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Ergonomics of human-system interaction —

Part 110: Dialogue principles

Ergonomie de l'interaction homme-système —

Partie 110: Principes de dialogue

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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.

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 9241-110 was prepared by Technical Committee ISO/TC 159, *Ergonomics*, Subcommittee SC 4, *Ergonomics of human-system interaction*.

This first edition of ISO 9241-110 cancels and replaces ISO 9241-10:1996, which has been technically revised as follows:

— the explanation of suitability for the task (4.3) has been made more comprehensible;

— for each dialogue principle given in 4.3 to 4.9, general recommendations have been made;

— examples for each of these general recommendations have been given;

— a framework for the use of the dialogue principles has been added to Clause 5;

— an explanation of the relationship with ISO 9241-11 and ISO 9241-12 has been given in Clause 6;

— Annex A, presenting an overview of the ISO 9241 has been added.

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 3: Visual display requirements*

— *Part 4: Keyboard requirements*

— *Part 5: Workstation layout and postural requirements*

— *Part 6: Guidance on the work environment*

— *Part 7: Requirements for display with reflections*

— *Part 8: Requirements for displayed colours*

— *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 equipment and services*

— *Part 110: Dialogue principles*

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

The following parts, under the general title *Ergonomics of human-system interaction*, are under preparation:

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

— *Part 171: Guidance on software accessibility*

— *Part 300: Introduction to requirements and measurement techniques for electronic visual displays*

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

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

— *Part 421: Workplace assessment methods for physical input devices*

Introduction

This part of ISO 9241 deals with the ergonomic design of interactive systems and describes dialogue principles which are generally independent of any specific dialogue technique and which are applicable in the analysis, design and evaluation of interactive systems.

These dialogue principles concern the development of user interfaces and help prevent users of those products 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, and

— inefficient error recovery.

In this part of ISO 9241, a dialogue is the “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”, where user actions include not only entry of data but also navigational and other (control) actions of the user.

The priority with which each dialogue principle is weighted will depend on the characteristics of the intended user of the system, the tasks, the environment and the specific dialogue technique used. Guidance on identifying relevant aspects of the users' tasks and environment of use is given in ISO 9241-11. Specific guidance on the use of techniques such as menus, command languages, direct manipulation and form-based entry can be found in ISO 9241-14 to ISO 9241-17.

The ultimate beneficiary of ISO 9241 will be the user of an interactive system. It is the needs of this user that provide the ergonomic requirements used by the International Standards developers. Although it is unlikely that the user will read ISO 9241 or even know of its existence, its application will lead to user interfaces that are more usable, consistent and that enable greater productivity.

This part of ISO 9241 comprises the following:

a) the dialogue principles;

b) recommendations corresponding to the dialogue principles;

c) a framework for requirements concerning analysis, design and evaluation that gives guidance on

   — the specification of dialogue requirements, based on the dialogue principles, for the design of interactive systems that adhere to ISO 9241-110, and this part of ISO 9241,

   — the specification of appropriate design solutions based on the recommendations for the application of dialogue techniques according to ISO 9241-14 to ISO 9241-17;

   — the evaluation of interactive systems against the dialogue requirements.

Ergonomics of human-system interaction —

Part 110: Dialogue principles

1 Scope

This part of ISO 9241 sets forth ergonomic design principles formulated in general terms (i.e. presented without reference to situations of use, application, environment or technology) and provides a framework for applying those principles to the analysis, design and evaluation of interactive systems.

While this part of ISO 9241 is applicable to all types of interactive systems, it does not cover the specifics of every context of use (e.g. safety critical systems, collaborative work).

It is intended for the following types of users:

— designers of user interface development tools and style guides to be used by user interface designers;

— user interface designers, who will apply the guidance during the development process;

— developers, who will apply the guidance during design and implementation of system functionality;

— buyers, who will reference this part of ISO 9241 during product procurement;

— evaluators, who are responsible for ensuring that products meet its recommendations.

This part of ISO 9241 focuses on dialogue principles related to the ergonomic design of the dialogue between user and interactive system, and does not consider any other aspect of design such as marketing, aesthetics or corporate design.

The list of recommendations for each of the dialogue principles is not exhaustive.

2 Normative references

The following referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO 9241-11:1998, *Ergonomics — Ergonomic requirements for office work with visual display terminals (VDTs) — Part 11: Guidance on usability*

ISO 9241-12, *Ergonomics — Ergonomic requirements for office work with visual display terminals (VDTs) — Part 12: Presentation of information*

ISO 9241-13, *Ergonomics — Ergonomic requirements for office work with visual display terminals (VDTs) — Part 13: User guidance*

ISO 9241-14, *Ergonomics — Ergonomic requirements for office work with visual display terminals (VDTs) — Part 14: Menu dialogues*

ISO 9241-15, *Ergonomics — Ergonomic requirements for office work with visual display terminals (VDTs) — Part 15: Command dialogues*

ISO 9241-16, *Ergonomics — Ergonomic requirements for office work with visual display terminals (VDTs) — Part 16: Direct manipulation dialogues*

ISO 9241-17, *Ergonomics — Ergonomic requirements for office work with visual display terminals (VDTs) — Part 17: Form filling dialogues*

3 Terms and definitions

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

3.1
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, 3.5]

3.2
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.

3.3
dialogue principles
set of general goals for the design of dialogues

NOTE Dialogue principles are not bound to any specific technology or technique.

3.4
dialogue requirement
characteristic of a dialogue which satisfies user needs within the identified context(s) of use

3.5
goal
intended outcome

[ISO 9241-11:1998, 3.8]

3.6
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

[ISO 13407:1999, 2.1]

NOTE 1 The term “system” is often used rather than “interactive system”.

NOTE 2 The term “interactive system” is not to be confused with the term “work system” as used in ISO 9241-11.

