at a particularly advanced stage. They include, for example, Common User Access (CUA) from IBM [10] and the SNI Style Guide [8] from Siemens Nixdorf

Informationssysteme AG. A whole series of internal standards in several organisations deal with ergonomic aspects of software applications design and aspects of video workstations.

There are also several notable examples in the field of telecommunications technology, namely the AT&T User-Interface Architecture [4] and the Deutsche Bundespost Telekom's FTZ Guideline on operating procedures for ISDN telephones [3].

Human Factors aspects relating to global use are mainly to be found in international telecommunications standards. They include standardised telephone dialling tones, unscripted symbols and pictograms for describing new features and services, as well as recommended operating procedures, e.g. for public card phones.

4.2 Why do we need Human Factors standards?

The guiding principle behind Human Factors standardisation is as follows.

A user who is familiar with one software application, telephone or telecommunications service will experience little difficulty with other, comparable products whose interfaces are built up on the same principles. This principle presupposes the existence of rules governing sequences of operations and representation, as well as standard designations and symbols, for the various functions.

For example, standardised design rules for Personal Computer (PC) office applications enable the user to effortlessly apply knowledge of functions and operation gained from using one application, such as a word-processing program, to another (e.g. as a spreadsheet program). Uniform user interfaces for different network management systems simplify the operator's work and save on expensive training. Standardised operating procedures for telephone services in office communications systems and the public telecommunications network increase both user acceptance and the willingness to have greater telephone convenience in the home. Future domestic terminals for an Integrated Services Digital Network (ISDN) will stand a high chance of being accepted by less experienced users if their user interfaces are based on the operating concepts of established and familiar domestic appliances.

The main aim of Human Factors standards should be to facilitate the development of new products and services for users, while at the same time allowing vendors to differentiate their products. Human Factors standards need to ensure that users can move between the products of service providers, network operators and terminal manufacturers without constraining the provision of products in any way.

Uniformity of functions and operation therefore facilitates free exchange in terminals and services between various countries and thus increases the market opportunities of manufacturers throughout Europe.

Finally, such standards are intended to guarantee that user interfaces satisfy a minimum standard of Human Factors comparable to that adopted in industry and thereby protecting the legitimate interests of the users and customers to a certain extent.

Human Factors standards activities have a wide scope of implementation, from the physical environment in which a user would find himself, to the physical and mental activities that users need to perform in interactions with equipment and applications, and to the design of the equipment.

5 European research basis for Human Factors standardisation in telecommunications

5.1 European Co-operation in the field of Scientific and Technical research (COST)

The name COST (European Co-operation in the field of Scientific and Technical research) first appeared in the early 1970s.

A basic feature of all COST projects is a joint attack on a research area of common interest by a minimum number of participants (four) and an exchange of the answering results among the participants. Each COST action lasts 3 - 5 years.

A basic motive for COST actions is the more efficient utilisation of resources for research. While financing only its own share in a project, each participant gains access to the full results of each action. The co-ordination of activities has the further advantage of better resource management through avoiding duplication of efforts as well as filling potential gaps in the total effort. As a result, COST projects facilitate research work which goes beyond the resources of individual partners.

Most COST projects are designed to promote basic applied scientific and technical research when the efforts are designed to achieve particular objectives.

Fields of co-operation within COST are confined to the following areas of applied research:

- Informatics;
- Telecommunications;
- Transport;
- Oceanography;
- Metallurgy and Material Science;
- Environmental Protection;
- Metallurgy;
- Agriculture;
- Food and Technology
- Medical Research and Health.

Two actions have being carried out concerning COST Human Factors activities: COST 212 (HUFIS, Human Factors in Information Services) and COST 219 (Future Telecommunications and Teleinformatics Facilities for Disabled People).

5.1.1 COST 212: Human Factors in Information Services (HUFIS)

The COST 212 project develops the discipline of Human Factors in telecommunications, inside the traditional "Human Factors Analysis". This approach focuses its attention on the impact of the new services taking into account end users and organisations needs.

The opportunities offered by the new information technologies allow communication among different persons. As a consequence, the new Human Factors approach should shift its attention from the "person-service" system to the "person-service-person" system. It is well known that the service evolves through different phases: service in the design phase, without any prototype available; prototype phase; pilot phase; operative phase. The Human Factors approach, as expressed by this project, operates in all of the above phases by identifying methods and trials according to the degree of the development of each phase.

Furthermore, the COST 212 project has developed a method, the so called "Emulation Approach", that allows, from the start of the design phases, a continuous feed-back among the designers and the users in order to ensure the acceptability of the service.

Taking into account the above considerations, COST 212 produced some case studies including:

- usability evaluation of telematics services;

- videoconferencing and videotelephony image quality assessment;

- socio-organisational effects of an office automation system.

Finally, COST 212 suggestions have been utilised in some activities carried out in RACE and in CCITT.

5.1.2 COST 219: Future Telecommunication and Teleinformatics Facilities for Disabled People

The main objective of the COST 219 project is to collect information about existing telecommunication and teleinformatics facilities and services as well as ongoing research and development appropriate to disabled people, to stimulate activities in this field, to survey the practical needs of disabled people and to evaluate the future possibilities of Information and Telecommunication Technologies. The aims of the COST 219 project is to start specific projects in appropriate areas where a need is encountered, e.g.:

- requirement studies of ISDN terminals on behalf of disabled persons;

- study of telecommunications by disabled persons;

- study of application areas of picture communication for different groups of disabled persons.

