TECHNICAL REPORT

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Ergonomics of human-system interaction —

Part 100: Introduction to standards related to software ergonomics

Ergonomie de l'interaction homme-système —

Partie 100: Introduction aux normes relatives à l'ergonomie des logiciels

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Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 2.

The main task of technical committees is to prepare International Standards. Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75 % of the member bodies casting a vote.

In exceptional circumstances, when a technical committee has collected data of a different kind from that which is normally published as an International Standard ("state of the art", for example), it may decide by a simple majority vote of its participating members to publish a Technical Report. A Technical Report is entirely informative in nature and does not have to be reviewed until the data it provides are considered to be no longer valid or useful.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights.

ISO/TR 9241-100 was prepared by Technical Committee ISO/TC 159, *Ergonomics*, Subcommittee SC 4, *Ergonomics of human-system interaction*.

ISO 9241 consists of the following parts, under the general title *Ergonomic requirements for office work with visual display terminals (VDTs)*:

— *Part 1: General introduction*

— *Part 2: Guidance on task requirements*

— *Part 4: Keyboard requirements*

— *Part 5: Workstation layout and postural requirements*

— *Part 6: Guidance on the work environment*

— *Part 9: Requirements for non-keyboard input devices*

— *Part 11: Guidance on usability*

— *Part 12: Presentation of information*

— *Part 13: User guidance*

— *Part 14: Menu dialogues*

— *Part 15: Command dialogues*

— *Part 16: Direct manipulation dialogues*

— *Part 17: Form filling dialogues*

ISO 9241 also consists of the following parts, under the general title *Ergonomics of human-system interaction*:

— *Part 20: Accessibility guidelines for information/communication technology (ICT) equipment and services*

— *Part 100: Introduction to standards related to software ergonomics* [Technical Report]

— *Part 110: Dialogue principles*

— *Part 129: Guidance on individualization*

— *Part 151: Guidance on World Wide Web user interfaces*

— *Part 171: Guidance on software accessibility*

— *Part 210: Human-centred design for interactive systems*

— *Part 300: Introduction to electronic visual display requirements*

— *Part 302: Terminology for electronic visual displays*

— *Part 303: Requirements for electronic visual displays*

— *Part 304: User performance test methods for electronic visual displays*

— *Part 305: Optical laboratory test methods for electronic visual displays*

— *Part 306: Field assessment methods for electronic visual displays*

— *Part 307: Analysis and compliance test methods for electronic visual displays*

— *Part 308: Surface-conduction electron-emitter displays (SED)* [Technical Report]

— *Part 309: Organic light-emitting diode (OLED) displays* [Technical Report]

— *Part 400: Principles and requirements for physical input devices*

— *Part 410: Design criteria for physical input devices*

— *Part 420: Selection procedures for physical input devices*

— *Part 910: Framework for tactile and haptic interaction*

— *Part 920: Guidance on tactile and haptic interactions*

The following parts are under preparation:

— *Part 143: Forms-based dialogues*

— *Part 154: Design guidance for interactive voice response (IVR) applications*

— *Part 310: Visibly,aesthetics and ergonomics of pixel defects* [Technical Report]

Evaluation methods for the design of physical input devices is to form the subject of a future part 411.

Introduction

The ISO 9241 series covers both the hardware and software-ergonomics aspects of human-system interaction. The individual parts of ISO 9241, their interrelationships, and the expected users of the parts are described in ISO 9241-1.

As part of the revision of ISO 9241, the scope of ISO 9241 has been broadened from “office work with visual display terminals (VDTs)” to cover a wide range of interactive systems and the title of the series was changed to “Ergonomics of human-system interaction”. In order to allow systematic integration of emerging standards into the ISO 9241 series, a structure and numbering scheme was introduced that allows standards to be grouped by subject area.

Ergonomics is the scientific discipline and systematic study concerned with the understanding of the interactions among human and other elements of a system, and the profession that applies theory, principles, data and methods to design in order to optimize human well-being and overall system performance. Software ergonomics, therefore, is the application of ergonomics to the software aspects of interactive systems.

The standards referred to in this part of ISO 9241 provide general guidance, principles, recommendations and requirements focusing on the interaction between human and system and also the processes and methods required to achieve usable and accessible interactive systems (e.g. ISO 9241 “200” subseries dealing with human-centred design).