3.7
task
activities required to achieve a goal

[ISO 9241-11:1998, 3.9]

NOTE The term “task” is used here, as in ISO 9241-11, in its widest sense, rather than in reference to the specifics of use of the dialogue system.

3.8
user
person who interacts with the interactive system

NOTE Adapted from ISO 9241-11:1998, 3.7.

3.9
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

4 Dialogue principles and recommendations

4.1 Overview

This clause presents the dialogue principles and gives recommendations illustrating the individual dialogue principles.

Seven principles have been identified as being important for the design and evaluation of interactive systems, which serve as a set of general goals for the design and evaluation of dialogues:

— suitability for the task;

— self-descriptiveness;

— conformity with user expectations;

— suitability for learning;

— controllability;

— error tolerance;

— suitability for individualization.

NOTE The order in which the principles are presented here does not imply any priority.

For each of the principles, this part of ISO 9241 provides a non-exhaustive list of illustrative recommendations at various levels of detail. Dialogues designed in accordance with these recommendations will help prevent users experiencing typical usability problems.

The set of dialogue principles presented in this part of ISO 9241 represents a particular way of identifying key impacts on usability for the design of interactive systems. This part of ISO 9241 does not preclude that there might be different ways of identifying those key aspects, thus leading to different sets of principles. The dialogue principles and the related recommendations within this part of ISO 9241-110 are not intended to be interpreted as a set of prescriptive guidelines that allow the direct specification of a design solution by themselves.

The recommendations given in 4.3 to 4.9 are each accompanied by an example placed in a specific context of use.

The recommendations given in this part of ISO 9241 will help in the identification and specification of dialogue requirements relevant to specific contexts of use. This part of ISO 9241 is not intended to be a detailed dialogue-requirements specification or design specification for interactive systems.

The recommendations are applied within the specific context of use which serves as the primary source of information that determines whether a recommendation applies or not. Not every recommendation within this part of ISO 9241 is applicable in every context of use. If the context of use does not imply user needs that correspond to one or more recommendations of this part of ISO 9241, then those recommendations do not apply within this particular context of use. The application of a single recommendation does not necessarily mean that the application of a principle has been fully satisfied.

A framework for the development of dialogue requirements that serve as the foundation for design of specific design solutions is presented in Clause 5.

4.2 Relationships between dialogue principles

The dialogue principles are not strictly independent and can semantically overlap. It may be necessary to achieve a "trade-off" between principles in order to optimize usability. The applicability and the priority given to each principle will vary with the specific field of application, user groups and the dialogue technique chosen. This implies taking into account the following aspects:

— goals of the organization;

— needs of the intended (end) user group;

— tasks to be supported;

— available technologies and resources.

The relevance and relative importance of each principle is determined by the particular context of use. Each of the principles needs to be considered in analysis, design and evaluation; however, principles might vary in their relative importance depending on the context of use and other design requirements. In practice, within design situations for an interactive system, compromises will be made.

EXAMPLE 1 Design for controllability is not independent from design for error tolerance or ease of learning.

EXAMPLE 2 A conflict between controllability and error tolerance can arise when using an e-mail client. Security functions of the e-mail client are less controllable when using automatic settings. If the user is allowed to control specific security functions (increasing controllability), error tolerance is decreased because it is difficult to prevent the user from making settings that have unintended consequences.

4.3 Suitability for the task

An interactive system is suitable for the task when it supports the user in the completion of the task, i.e. when the functionality and the dialogue are based on the task characteristics (rather than the technology chosen to perform the task).

4.3.1 The dialogue should present the user with information related to the successful completion of the task.

NOTE The needs of the task determine the required quality, quantity and type of information to be presented.

EXAMPLE 1 In a context where the processing of some of the incoming correspondence is time-critical, the dialogue system displays relevant deadlines related to each item.

EXAMPLE 2 In the context of an online shop, the dialogue system offers context-sensitive help that describes the steps needed to complete an order.

4.3.2 The dialogue should avoid presenting the user with information not needed for the successful completion of relevant tasks.

NOTE The presentation of inappropriate information could lead to decreased task performance and unnecessary mental workload.

EXAMPLE In a context where travellers want to book a hotel room for a specific date, the dialogue system displays only hotels with available rooms for this specific date. Information about other hotels in the area that are booked out, or additional information about travelling, such as sightseeing spots, is only displayed on request.

4.3.3 The format of input and output should be appropriate to the task.

EXAMPLE 1 A currency conversion application designed for travellers converting currencies displays converted amounts with a precision that is suitable for the target currency (e.g. two decimal digits for most European currencies).

EXAMPLE 2 A dialogue which is purely intended for a domestic market states this clearly to the user.

4.3.4 If typical input values are required for a task, these values should be available to the user automatically as defaults.

EXAMPLE 1 In a ticket machine at a railway station, where it has been determined that railway travellers typically buy railway tickets from the station they start their journey from, the station of departure is preselected at the start of the dialogue.

EXAMPLE 2 Within a business application, once the user has identified him or herself to the system based on user name and password, the system automatically makes the e-mail address of the user available for processing wherever required in the dialogue.

4.3.5 The steps required by the dialogue should be appropriate to the completion of the task, i.e. necessary steps should be included and unnecessary steps should be avoided.

NOTE 1 Unnecessary steps include actions that can be more appropriately done automatically by the system.

NOTE 2 The dialogue can offer additional support to the user when performing recurrent tasks/steps in order to minimize task steps.

EXAMPLE 1 A mobile phone for business users who often access messages on their answering machine (mail box), provides a dedicated option at the top level for this task in order to avoid unnecessary dialogue steps.

EXAMPLE 2 A software package for business contact management which contains input fields for both postcode (zip code) and city, automatically displays the city based on the input of the postal code and vice versa in order to avoid unnecessary dialogue steps.

EXAMPLE 3 A dialogue which is open for both domestic and international users does not demand data that are only relevant for the domestic market.