A number of publications have been issued. One of them has already been used as a basic input to an ETSI Technical Report on Recommendations for services and terminals.

The COST 219 project has gathered material which refers to standardisation issues and which has led to recommendations on the following:

- design criteria and user requirements on telecommunication equipment and services;

- terminal design on behalf of the disabled and elderly, adaptive terminals, new services;

- remote text communications for deaf, deaf blind and speech impaired people;

- picture communications. This includes videophony for the use of lip reading and sign/symbol language;

- alerting systems for emergency alarms for deaf or hard of hearing persons.

During the life of the COST 219 project, significant changes have taken place in the various relevant fields of technology, as well as in the socio-economic and political scene. When the project started, new technologies, such as ISDN and Integrated Broadband Communication (IBC), were at their formative stages and legislation, to bring about the privatisation of PTTs and liberalisation of equipment, was either at an early stage or had not been initiated in many countries. Practical applications of the new technology brought about more problems than those identified at the start of this project. Furthermore, developments, based on the new technologies, may now allow the consideration of implementing technical solutions and services that were previously not available or possible.

In order to continue the co-operation established during COST 219, to utilise the results carried out by the project and to ensure the exchange of information between the different fields of technology (keep up to date information for telecommunication, teleinformatics and rehabilitation technology) for the benefit of disabled people, a new programme is proposed: COST 219 bis.

5.2 Research and Development in Advanced Communications Technologies in Europe (RACE)

In the RACE Programme the Human Factors issues are, in the first place, addressed in the area of Usability Engineering, one of the five principal action lines of Part II, IBC Technologies. The main focus points in this, and other parts of the programme, are:

- investigations of the usability factors of dialogue, distribution, retrieval and integrated services and of usability issues of domestic Customers Permanence Network (CPN);

- investigations into the usability issues for people with special needs (e.g. the elderly and the handicapped);

- improving consistency of design through the development of a Usability Design Targets Database with easy access to usability knowledge and data;

- incorporation and evaluation of usability issues in Application Pilots.

This approach is an integrated element of the overall objects of the RACE programme to effectively enable evolution toward the successful implementation of Integrated Broadband Communication and the introduction of Commercial IBC services in 1995.

A brief description of the main projects of interest are given in subclauses 5.2.1 to 5.2.8.

5.2.1 R 1007 ITIS: IBC Terminal for Interactive Services.

At the end of this 4 year project period it will provide a Multi-Service Terminal (MST) demonstrator for broadband services, i.e. a prototype of a terminal, supporting a number of simultaneous Integrated Broadband Communication Network (IBCN) services. There are three main areas of interest in this project:

- the capacity of a terminal to process several requested IBCN services simultaneously, for instance in one multi-media session or a multi-service connection;

- advanced terminal user interface procedures for comfortable simultaneous usage of services;

- the general hardware and software architecture for a variety of dedicated terminals and a basis for defining standard terminal integrated circuits for economic terminal production.

5.2.2 R 1038 MCPR: Multimedia Communication, Processing and Representation.

In this project, a concept and architecture for a multimedia system for broadband application is being developed. The main features of this system will be demonstrated as a technological integration of diverse audio and visual media on suitable workstations.

5.2.3 R 1054 APPSN: Application Pilot for People with Special Needs

This project demonstrates the opportunities of videocommunication services for the elderly and for deaf and hard of hearing people.

5.2.4 R 1065 ISSUE: IBC Systems and Services Usability Engineering.

The main objectives of this project are:

- identify factors affecting acceptability and uptake of videocommunications and multimedia retrieval services;

- define evaluation methods concerning videocommunications and multimedia retrieval services;

- some experimental investigations have been carried out; multipoint videotelephone investigation, a videoconferencing end users survey and multimedia retrieval system investigation.

5.2.5 R 1066 IPSNI: Integration of People with Special Needs by IBC.

This project's main objective is the analysis and production of specifications of possible means of integration of people with visual and/or motor-speech disabilities into a multimedia communication network.

5.2.6 R 1067 GUIDANCE: Usability Design Information Support for the Integration of IBC Services.

This project studies the issues of integrated dialogue and retrieval services. It will use the multimedia terminal from project R 38 as its vehicle for experimentation.

5.2.7 R 1088 TUDOR: Usability Issues for People with Special Needs.

This project will provide:

- a sector analysis of handicapped and elderly people;
- usability data for this sector;
- tutorials for the RACE community to increase the awareness of this sector.

5.2.8 RACE Application Pilot Projects

All application pilots are expected to have considered the user requirements of their applications, and their results will contribute to the usability conclusions coming from RACE.

5.3 Technology for the Socio-Economic Integration of Disabled and Elderly People (TIDE)

The TIDE research programme is now being prepared by the European Commission Directorate General XIII.

The main thrust of TIDE is the application of technology, rather than the advancement of technology itself. When a new technology is developed the emphasis will be on general purpose devices, which are also capable of meeting the requirements of a person with special needs. Moreover, TIDE aims to improve the technological competitiveness of European industry (involved in communication, information, robotics, technical aids and control systems) and service providers in the field.

A pilot phase of TIDE, with a duration of about 18 months, will probably start in November 1991. If this pilot phase produces encouraging results, it may be followed by a main phase of 4 - 5 years, either as an independent programme or under the auspices of RACE.

6 European and international committees for Human Factors standardisation

The main organisations engaged, at the international level, in standardising Human Factors aspects and user interfaces deal with video workstations and fundamental questions of Human Factors. They are:

- the Organisation for International Standardisation (ISO); and
- CEN (Comité Européen de Normalisation).