NOTE There are a number of software-ergonomics standards which are not yet part of the ISO 9241 “100” series (e.g. ISO 14915). These standards will be revised and are presented in this part of ISO 9241 in their intended position within the structure of the ISO 9241 “100” subseries.

There are numerous International Standards, related to user interface design, which can be applied to software ergonomics. These cover a wide range of needs of standards users including ergonomists, designers, project managers, managers, workers or their representatives, consumers/their representatives, procurers and certification bodies.

This part of ISO 9241 is designed to help the potential users of software-ergonomics standards identify which of these standards are relevant to their needs.

The principles, recommendations and requirements given in the software-ergonomics standards help prevent users from experiencing usability problems such as:

— additional unnecessary steps not required as part of the task;

— misleading information;

— insufficient and poor information on the user interface;

— unexpected response of the interactive system;

— navigational limitations during use;

— inefficient error recovery.

In addition, the application of the principles, recommendations and requirements contributes to increased levels of accessibility.

Ergonomics of human-system interaction —

Part 100: Introduction to standards related to software ergonomics

1 Scope

This part of ISO 9241 enables users of standards related to software ergonomics to identify ergonomics standards particularly relevant to software development, gain an overview on the content of software-ergonomics standards, understand the role of software-ergonomics standards in specifying user requirements as well as designing and evaluating user interfaces and understand the relationship between the various standards.

The software-ergonomics standards are applicable to all those software components of an interactive system affecting usability, including:

— application software (including web-based applications);

— operating systems;

— embedded software;

— software development tools;

— assistive technologies.

The range of standards discussed in this part of ISO 9241 includes general International Standards relating to software ergonomics, International Standards for processes and methods related to software ergonomics and software-ergonomics standards.

This part of ISO 9241 provides summary information on standards relevant to the following professions:

— ergonomists;

— usability professionals;

— designers;

— project managers;

— managers;

— workers or their representatives;

— consumers or their representatives;

— procurers;

— certification bodies.

2 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

2.1
ergonomics
study of human factors
scientific discipline concerned with the understanding of interactions among human and other elements of a system, and the profession that applies theory, principles, data and methods to design in order to optimize human well-being and overall system performance

[ISO 6385:2004, definition 2.3]

2.2
usability
extent to which a product can be used by specified users to achieve specified goals with effectiveness, efficiency and satisfaction in a specified context of use

[ISO 9241-11:1998, definition 3.1]

2.3
context of use
users, tasks, equipment (hardware, software and materials), and the physical and social environments in which a product is used

[ISO 9241-11:1998, definition 3.5]

2.4
effectiveness
accuracy and completeness with which users achieve specified goals

[ISO 9241-11:1998, definition 3.2]

2.5
efficiency
resources expended in relation to the accuracy and completeness with which users achieve goals

[ISO 9241-11:1998, definition 3.3]

2.6
satisfaction
freedom from discomfort, and positive attitudes to the use of the product

[ISO 9241-11:1998, definition 3.4]

2.7
accessibility
extent to which products, systems, services, environments or facilities can be used by people from a population with the widest range of capabilities to achieve specified goals in a specified context of use

NOTE Context of use includes direct use or use supported by assistive technology.

[ISO/TR 22411:2008, definition 3.6]

2.8
accessibility
〈interactive systems〉 usability of a product, service, environment or facility by people with the widest range of capabilities

NOTE 1 The concept of accessibility addresses the full range of user capabilities and is not limited to users who are formally recognized as having a disability.

NOTE 2 The usability-orientated concept of accessibility aims to achieve levels of effectiveness, efficiency and satisfaction that are as high as possible considering the specified context of use, while paying particular attention to the full range of capabilities within the user population.

[ISO 9241-20:2008, definition 3.1]

2.9
interactive system
combination of hardware and software components that receive input from, and communicate output to, a human user in order to support his or her performance of a task

NOTE The term “system” is often used rather than “interactive system”.