4.3.6 When a task involves source documents, the user interface should be compatible with the characteristics of the source document.

NOTE This recommendation is not intended to prohibit improvements of source documents to make them better suited for the task.

EXAMPLE Within an insurance company, a paper document is used as the source for computer input. The form-filling dialogue screen is designed to be consistent with the structure of the paper source document in terms of item ordering, grouping and units for input values.

4.3.7 The channels for inputs and outputs offered by the dialogue system should be appropriate to the task.

EXAMPLE In a computer aided design (CAD) application where the user's hands are used for positioning the pointer, simple actions can be activated by voice commands.

4.4 Self-descriptiveness

A dialogue is self-descriptive to the extent that, at any time, it is obvious to the users which dialogue they are in, where they are within the dialogue, which actions can be taken and how they can be performed.

NOTE This principle relates to the characteristics of presented information in ISO 9241-12.

4.4.1 The information presented to the user at any step of a dialogue should guide the user in completing the dialogue.

NOTE Information includes guidance, feedback, status information, etc.

EXAMPLE A hotel reservation system permits the user to enter the needed data and uses a [Next] button and a [Back] button to be guided through the steps of the dialogue.

4.4.2 During the interaction, the need to consult user manuals and other external information should be minimized.

EXAMPLE 1 An office phone with answering machine and call-forwarding facility offers clearly labelled buttons to initiate actions such as “recording a message” or “setting a forwarding number”.

EXAMPLE 2 A software package offers a set of menu items, the titles of which explicitly reflect the typical user tasks supported by the software package.

4.4.3 The user should be kept informed about changes in the status of the interactive system, such as

— when input is expected,

— by provision of an overview of upcoming steps in the dialogue.

EXAMPLE 1 An office phone with answering machine and call-forwarding facility clearly indicates whether or not the answering machine or “call forwarding” is active.

EXAMPLE 2 An e-commerce application explicitly displays to the user all required steps which need to be completed for purchasing a product. The dialogue always clearly indicates to the user which step he/she is currently in.

4.4.4 When input is requested, the interactive system should provide information to the user about the expected input.

EXAMPLE Within an e-commerce application, an entry field for the expiration date of a credit card displays the expected format as ““dd/mm/yyyy””.

4.4.5 Dialogues should be designed so that the interaction with the interactive system is apparent to the user.

EXAMPLE A software package for playing DVDs on a computer provides controls with icons picturing the established buttons for “play”, “stop”, “pause”, “fast forward”, etc.

4.4.6 The interactive system should provide the user with information on required formats and units.

EXAMPLE A stationary purchase system displays the unit of goods (1 000 sheets of paper possibly representing one unit) that can be ordered to clearly indicate the total amount to be ordered.

4.5 Conformity with user expectations

A dialogue conforms with user expectations if it corresponds to predictable contextual needs of the user and to commonly accepted conventions.

NOTE 1 Conforming to existing conventions is only one aspect of conformity with user expectations.

NOTE 2 Consistency generally increases the predictability of the dialogue.

4.5.1 The interactive system should use the vocabulary which is familiar to the user in the performance of the task, or one which is based on the users' existing knowledge.

NOTE This recommendation is not intended to prohibit improvements of established vocabulary to make it better suited for the task.

EXAMPLE 1 A banking business application adopts banking terminology such as "wire transfer" and "time and savings deposits".

EXAMPLE 2 For international users of an online credit card application, entry fields for specifying an individual's full name are labelled "Last name" and "First name" rather than "Name" and "Given name".

4.5.2 Immediate and suitable feedback on user actions should be given, where appropriate to user expectations.

EXAMPLE When installing a software package, the user gets a feedback upon successful completion of the installation procedure.

4.5.3 If a response time can be expected to deviate considerably from the response time expected by the user, the user should be informed of this.

EXAMPLE When a user searches for available flights on the website of a travel agency and presses the search button, the website indicates that the search is in progress but due to the large number of customers currently online, it may take up to 60 s to display the search results.

4.5.4 Dialogues should reflect data structures and forms of organization which are perceived by users as being natural.

EXAMPLE The online shop of a department store organises the goods (grouping and location) in a similar way to the physical layout of the goods in the store.

4.5.5 Formats should follow appropriate cultural and linguistic conventions.

EXAMPLE A software package uses left-ordering for the English and right-ordering for the Arab languages.

4.5.6 The type and length of feedback or explanations should be based on user needs.

EXAMPLE 1 Type of feedback or explanation: within the context of a presenter who needs to turn off the video projector and therefore does not look at the displayed screen, the video projector offers a label below the On/Off button "Press twice to turn off" rather than a message on the displayed screen.

EXAMPLE 2 Length of feedback or explanation: help information in a software package that supports a complex task is comprehensive and describes how the task is being completed with the software package; while help information on a required format simply shows the required format.

4.5.7 Dialogue behaviour and appearance within an interactive system should be consistent within tasks and across similar tasks.

NOTE 1 Consistency across similar tasks enables the user to develop common procedures for performing tasks.

NOTE 2 Consistency across tasks could have to be traded with task requirements and other requirements derived from the context of use.

EXAMPLE 1 Within a software package, the push buttons "OK" and "Cancel" are always located at the same position.

EXAMPLE 2 Within a software package that supports compressing and decompressing files, the dialogue steps for both tasks are designed similarly.

4.5.8 If a specific location of input is predictable on the basis of user expectations, then this location should be ready for input when input is requested by the dialogue

EXAMPLE Within the installation procedure for a software package, each dialogue step that requires user action can be completed by pressing the "Enter" key on the keyboard.

4.5.9 Feedback or messages presented to the user should be formulated and presented in an objective and constructive style.

NOTE Exceptions could apply in certain application domains, such as entertainment, where subjective and/or emotional styles are used.