In addition, the European Computer Manufacturers Association (ECMA) performs work in the Human Factors area of computer applications (see Annex B, figure B.1).

The field of telecommunications is covered by:

- CCITT (Comité Consultatif International de Télégraphique et Téléphonique); and
- ETSI (European Telecommunications Standards Institute).

To improve co-ordination between the several standardisation bodies in the field of Human Factors and to avoid overlapping and duplicating activities, an ad-hoc Co-ordination Committee under the chairmanship

of CEN was recently established. The several chairmen of these groups meet about twice a year to exchange information and to discuss matters of co-ordination between their different standardisation activities.

Annex D, figure D.1 shows the interrelationships between these standardisation groups.

6.1 ISO

ISO deals with numerous questions of industrial standards at the international level. Where issues of Human Factors and user interfaces arise, all aspects of display terminals and video workstations are covered, in addition to those of physiology, anthropometry (body measurements), biomechanics and environmental influences. So far, ISO has not done much work in the field of telecommunications. Like ETSI, ISO is organised in technical committees. The principal relevant committee is TC 159. Four subcommittees (SCs) and 13 Working Groups (WGs) deal with the following subjects (see Annex C, figure C.2):

TC 159/SC1: Ergonomic guiding principles

TC 159/SC3: Anthropometry and biomechanics

TC 159/SC4: Signals and controls

TC 159/SC5: Ergonomics of physical environment

The best known, and most important, subject dealt with by ISO/TC 159/SC4 is the ISO Standard 9241, "Human Factors requirements for office work with displays terminals (VDTs)". It describes various aspects of office work with display terminals in (so far) 19 parts. Its subject matter ranges from general principles of Human Factors through standards for keyboards to design rules for menu dialogue and the use of colours on screens.

6.2 IEC

The International Electrotechnical Commission (IEC) is the world-wide standardisation organisation responsible for developing international standards in the field of electrical standardisation.

IEC and ISO formed a Joint Technical Committee (JTC), i.e. ISO/IEC/JTC1/SC18 "Text and Office Systems", Working Group 9 "User Interface", that deals with aspects of the user dialogue in display applications using graphic user interfaces. Work items are symbols and pictograms ("ICONS"), user guidance like user prompting, error management, dialogue interaction, e.g. cursor selection and window control. The relevant standards are still being drawn up.

6.3 CEN/CENELEC

CEN is the European counterpart to ISO. It is especially concerned with performing tasks on machine safety in Europe on the basis of a mandate from the EC Commission. The relevant committee responsible for Human Factors is CEN TC 122.

Subjects treated include temperatures of touchable surfaces and vibrations. As far as office work with display terminals is concerned, CEN TC 122 intends to largely adopt ISO Standard IS 9241, but possibly with an enlarged scope.

CENELEC is working on safety aspects of technical equipment for office and telecommunications application. The responsible committee is CENELEC TC 74X.

6.4 CCITT

CCITT is a committee of the International Telecommunications Union (ITU) which belongs to the United Nations Organisation (UNO) and has a global span of activities. CCITT is divided into Study Groups (SGs) that devise recommendations for several technical areas of telecommunications.

Study Group I, "Services", contains a special Working Party, WP 2C, devoted to the subject of "Human Factors".

Study Group X, "Languages for Telecommunication Applications", and Study Group XII, "Transmission Performance of Telephone Networks and Terminals" contain several working parties having a bearing on Human Factors and man/machine interfaces.

In Study Group X, WP 1, "Human Machine Interface for Telecommunication Networks" has been responsible for the part in the CCITT Z. series of Recommendations specifying the Man Machine Language No. 1 (MML) for Stored Programme Control (SPC) Telecommunication Equipment.

The work of SGX WP 1 is seen as being relevant to the user interface of Telecommunications Management Network (TMN). This is known in TMN as the "G"-interface. The activity in this WP, during the current study period, has been to review the method of representing the data that would be presented across the user interface for the Network Manager. Also part of this activity has been to identify Network Management functions that need to be supported across the user interface. This work has been influenced by the work in TMN (CCITT SG IV) based on the OSI Management activity.

In SG XII there are 3 working parties:

a) WP1 "Telephonometry" (Measurements on telephones);

b) WP2 "Terminals" (Telephone sets of different types); and

c) WP3 "Transmission performance and modelling" (Speech transmission quality).

Topics dealt with by CCITT are formulated as study questions. Each question is handled by a "Special Rapporteur", often together with a small working party. Standards issued by CCITT are called "Recommendations" but may be made binding for manufacturers of telecommunications equipment by authorities and customers.

The subjects of the "Human Factors Working Party" are covered by the following questions:

Q 27/I:	Providing customer satisfaction and efficiency when using worldwide telecommunications.
Q 28/I:	Symbols and pictograms.
Q 29/I:	Customer control procedures in the PSTN and the ISDN.
Q 30/I:	User indications in the PSTN and ISDN.
Q 31/I:	Human Factors aspects of access to voice and non-voice services using public terminals.
Q 32/I:	Human Factors issues of new and updated telecommunications services.

In Study Group X the following question is the relevant one:

Q 5/X:	Specification of the Human-Machine Interface to support the management of telecommunication networks.

The following questions within Study Group XII are relevant for Human Factors and Man Machine Interfaces (MMI) in telecommunications:

Q2/XII:	Hands-free telephony.
Q7/XII:	Models for predicting transmission quality from objective measurements.
Q10/XII:	Speech transmission characteristics for digital handset telephones .
Q11/XII:	Transmission degradation introduced by interaction between voice operated devices.
Q17/XII:	Actual and preferred speech levels in telephone connections.