[ISO 13407:1999, definition 2.1]

2.10
user interface
all components of an interactive system (software or hardware) that provide information and controls for the user to accomplish specific tasks with the interactive system

[ISO 9241-110:2006, definition 3.9]

2.11
dialogue
interaction between a user and an interactive system as a sequence of user actions (inputs) and system responses (outputs) in order to achieve a goal

NOTE 1 User actions include not only entry of data but also navigational actions of the user.

NOTE 2 Dialogue refers to both the form (syntax) and the meaning (semantics) of interaction.

[ISO 9241-110:2006, definition 3.2]

3 International Standards and software ergonomics

3.1 Benefits of standards related to software ergonomics

The ultimate beneficiary of standards related to software ergonomics is the user of the interactive system. It is the needs of these users that provided the ergonomics recommendations in the software-ergonomics standards. Although it is unlikely that the end user would read standards related to software ergonomics or even know of their existence, their application could provide user interfaces which are more usable, accessible and consistent and which enable greater productivity.

3.2 Current International Standards relating to software ergonomics

There is a range of standards relating to software ergonomics which contribute to achieving these goals including:

a) software-ergonomics standards:

— ISO 9241-12 to ISO 9241-17;

— ISO 14915-1, ISO 14915-2 and ISO 14915-3;

— ISO 9241-110, ISO 9241-151 and ISO 9241-171.

b) standards on general ergonomics relevant to software ergonomics:

- ISO 6385;
- ISO 9241-11;
- ISO 9241-20.

c) standards for processes and methods relevant to software ergonomics:

- ISO/TR 16982;
- ISO/PAS 18152;
- ISO/TR 18529;
- ISO/IEC 25062.

3.3 Usability and context of use

Usability is an important consideration in the design of products, systems, services and facilities, because it is concerned with the extent to which the users are able to perform effectively, efficiently and with satisfaction. In order to determine the level of usability achieved, it is necessary to measure the performance and satisfaction of users. Measurement of usability is particularly important in view of the complexity of the interactions between the users, the tasks and the other elements of the context of use.

Planning for usability as part of the design and development involves the systematic identification of requirements for usability, including usability measures and verifiable descriptions of the context of use. These provide design targets that can be the basis for verification of the resulting design.

The concept of effectiveness relates the goals or secondary goals of the user to the accuracy and completeness with which these goals can be achieved.

The concept of efficiency relates the level of effectiveness achieved to the expenditure of resources. Relevant resources can include mental or physical effort, time, materials or financial cost. Human efficiency can be measured as effectiveness divided by human effort.

Satisfaction measures the extent to which users are free from discomfort and also measures their attitudes to the use of the product. Satisfaction can be measured by subjective ratings on scales, such as levels of discomfort experienced, satisfaction with use or acceptability of the workload when carrying out different tasks or the extent to which particular usability objectives (such as efficiency or suitability for learning) have been met.

3.4 Accessibility

Accessibility is an important consideration in the design of products, systems, services and facilities, because it affects the range of people who are able to use them and use them easily. Accessibility can be increased to improve usability for individuals and widen the range of people who can use the product, system, service and facility.

An accessible user interface with usability defects would not serve its purpose. Therefore, applying software-ergonomics standards is a precondition to achieving effective accessibility.

Accessibility can be improved by incorporating features and attributes known to benefit users with special requirements. To achieve a given level of accessibility, the effectiveness, efficiency and satisfaction for the widest range of users should be specified. Planning for accessibility is an integral part of the design and development process and involves the systematic identification of requirements for accessibility, including accessibility measurements and verification criteria within the context of use. These provide design targets that can be the basis for verification of the resulting design.

Measurement of accessibility is particularly important in view of the complexity of the interactions with the user, the goals, the task characteristics and the other elements of the context of use. A product, system, service or

facility can have significantly different levels of accessibility when used in different contexts, in particular by different user groups with special requirements.

ISO 9241-171 explicitly covers accessibility for software.

4 Software-ergonomics standards

4.1 General

Software-ergonomics standards contain guidance which assists both the specification of user requirements and the design and evaluation of the user interface of an interactive system. These standards do not aim at standardizing the user interface; rather, they give recommendations that should be applied in order to ensure the usability of the user interface of the product and eliminate design solutions which can be predicted to cause usability problems to users.