EXAMPLE If a date has been entered in an incorrect format, an error message reading “Please enter date in the format “dd/mm/yyyy”” is displayed.

4.6 Suitability for learning

A dialogue is suitable for learning when it supports and guides the user in learning to use the system.

4.6.1 Rules and underlying concepts which are useful for learning should be made available to the user.

NOTE This allows the user to build up his/her own patterns and strategies for memorizing activities.

EXAMPLE A software package for compressing files explains the concept of an archive to the user (e.g. as part of an initial tutorial).

4.6.2 If infrequent use or user characteristics require relearning of the dialogue, then appropriate support should be provided.

EXAMPLE A software package for bookkeeping provides a help system that guides the user through the required dialogue steps of creating the annual balance sheet.

4.6.3 Appropriate support should be provided to assist the user in becoming familiar with the dialogue.

NOTE Different users can have different support needs.

EXAMPLE A software package explains the use of individual menu items when the user presses the assigned help key.

4.6.4 Feedback or explanations should assist the user in building a conceptual understanding of the interactive system.

NOTE The needs for feedback in the phase of learning how to use an interactive system can differ from the needs for feedback by experienced users. It is best, however, to design dialogs so that they will suit both beginners and expert users. This is because a system cannot reliably assess the expertise of the user, and a person's expertise may not be uniform across a system.

EXAMPLE A scanning software package shows all the various steps (including their order and interrelationships) required for scanning paper documents and converting them into electronic text files and the current step reached by the user.

4.6.5 The dialogue should provide sufficient feedback about the intermediary and final results of an activity so that the user learns from successfully accomplished activities.

EXAMPLE When a user reserves a room using a hotel room reservation system, the user receives step-by-step feedback to refine his/her queries and details about the successful reservation of the room.

4.6.6 If appropriate to the tasks and learning goals, the interactive system should allow the user to explore (“try out”) dialogue steps without negative consequences.

NOTE This may not be appropriate for safety critical systems.

EXAMPLE 1 A scheduling system for scheduling deliveries of goods in a large warehouse allows a user to evaluate potential variations of the schedule in order to allow the user foresee negative impacts before changes are applied.

EXAMPLE 2 In a photo processing package, a sequence of changes to an image can be reversed by successively using an “Undo”.

4.6.7 The interactive system should enable the user to perform the tasks with minimal learning by entering only the minimum amount of information required in the dialogue, with the system supplying additional information on request.

EXAMPLE A software package for scanning documents provides a button “Scan” that allows a user to scan a document without any necessary user configuration, utilizing sensible default settings for all configuration options.

4.7 Controllability

A dialogue is controllable when the user is able to initiate and control the direction and pace of the interaction until the point at which the goal has been met.

4.7.1 The pace of user interaction should not be dictated by the operation of the interactive system. It should be under the control of the user according to the user's needs and characteristics.

NOTE 1 Certain interactive systems could contain explicit requirements that do not permit user control under certain circumstances, e.g. in testing situations where time constraints are part of the test.

NOTE 2 In certain contexts of use, the task itself may dictate the minimum and maximum limits for the pace of interaction.

NOTE 3 The pace of user interaction can be restricted by company policy, e.g. “log off after 2 h of inactivity”.

EXAMPLE A mobile phone which allows a user to send text messages keeps partially completed messages visible and editable until the user decides to send or store or delete the message, independent of the time taken by the user to complete the message.

4.7.2 The user should have control over how to continue with the dialogue.

EXAMPLE 1 A business phone that displays the telephone number of an incoming call provides the possibility to directly add this number to its telephone directory, together with the caller’s name.

EXAMPLE 2 When registering an incoming payment in an accounting application, the system automatically selects the oldest unpaid invoice of that customer for settlement by this payment, but also permits the user to select other invoices of that customer for settlement by this payment.

4.7.3 If the dialogue has been interrupted, the user should have the ability to determine the point of restart — the point at which the dialogue is resumed — if the task permits.

EXAMPLE An enterprise resource planning application (ERP system) allows the user to store partially entered orders in order to proceed with another order that needs to be completed with priority, and later on continue to complete the partially entered order.

4.7.4 If task operations are reversible and the context of use allows, it should be possible to undo at least the last dialogue step.

EXAMPLE Within a text editor, a dedicated option is offered to undo the last editorial step.

4.7.5 If the volume of data relevant to a task is large, then the user should be able to control the data presented.

EXAMPLE A business calendar application allows a user to view entries by day, week, month or user-specified criteria such as “all appointments with a specific customer”.

4.7.6 The user should be enabled to use any available input/output devices, where appropriate.

EXAMPLE Within a search form, the search button can be activated by using the mouse or by pressing the “Enter” key on the keyboard.

4.7.7 If appropriate to the task, users should be able to change default values.

EXAMPLE In an e-mail application, the default location for storing attachments can be modified according to user needs.

4.7.8 When data have been modified, the original data should remain available to the user if required for the task.

EXAMPLE In a customer relationship management (CRM) application, where existing customer data are modified and official records are needed, original customer data (i.e. prior to modification) remain accessible to the user after modification.

4.8 Error tolerance

A dialogue is error-tolerant if, despite evident errors in input, the intended result may be achieved with either no, or minimal, corrective action by the user. Error tolerance is achieved by means of

— error control (damage control),

— error correction, or

— error management, to cope with the errors that occur.

4.8.1 The interactive system should assist the user in detecting and avoiding errors in input.

EXAMPLE An e-commerce application points the user to required fields that have not been filled in by the user.

4.8.2 The interactive system should prevent any user action from causing undefined interactive system states or interactive system failures.

EXAMPLE A printing dialogue for a document of 35 pages allows the user to type in only page numbers in the range 1 to 35.

4.8.3 When an error occurs, an explanation should be provided to the user to facilitate the correction of the error.

EXAMPLE A DVD player provides the user with a message “You have pressed the “Play” button, but there is no DVD to play. Please insert a DVD if you wish to play one”.