Q18/XII: Transmission performance of digital systems.

Q20/XII: Wideband telephony.

Q23/XII: Coupling of hearing aids to telephone sets.

Q31/XII: Speech quality in multi-media terminals.

Until recently CCITT published its Recommendations in "Coloured Books". The last one was the "Blue Book" (1988). It contains a number of Recommendations on aspects of user interfaces in the widest sense; some of these are very old and have been updated, while others are new. They include defined dialling tones, keyboard layout for telephones and symbols for telephone services in ISDN telecommunications equipment, as well as recommended handset dimensions and electroacoustic characteristics for optimising the mouth and ear interfaces of telephone terminals.

CCITT operates in study periods of 4 years. In other words, new Recommendations on the subjects mentioned above will be made when the current period elapses at the end of 1992. However, with changes that have taken place, Recommendations may be published before the end of the four years.

6.5 ETSI

ETSI Technical Committee Human Factors (TC-HF) is one of 12 ETSI Technical Committees. Its functions are as follows:

- to support other committees dealing with Human Factors questions and aspects of user interfaces in devising technical standards;

- to devise technical reports and guidelines on current Human Factors topics in telecommunications;

- to devise standards on aspects of user interfaces of international importance;

- to co-ordinate ETSI activities in user interfaces and Human Factors with other committees, such as CCITT and ISO, but also with appropriate European research programs, such as RACE and COST.

For practical reasons, it is sometimes less effective to develop special standards for Human Factors aspects because they are easily overshadowed by apparently more important technical standards. It is preferable to integrate such requirements into, and hence to make them a component of, industrial standards.

TC-HF is further divided into sub-technical committees that deal mainly with the following three areas:

- telecommunications services;

- people with special needs;

- usability evaluation.

6.5.1 Telecommunications Services

ETSI STC-HF1 is responsible for all Human-Factors aspects of telecommunications services and terminals. Its task is to ensure that user needs for services and terminals are incorporated into industrial standards and not just treated as marginal subjects or even not at all. These needs include the following:

- user procedures, including displays, tones and announcements, symbols, pictograms, help functions, e.g., for ISDN telephones and video telecommunications;

- requirements imposed on the user interface of terminals and services, e.g. system response times;

- requirements for multifunctional terminals and integration of services, e.g., computer services.

6.5.2 People with Special Needs

ETSI STC-HF2 is responsible for the Human-Factors aspects of people with special needs. These people include the physically handicapped, those with hearing or speech defects or both, those with poor vision but also the increasing number of elderly people. Similar problems are faced by people travelling in a foreign country whose language they do not understand well. The EC Commission, which is actively supporting this subject field, estimates that 20% (approx. 70 million) of Europe's population will be older than 60 by the year 2000. A large section of the population may then experience difficulties in using telecommunications devices.

The mission of STC-HF2 is to ensure that the requirements of these user groups are noted and taken more into account in existing and future industrial standards. The sophisticated technology used nowadays in telecommunications affords good prospects of facilitating or even making it at all possible for these people to use them with very little need for additional expenditures. So far, however, the telecommunications industry has hardly dealt with this issue. Experts on, and knowledge about, this topic are already available, primarily in universities and specific institutions for these people, but also within various national and European research programmes.

The work schedule embraces the following topics:

- proposals for complementing and modifying existing standards or those in hand, particularly with regard to ISDN;

- collating Human Factors data and information about the special needs of these users as an aid for developers of terminals and services;

- recommendations and standards for sub-aspects of terminals and services aimed at improving communication between these classes of users.

6.5.3 Usability Evaluation

The brief of this STC-HF3 is to pursue all aspects of study and measurement of the Human Factors quality of user interfaces and their degree of user friendliness. It provides methodical support for standardisation experts, product developers and quality experts.

Their topics include:

- methods and tools for user attitude testing (subjective parameters);

- recommendations on methodology of user performance tests (objective parameters);

- check-lists for assessing the quality of user interfaces (evaluations, estimates).

One long-term aim of the committee is to develop a "Quality Certificate" for user interfaces on the basis of the check-lists that they have developed.

6.5.4 Work results

The results of work in TC-HF will initially be published in the form of ETSI Technical Reports (ETRs). As soon as they are available, discussions will be held about whether or not at least some of them should be incorporated into ETSI Standards (ETSs or I-ETSs).

6.6 Feeding organisations

To date, ECMA has done very little of its own development work in the field of Human Factors. It is very strongly oriented towards CEN and ISO and views its mission as supporting and complementing these committees from the manufacturers viewpoint. The relevant committee is ECMA TC 35, which was founded recently. It aims to develop a reference model for user interfaces of software applications as a means of studying and defining the requirements imposed on standardisation.

7 Human Factors standards and recommendations

7.1 ISO

The main result of Human Factors standardisation work in ISO is the multi-part Standard IS 9241: "Ergonomic Requirements for Office Work with Visual Display Terminals (VDT)".