Figure 1 illustrates the role of software-ergonomics standards in analysis, design and evaluation. These standards contain recommendations which are applicable to a wide range of different contexts of use. Therefore, the standards themselves specify recommendations that need to be "contextualized" in the specific context of use of the interactive system to be designed or redesigned. Not all recommendations apply in every context of use. For every decision on user requirements and design solutions, the requirements and recommendations in software-ergonomics standards help to ensure that appropriate levels of usability and accessibility are established. The requirements and recommendations contained in these standards should be assessed for their applicability in the given context of use and applied accordingly.

Some other ergonomics standards also take this approach, e.g. ISO 9241-20 and ISO 9241-920.

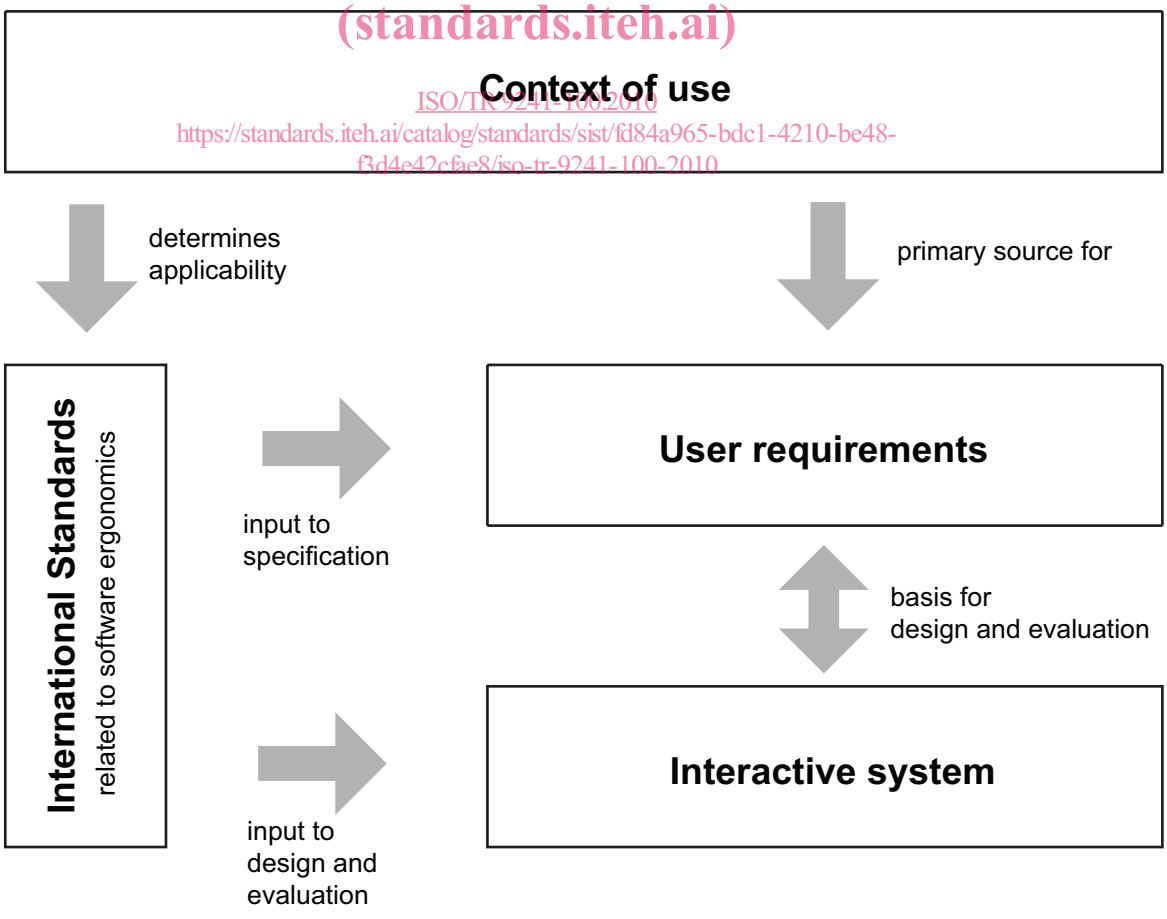

Figure 1 — The role of software-ergonomics standards in analysis, design and evaluation