4.8.4 Active support for error recovery should be provided where errors typically occur.

EXAMPLE The cursor is positioned at the location where correction is required.

4.8.5 In cases where the interactive system is able to correct errors automatically, it should advise the user of the execution of the corrections and provide the opportunity to override the corrections.

EXAMPLE In a spell-check facility, words with errors are marked. The spell-check facility offers selection of one or more corrected versions of the misspelled word, while giving the user the opportunity to type in another corrected version of the word.

4.8.6 The user should be enabled to defer the correction of an error or allow the error to remain uncorrected, unless the correction is required in order for the dialogue to be able to proceed.

EXAMPLE In a data base application where postal (zip) codes are validated during entry, the user is permitted to continue editing other entry fields even if the postcode entry field contains an invalid postal code.

4.8.7 When possible, additional information about the error and its correction should be provided to the user upon request.

EXAMPLE Error messages within a software package offer a concise statement about the error and how the user can correct it. In addition to this statement, a hyperlink gives access to more comprehensive background information on the error situation.

4.8.8 Validation/verification of data should take place before the interactive system processes the input.

EXAMPLE 1 An e-mail client verifies the correct syntax of an e-mail address before storing it in its address book.

EXAMPLE 2 In a context where users tend to forget to attach files that they originally wanted to attach, an e-mail client checks the message for the words “attach”, “attached” and “attachment” and offers a message “Do you want to attach a file to your message?” before sending the message.

4.8.9 The steps required for error correction should be minimized.

EXAMPLE Within a form-filling application, after an error has been identified, the cursor is automatically positioned in the entry field of the erroneous input and the field content can be directly modified.

4.8.10 If severe consequences could result from a user action, the system should provide explanation and request confirmation before carrying out the action.

EXAMPLE When deleting files within an application, the user is required to confirm each deletion.

4.9 Suitability for individualization

A dialogue is capable of individualization when users can modify interaction and presentation of information to suit their individual capabilities and needs.

NOTE 1 Although providing users with individualization capabilities is often desirable, it is not an acceptable substitute for ergonomically designed dialogues. In addition, individualization capability should only be provided within certain limits, such that modifications cannot cause users predictable discomfort or harm (e.g. unacceptable noise levels with user-configured auditory feedback).

NOTE 2 Suitability for individualization can offer a means to increase accessibility by accommodating a wider range of users.

4.9.1 Mechanisms should be provided to allow the characteristics of the user of the interactive system to be modified to take account of the diversity of user characteristics, where such needs typically occur.

NOTE Sources of diversity include the user's language and culture, individual knowledge and experience of task domain, perceptual, sensory-motor and cognitive abilities.

EXAMPLE For a text-based application, icons and graphics can be used for an audience with limited reading skills.

4.9.2 The interactive system should allow the user to choose from alternative forms of representation, where appropriate to the individual needs of different users.

EXAMPLE 1 A visually impaired user has the possibility to navigate through screens using a “screen reader” software that converts the information on the screen into acoustic output.

EXAMPLE 2 An order-entry system is used by a number of employees. When the previous user has changed a familiar setting via individualization, the next user finds the system behaving in unexpected ways and is able to restore the default.

4.9.3 The amount of explanation (e.g. details in error messages, help information) should be able to be modified according to the individual level of knowledge of the user.

EXAMPLE A business application allows turning off system-initiated help for advanced users.

4.9.4 Users should be enabled to incorporate their own vocabulary to establish individual naming for objects and actions, if appropriate.

EXAMPLE In a business application, users are enabled to rename menu options to reflect the terminology which is typical in their sector of industry.

4.9.5 The user should be enabled to set up the speed of dynamic inputs and outputs to match his/her individual needs, where appropriate.

EXAMPLE The sensitivity of a pointing device can be adjusted to individual user needs.

4.9.6 Users should be enabled to choose between different dialogue techniques, where appropriate.

EXAMPLE A ticket machine in a railway station permits the user to enter station names either directly or by selecting them from a list.

4.9.7 The user should be enabled to select the levels and methods of interaction that best meet his/her needs.

EXAMPLE A word processor offers the user the function of saving a document via a menu option, an icon or a keyboard short cut.

4.9.8 The user should be enabled to select the way that input/output data are represented (format and type).

EXAMPLE 1 A word processor that allows background colour choice and lettering colour choice, and a user selects a pair of colours that, while they might be pleasing to that user, makes reading slower and the reading error rate higher. It could be wiser not to allow such choices.

EXAMPLE 2 A business application allows users to adjust character sizes according to their needs.

4.9.9 If appropriate, it should be possible for the users to add or rearrange dialogue elements or functionality specifically supporting their individual needs when carrying out tasks.

EXAMPLE A word processing software allows adding a tool to its tool bar for “striking through” letters in a similar way to the tools “bold”, “italic” and “underlined”.

4.9.10 Individualization of a dialogue should be reversible and allow a user to return to the original settings.

EXAMPLE An operating system allows the user to reset user-initiated changes of colours to the original colour scheme which was supplied with the operating system at its initial installation.

5 Framework for using the dialogue principles and recommendations

5.1 General

When specifying, developing or evaluating interactive systems, the dialogue principles of this part of ISO 9241 and its corresponding recommendations serve as general guidelines for

— assisting in the specification of dialogue requirements based on the context of use,

— guidance for identifying and specifying dialogue requirements based on the dialogue techniques described in ISO 9241-14 to ISO 9241-17,

— assisting in the design of solutions that adhere to ISO 9241-12 to ISO 9241-17, and

— assisting in the evaluation of actual design solutions with regards to the dialogue requirements.