Overview:

Part 01: "General introduction (IS)"

Part 02: "Guidance on task requirements" (IS)

Part 03: "Visual display requirements" (IS)

Part 04: "Keyboard requirements" (Draft International Standard (DIS))

Part 05: "Workstation layout and postural requirements" (Committee Draft (CD))

Part 06: "Environmental requirements" (CD 3/92)

Part 07: "Display requirements with reflections" (CD)

Part 08: "Requirements for displayed colours "(CD)

Part 09: "Requirements for non-keyboard input devices" (CD 3/92)

Part 10: "Dialogue principles" (CD)

Part 11: "Usability Statements" (CD 5/92)

Part 12: "Presentation of information" (CD 5/92)

Part 13: "User guidance" (CD 12/92))

Part 14: "Menu dialogues" (DIS)

Part 15: "Command dialogues" (CD 12/92)

Part 16: "Direct manipulation dialogues" (CD 12/92)

Part 17: "Form filling dialogues" (under study)

Part 18: "Question and answer dialogues" (under study)

Part 19: "Natural language dialogues" (under study)

NOTE: The abbreviation in brackets indicate the status. With exception of Parts 1 to 3 (which are approved and going to be printed) all other parts are not yet definitive. Some of the other parts are already in the status of a committee draft (CD).

The following description reflects the current situation.

Part 1: General introduction

This part contains the scope and the principles which are to be followed in all parts of the standard, plus an overview of the intended parts of the standard. Terminology should form an annex to Part 1 later on.

The scope for the whole standard primarily should be the Human Factors of work systems with Visual Display Terminals (VDTs) used for office tasks. A Working Group 6 (WG 6) has been founded within ISO/TC159/SC4 for work on enlargement of the scope to other kinds of workplaces. Probably the already adopted scope will remain as it is and additional parts will be edited for other applications.

Part 2: Guidance on task requirements

This part says in the scope that it should give guidance to both the organisation implementing the system and the people using the equipment. The objective is to enhance the efficiency and the well-being of the individual users. It is stated that this standard does not address software and dialogue design, but this may not be considered as correct because Part 10 and Parts 14 to 19 deal with software inclusively.

The statements on task design are rather common and well-known facts. Part 2 is neither intended nor suitable as a product standard, because there are no conformance Clauses. It has its value as a guideline for the development and implementation of application of specific tasks.

Part 3 : Visual display requirements

According to the scope, this part establishes the image quality requirements for the design and evaluation of single- and multi-colour VDTs for Latin, Cyrillic and Greek alphabetic characters and (so called) Arabic numerals used for office tasks. Excluded are other specific applications as Computer Aided Design or process control.

This part gives 31 definitions, guiding principles and exactly measurable design requirements and recommendations. Contrary to the usual practice, a "design viewing distance" is introduced. This means, that the supplier has to indicate for which distance range the VDT is designed (or suitable).

Measurement conditions and conventions are described in detail. Two compliance routes are mentioned:

(A): by meeting all mandatory requirements; or

(B): by a positive result using a test method described in an informative annex, which later on, after experience has been gained, is intended to become an Addendum to Part 3. This route should be applied for new technologies where the requirements of Section 6 cannot be applied. As long as the addendum is not yet published, only route (A) is allowed.

Route (B) is a merely subjective test executed by a number of "test subjects" who compare the test display nor the statistical methods for evaluation are defined. The number of test subjects can be calculated from the tolerated risks to obtain wrong results in one or the other direction, named "manufacturer's risk" and "user's risk".

Part 4: Keyboard requirements

According to the scope, Part 4 has the objective to influence the design of keyboards for typical office tasks so that they take account of known capabilities and limitations in human performance, and requirements for safety and comfort. Special keyboards, e.g. those used in control rooms, are outside the scope of Part 4.

This part gives definitions, guiding principles, regarding also the kind of task (alphabetic, alphanumeric, coded or natural language), performance requirements, also design requirements and recommendations. It does not cover the layout, which is dealt with by ISO/IEC/JTC 1/SC 8/WG 9.

Part 5: Workstation layout and postural requirements

This part deals with furniture requirements specific for office work with VDT terminals. It covers the chair and ancillary items such as footrests and document holders as well as work surfaces and desking.

Part 6: Environmental requirements

Part 6 deals with specific requirements for VDT work with regard to environmental conditions, as climate, noise and lightning.

Valuable information will be given in the informative annexes, "Lighting and Workplace Layouts".

Part 7: Display requirements with reflections

This part gives a very detailed physical and mathematical description of the phenomenen of reflection. The requirements are clearly defined: the calculated large-area contrast shall be at least 0,5, under specific conditions that can produce both diffuse and specular reflections from the screen.

The rest are definitions, descriptions of measurements and calculations, measurement specifications and procedures. An informative annex is a screen reflection tutorial; others deal with the measurement of reflected details as well as optical treatments of the screen surface and filters. For all known sorts of filters advantages and disadvantages are listed.

Part 8: Requirements for displayed colours

This part deals with the characteristics of colour (controlled by hardware and software) assigned to test and simple graphics on CRT or emissive flat panel computer displays. The purpose of this part is to prescribe basic specifications for colours to optimise their visibility and discrimination and to provide recommendations on applying colour as a code to enhance the interpretation of information (wording of the scope).

The document contains definitions, guiding principles, design requirements and recommendations, concerning colour uniformity, colour misconvergence, character height or object size, colour differences, colour legibility, contrast, background and surround effects, chromostereopsis (presentation of extreme colours) and number of presented colours. Colour measurement procedures and calculations are described. The most important compliance requirement is that colour difference shall conform to the required minimum value.

Also in this part, an informative annex contains a subjective test method as an alternative to colour measurement.

Part 9: Requirements for non-keyboard input devices

This part deals with Human Factors requirements for non-keyboard input devices such as: Mouse, joystick, trackball, tablet/puck/stylus, touch sensitive screen, light pen, digitising pad, thumb wheel, CAD multi-rocker switch, foot switch.