In order to specify a dialogue requirement for a specific application, a recommendation can be expressed in terms of a required user performance, based on the implied needs in the flow of the user's task, or in terms of the specific attributes of the product's context of use. There are various ways for identifying and describing the context of use (e.g. as described in ISO 9241-11). This part of ISO 9241 does not aim at giving specific guidance for context of use analysis.

Specifying dialogue requirements requires thorough analysis of context of use data in order to identify the sources for dialogue requirements. Therefore, it is essential to specify the context of use as comprehensively as possible from the user’s perspective in order to provide a broad basis for the specification of dialogue requirements.

For examples on the relationship between context of use and dialogue requirements, see ISO 9241-11:1998, Annex D.

Figure 1 shows the framework in which the dialogue principles and the corresponding recommendations assist analysis, design and evaluation of interactive systems. The arrows in Figure 1 illustrate dependencies between the components relevant for the specification of dialogue requirements as well as design solutions.

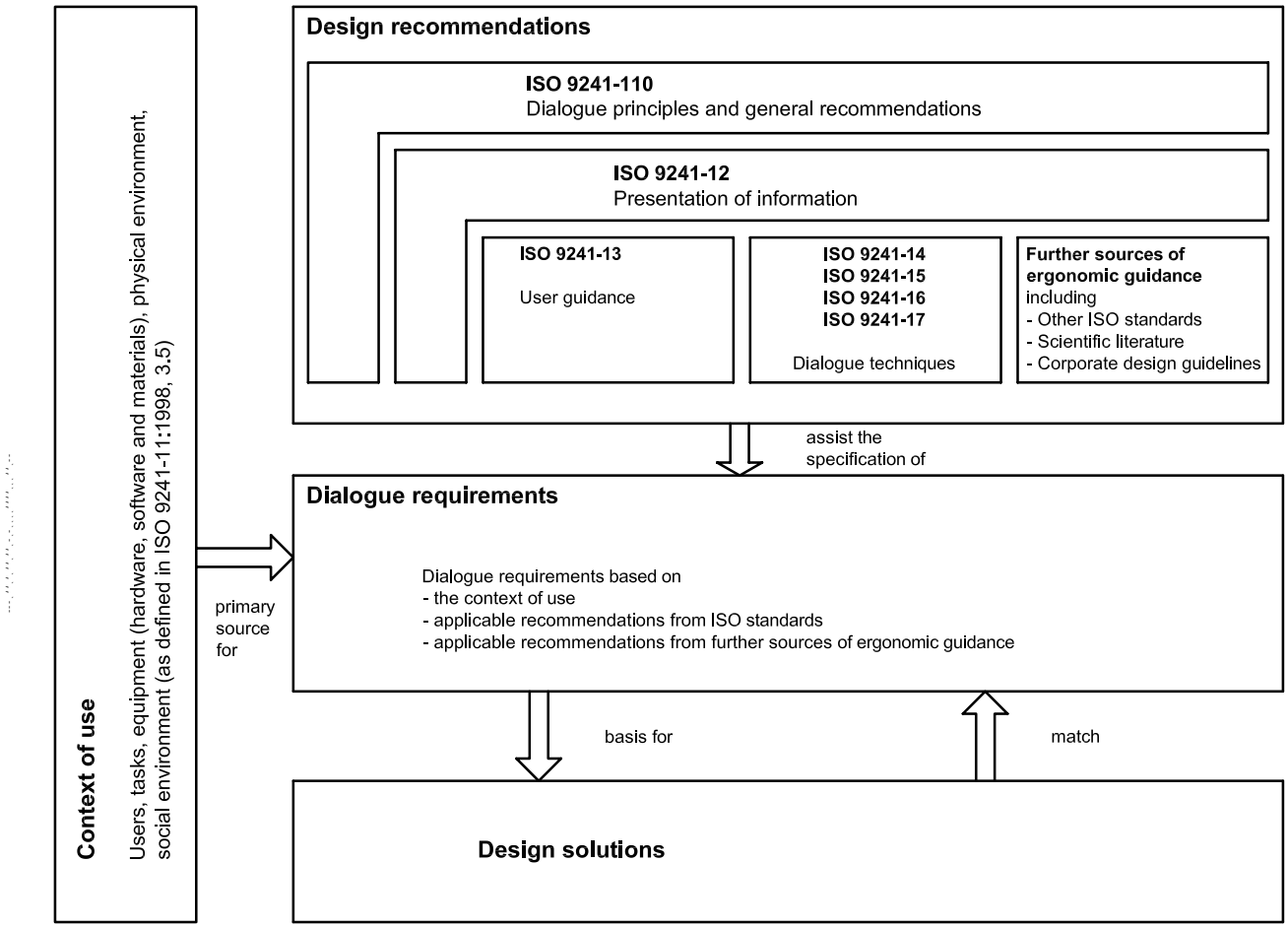

Figure 1 — Framework for the application of this part of ISO 9241

This part of ISO 9241 provides a framework for the specification of dialogue requirements, but does not specify dialogue requirements themselves. Dialogue requirements depend on the specific context of use for which an interactive system is to be designed and/or used, and need to be developed for that specific context of use.

The context of use is the primary source for dialogue requirements. The dialogue principles of this part of ISO 9241 are aimed at assisting in the specification of dialogue requirements based on the context of use. Context of use information and the dialogue requirements themselves are not within its scope.

User interface design relies on a clear understanding of the context of use as well as on the dialogue requirements contained within the context of use. Therefore, in ISO 9241-12 to ISO 9241-17, many recommendations are stated as “conditional recommendations”.

“Conditional” means that either an explicit “if” is a condition of the recommendation, or that the context of use description needs to be taken into account in order to specify a dialogue requirement.

5.2 Example for use of this part of ISO 9241 in the analysis of interactive systems

This subclause illustrates an example for using the framework to identify dialogue requirements which are based on the dialogue principles. Dialogue requirements can be formulated as translations of recommendations into specific dialogue requirements which fit with the user needs in the context of use. In dialogue requirements analysis, the context of use is identified and specified in terms of users, their tasks and the social and organizational environment in which the tasks are accomplished. Context of use data are analysed in order to identify dialogue requirements.

The example given here shows how the dialogue principle “suitability for the task” can assist the specification of a dialogue requirement based on the description of a context of use and a recommendation within this part of ISO 9241.

It is assumed that a context-of-use analysis has been carried out in relation to the design of a ticket machine within a railway station. As part of the context of use analysis (conducted in Europe), it has been identified that railway travellers typically buy railway tickets for long-distance journeys at the railway station from which they start their journey. The example given here only represents a “fragment” of a complete context of use description. It is essential in context of use analysis to identify and specify the complete context of use in terms of users, tasks, equipment and environment.

Context of use (extract):

Railway travellers typically buy railway tickets at the railway station from which they start their journey.

Corresponding recommendation within this part of ISO 9241:

“If typical input values are required for a task, these values should be available to the user automatically as defaults.”

See 4.3.4.

Dialogue requirement as derived from both the context of use and the appropriate recommendation within this part of ISO 9241:

The station of departure should be preselected at the start of the dialogue.

5.3 Example for use of this part of ISO 9241 in design of interactive systems (Relationship with ISO 9241-13 to ISO 9241-17)

This subclause illustrates how the identified dialogue requirement can be further progressed towards design by consulting other parts of ISO 9241. Each dialogue requirement is analysed in relation to the suitable dialogue technique(s) as a basis for creating a design solution. Once the appropriate dialogue technique has been identified, the appropriate recommendations for this dialogue technique are consulted.

The applicable recommendation(s) provide(s) guidance to the designer in relation to solutions. The example below shows the application of this part of ISO 9241 to user interface design. The application of this part of ISO 9241 produces dialogue requirements which can be turned into suitable design solutions by referring to the recommendations given in ISO 9241-13 to ISO 9241-17.

The example shows how this part of ISO 9241, together with ISO 9241-17, can assist in the specification of a design solution which in turn adheres to the dialogue requirements derived by consulting both these parts of ISO 9241. The design solution proposed is not necessarily the one according to these parts of ISO 9241. An alternative design solution might be depicted, which uses a different approach but still meets the requirement, thus maintaining the required level of usability.

Dialogue requirement as derived from both the context of use and the appropriate recommendation within ISO 9241-110:

“The station of departure should be preselected at the start of the dialogue” (see 5.2).

Selected dialogue technique:

Form-filling dialogues (ISO 9241-17)

Corresponding recommendation within ISO 9241-17:1998, 6.1.3 a):

“Fields should contain default values wherever possible and appropriate to the task.”

See ISO 9241-17:1998, 6.1.3 a).

Dialogue requirement specified in correspondence with ISO 9241-17:1998, 6.1.3 a):

If a form is used to allow the user to enter the departure station, then the default value should be set to the physical station of departure.

Design solution:

The ticket machine offers a form that by default offers the station of departure at the beginning of the purchasing process.

The reader of this part of ISO 9241 may well have recognize that the step from reading the recommendations to creating design solutions requires design experience. The main intention of ISO 9241 is to lay down the minimum quality stated in a requirement. The intention is not to provide a textbook on design.

It could be the case that there is no applicable guidance on the use of the dialogue techniques given in ISO 9241. In such situations, other forms of guidance relevant to the particular context of use should be consulted, or it could be necessary to use the context of use and the dialogue principles to establish context specific dialogue requirements.

5.4 Example for use of this part of ISO 9241 in evaluation of interactive systems

This subclause illustrates the application of this part of ISO 9241 to the evaluation of usability problems.

In the following example, it is assumed that a usability problem has been identified within a usability test of a ticket machine in a particular railway station.

All test users have stated that it takes too much effort to select departure station and destination.

Therefore, the attributes of the ticket machine for selecting the station of departure are inspected and compared with the dialogue requirement that has been specified based on both context of use and this part of ISO 9241.

Attribute of the interactive system that has been found to cause a usability problem:

The tested ticket machine offers two lists to the user: one with selectable departure stations; the other with selectable destinations. In both lists, the same default entry is displayed. The default entry is the first city in the alphabet.

Dialogue requirement derived from both the context of use and the appropriate recommendation within this part of ISO 9241:

“The station of departure should be preselected at the start of the dialogue.”

cf. 5.2.

Comparing the attribute of the ticket machine with the dialogue requirement shows that the dialogue requirement has not been met. Therefore, the ticket machine does not adhere to the dialogue requirement which has been identified based on both the context of use and the appropriate recommendation associated to the dialogue principle “suitability for the task” according to this part of ISO 9241.

6 Relationship between this part of ISO 9241 and ISO 9241-11 and ISO 9241-12

Figure 2 illustrates the relationship between this part of ISO 9241, ISO 9241-11 and ISO 9241-12. ISO 9241-12 provides characteristics of presented information and gives guidance on how to present information as part of the dialogue (information design). This information is contained in dialogues which are based on the principles provided in this part of ISO 9241, which primarily supports the design of the dynamic behaviour of an interactive system (interaction design). The characteristics of presented information of

ISO 9241-12 especially support self-descriptiveness and conformity with user expectations. Applying the principles of this part of ISO 9241 and of ISO 9241-12 supports usability in terms of effectiveness, efficiency and satisfaction in accordance with ISO 9241-11.