This part will describe the used task primitives, as pointing, translation, volume rotation and free-hand drawing. Guiding principles, design principles and guidelines will be given for input devices. The Human Factors requirements for the different input devices will be specified, details of a user performance test method will also be provided.

Part 10: Dialogue principles

This is the first part of IS 9241 dealing with software aspects. Since the user engages in an dialogue with the computer, the "technique" used to enable the dialogue is particularly important. Dialogue principles cover procedural as well as structural aspects. The provided Human Factors principles are independent of any specific dialogue technique.

The following principles were identified to be important for design and evaluation of a dialogue:

- suitability for the task;
- self-descriptiveness;
- controllability;
- conformity with user expectations;
- error tolerance;
- individualisation;
- learnability.

The principles should be applied as guidelines when developing or evaluating dialogue systems. There are currently no universally accepted measures of the principles. Hence, current state of the art does not allow for direct conformance to this part.

Dialogue techniques should consider the psychological characteristics of the user, e.g. attention span, limits of short-term memory, learning behaviour, degree of experience, procedural conditions, curiosity and should allow the user to select different levels of experience.

After giving definitions, the above-mentioned dialogue principles are dealt with in a detailed manner. Informative Annex A to Part 10 lists examples for the mentioned principles. Informative Annex B to Part 10 describes a methodology, how to develop user scenarios.

Part 11: Usability Statement

This part provides a definition of usability and explains how usability can be described and measured. It also specifies the minimum information requirements to describe usability when usability needs to be considered as part of the specification, development or evaluation of a work system consisting of a product, user, task and environment. It does not specify the means by which a desired level of usability can, or should be, achieved or how usability problems can be diagnosed.

This part presents an operational model of usability in which the components of the quality of interaction and of the context of use are decomposed into measurable and verifiable attributes. The quality of interaction may be defined in terms of whether or not the intended goals of use of the work system are achieved (effectiveness); how much resource has to be expended to achieve the intended goals (efficiency); and whether or not the user finds the work system acceptable (satisfaction). Similarly, the context of use may be decomposed into attributes of the product, user, task and environment.

Part 12: Presentation of information

Part 12 deals with the specific Human Factors issues involved in representing and presenting information in a visual or auditory form. It will include guidance on ways of representing complex information, screen layout and design as well as the use of windows. There is already a substantial of material available in guidelines and recommendations and this part represents a distillation of the most useful and relevant ones. At present, the information is envisaged as guidelines without any need for formal conformance testing.

Part 13: User guidance

Part 13 will deal with various forms of user guidance including documentation and help screens, offering system aids in error free task solution situations to prevent errors and error situations as well as to manage errors.

Part 14: Menu Dialogues

This part should be applied by user interface designer, customers and those responsible for ensuring products conform to this part. The use of Part 14 shall make software interfaces more usable and consistent and, by these means, enlarge productivity.

A large number of guidelines is given. The applicability of each guideline has to be checked by means of an "if-statement". If the respective condition is true, it has to be checked whether or not compliance with the guideline exists. All this is done by means of a very long and comprehensive "conformance checklist".

After filling in all criteria, a Compliance Rate (CR) has to be calculated as the percentage of the applicable guidelines successfully complied with. This calculation is recommended for each separate menu as well as for the system as a whole.

Part 15: Command dialogues

Part 16: Direct manipulation dialogues

Part 17: Formfilling dialogues

Part 18: Question and answer dialogues

Part 19: Natural language dialogues

These other dialogue techniques are still under consideration. At present they are in the very early stages. A set of task-independent control functions will be specified for each of these dialogue techniques. Application examples will be given for illustration.

7.2 IEC

ISO/IEC/JTC 1/SC 18/WG 9 develops the multipart Standard ISO/IEC 9995: "Information Processing-Keyboard Layouts for Text and Office Systems (TOS)". The parts of the standard are:

ISO/IEC 9995, Part 1: "General principles governing keyboard layouts";

ISO/IEC 9995, Part 2: "Alphanumeric Section".

ISO/IEC 9995, Part 3: "Common primary and common secondary layout of the alphanumeric zone".

ISO/IEC 9995, Part 4: "Numeric Section".

ISO/IEC 9995, Part 5: "Editing Section".

ISO/IEC 9995, Part 6: "Function Section".

ISO/IEC 9995, Part 7: "Symbols used to represent functions".

ISO/IEC 9995, Part 8: "Allocation of letters to the keys of a numeric keyboard".

Most of them have already reached DIS status and will be going to be issued as an IS in the course of 1992.

7.3 CEN

CEN has decided to adopt IS 9241 as a basis for the European Ergonomic Standard EN 29241. The different parts closely correspond to the structure of IS 9241. The approval is under consideration but not yet completed, according to the progress on IS 9241

7.4 ECMA

To date, ECMA has developed three standards for Visual Display Terminals. The requirements of these standards are restricted to those features of the display unit and keyboard which are entirely under the control of the manufacturer and, as such, are mandatory. The standards does not address those Human Factors considerations which are under the control of the user since these can be given only as recommendations. Recommendations for these considerations are to be found in ECMA TR/22.

ECMA 110 Ergonomics - "Requirements for monochromatic visual display devices".

This ECMA Standard specifies requirements for Visual Display Terminals (VDT) using a monochromatic CRT and an associated keyboard input. This Standard applies specifically to VDTs used intensively by a seated operator who is a skilled typist, for data entry work, data acquisition, interactive communication, or word processing.

ECMA 126 Ergonomics - "Requirements for colour visual display devices".

This ECMA Standard specifies requirements for Visual Display Terminals (VDT) using colour CRT and an associated keyboard input. It is applicable to display units based on three-gun, shadow mask CRTs. This Standard applies specifically to VDTs used intensively by a seated operator who is a skilled typist, for data entry work, data acquisition, interactive communication, or word processing.

ECMA 136 Ergonomics - "Requirements for non-CRT visual display units".

This ECMA Standard specifies requirements for Visual Display Units (VDU) using a non-CRT technology and an associated keyboard input. This Standard applies specifically to VDUs used intensively in an office by a seated operator for data entry work, data acquisition, interactive communication, or word processing.

The first deliverable of the new ECMA TC 35 will be a User Interface Taxonomy (June 1992).

7.5 CCITT

The following list contains those CCITT Recommendations which are relevant to Human Factors (HF) and the Man Machine Interface (MMI) in the design of telephone terminals and services.

E-Series (contained in Vol. II of the Blue Book, Geneva 1988):

E.120: "Instructions for users of the international telephone services".

E.121: "Pictograms and symbols to assist users of the telephone service".

E.122: "Measures to reduce customer difficulties in the international telephone services".

E.123: "Notation for national and international telephone numbers".

E.124: "Discouragement of frivolous international calling to unassigned or vacant numbers answered by recorded announcements without charge".

E.125: "Inquiries among users of the international telephone services".

E.126: "Harmonisation of the general information pages of the telephone directories".

E.127: "Pages in the telephone directory intended for foreign visitors".

E.128: "Leaflet to be distributed to foreign visitors".

E.130: "Choice of the most useful and desirable supplementary telephone services".

E.131: "Subscriber control procedures for supplementary telephone services".

E.132: "Standardisation of elements of control procedures for supplementary telephone services".

E.133: "Operating procedures for cardphones".

E.161: "Arrangement of figures, letters and symbols on telephones and other devices that can be used for gaining access to a telephone network".

E.180: "Technical characteristics of tones for the telephone service".

E.181: "Customer recognition of foreign tones".

E.182: "Application of tones and recorded announcements in telephone services".

E.183: "Guiding principles for telephone announcements".

E.184: "Indications to users of ISDN terminals".

E.330: "User control of ISDN-supported services".

E.333: "Man machine interface".

P-Series (contained in Vol. V of the Blue Book, Geneva 1988):

P.30: "Transmission performance of Group Audio Terminals".

P.31: "Transmission characteristics for digital telephones".

P.34: "Transmission characteristics of hands-free telephones".

P.35: "Handset telephones".

P.37: "Inductive coupling of hearing aids to telephone sets".

Z-Series (contained in Vol. X of the Blue Book, Geneva 1988):

Z.301: "Introduction to the CCITT Man-Machine Language (MML)".

Z.323: "Man-machine interaction".

7.6 ETSI

Since ETSI TC-HF is a fairly new one, no standards with regard to Human Factors have been completed so far.

Several ETRs are completed or in progress. TC-HF regards these ETRs as a first step to technical standards (ETSs). After having received feedback on these ETRs, some of them will be considered for transformation into ETSs.

The following list contains all the planned ETSI deliverables of the work programme.

ETR 039 (1992): "Overview of Human Factors standards for telecommunication application".

DTR/HF-0002: "Human Factors guidelines for ISDN terminal equipment design" (expected 1992).

DTR/HF-1002: "Phone based interfaces" (expected 1992).

DTR/HF-1003: "Guidelines for specification of tones" (expected 1992).

DTR/HF-1006: "Human Factors in videotelephony" (expected 1992).

DTR/HF-1010: "Pictograms for ISDN videotelephony" (expected 1992).

DTR/HF 1011: "Unified European Numbering Plan" (expected 1992).

DTR/HF-2002: "Recommendations for improving and adapting services and terminals for PSN" (completed).

DTR/HF-2003: "Implications of human ageing on telephone terminal design" (expected 1992).

DE/HF-2004: "Magnetic coupling of telephony terminals to hearing aids" (expected 1992).

DTR/HF-2006: "Standardisation model for telecommunications facilities for PSN" (expected 1992).

DTR/HF-3001: "Guide on usability testing methods for telecommunication terminal and services" (expected 1992).

DTR/HF-3002: "Usability checklist for telephone sets" (expected 1992).

Annex A: Addresses

ISO:	Rue de Varambé 1, CH-1211 Genève. Phone: +41 22 341 240, Fax: +41 22 333 430.
CEN/CENELEC:	Rue de Bréderode 2, B-1000 Bruxelles Phone: +32 2 519 6811, Fax: +32 2 519 6119.
ECMA:	Rue du Rhone 114, CH-1204 Genève. Phone: +41 22 735 3634, Fax: +41 22 786 5231.
ETSI:	B.P. 152, F-06561 Valbonne Cedex. Phone: +33 92 94 4200, Fax: +33 93 65 4716.
CCITT:	Place des Nations, CH-1211 Genève. Phone: +41 22 730 5111, Fax: +41 22 733 7256.

Annex B: International standardisation bodies in Human Factors

ISO TC 159: Ergonomics

/SC1: Ergonomic Guiding Principles.

/SC3: Anthropometry and Biomechanics (ref. workplace).

/SC4: Signals and Controls

/SC5: Ergonomics of the Physical Environment

/SC6: Ergonomic Requirements of Work Systems

ISO/IEC/JTC1/SC 18/WG 9: User System Interfaces and Symbols.

CEN TC 122: Ergonomics (Structure reflects ISO TC 159)

ECMA TC 35: User System Interface

CCITT SG I: Services

/SWP 2C: Human Factors

CCITT SG X: Languages for Telecommunications Applications

/WP 1: Human Machine Interface for Telecommunications Networks

CCITT SG XII: Transmission Performance of Telephone Networks and Terminals

/WP 1: Telephonometry

/WP 2: Terminals

/WP 3: Transmission Performance and Modelling

ETSI TC HF: Human Factors

Figure B.1: International standardisation bodies in Human Factors

Annex C: ISO TC 159 Ergonomics

SC 1 Ergonomic guiding principles

- WG 1 Revision of ISO 6385
- WG 2 Ergonomic principles related to mental work

SC 3 Anthropometry and biomechanics

- WG 1 Anthropometry
- WG 2 Evaluation of working postures
- WG 3 Human physical strength
- WG 4 Manual harding of heavy weights

SC 4 Signals and controls

- WG 1 Fundamentals of controls and signalling methods
- WG 2 Visual display requirements
- WG 3 Control, workplace and environmental requirements
- WG 5 Software ergonomics and man-machine dialogue
- WG 6 Usage of 9241
- WG 7 Vocabulary
- WG 8 Ergonomic Requirements of Control Rooms

SC 5 Ergonomics of the physical environment

- WG 1 Thermal environment
- WG 2 Lighting
- WG 3 Danger signals and communication in noisy environments

Figure C.1: ISO TC 159 Ergonomics

Annex D: Interrelationship between standardisation bodies on Human Factors

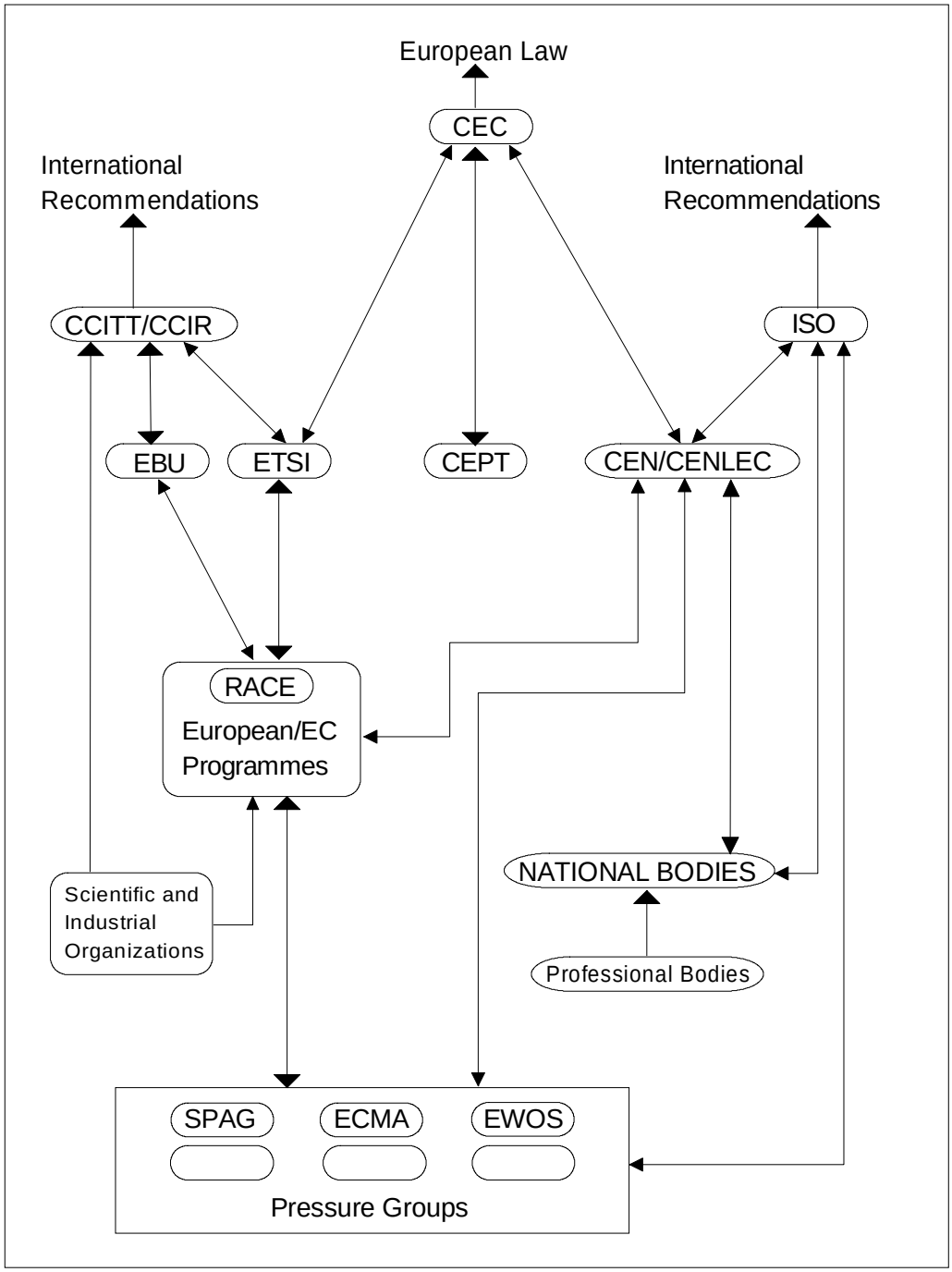

Figure D.1: Interrelationship between standardisation bodies on Human Factors

History

Document history	
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