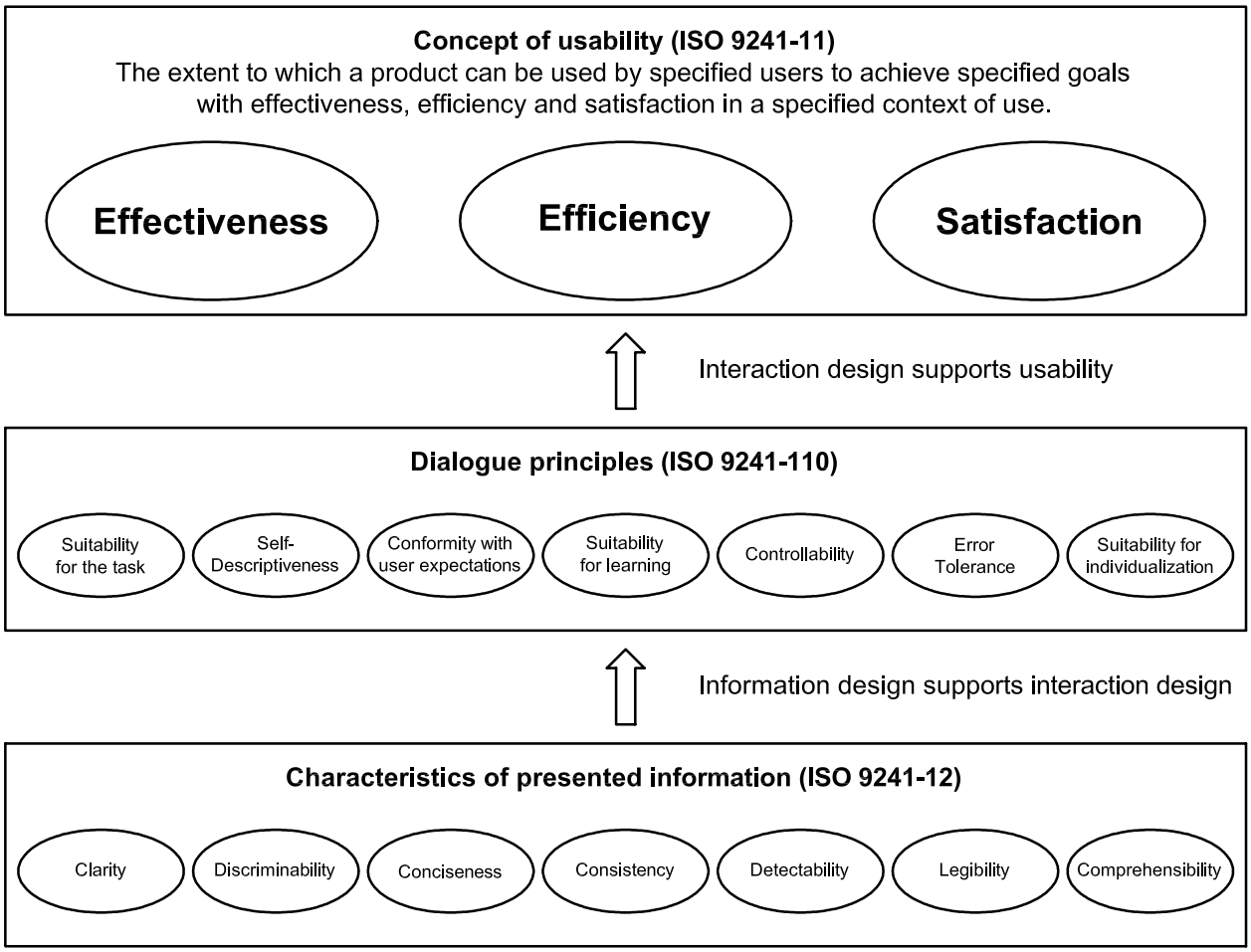

Figure 2 — Relationship between this part of ISO 9241 and ISO 9241-11 and ISO 9241-12

Annex A
(informative)

Overview of the ISO 9241 series

The annex presents an overview of ISO 9241: its structure, subject areas and the current status of both published and projected parts, at the time of publication of this part of ISO 9241.

Part no.	Subject/title	Current status
1	General introduction	International Standard (intended to be replaced by ISO/TR 9241-1 and ISO 9241-130)
2	Guidance on task requirements	International Standard
3	Visual display requirements	International Standard (intended to be replaced by the ISO 9241-300 subseries)
4	Keyboard requirements	International Standard (intended to be replaced by ISO 9241-400 subseries)
5	Workstation layout and postural requirements	International Standard (intended to be replaced by ISO 9241-500)
6	Guidance on the work environment	International Standard (intended to be replaced by ISO 9241-600)
7	Requirements for display with reflections	International Standard (intended to be replaced by the ISO 9241-300 subseries)
8	Requirements for displayed colours	International Standard (intended to be replaced by the ISO 9241-300 subseries)
9	Requirements for non-keyboard input devices	International Standard (intended to be replaced by the ISO 9241-400 subseries)
10	Dialogue principles	International Standard (intended to be replaced by ISO 9241-110)
11	Guidance on usability	International Standard
12	Presentation of information	International Standard (intended to be replaced by ISO 9241-111 and ISO 9241:141)
13	User guidance	International Standard (intended to be replaced by ISO 9241-121)
14	Menu dialogues	International Standard (intended to be replaced by ISO 9241-131)
15	Command dialogues	International Standard (intended to be replaced by ISO 9241-132)
16	Direct-manipulation dialogues	International Standard (intended to be replaced by ISO 9241-133)
17	Form filling dialogues	International Standard (intended to be replaced by ISO 9241-134)

Part no.	Subject/title	Current status
20	Accessibility guidelines for information communication equipment and services	Under preparation
Software Ergonomics		
100	Introduction to software ergonomics	Planned as ISO/TR 9241-100
Guiding principles		
110	Dialogue principles	To be published
111	Presentation principles	Planned to partially revise and replace ISO 9241-12
112	Multimedia principles	Planned to revise and replace ISO 14915-1
113	GUI and controls principles	Planned
User support (independent of dialogue techniques)		
121	User guidance	Planned to revise and replace ISO 9241-13:2003
122	Dialogue navigation	Planned to partially revise and replace ISO 14915-2, together with ISO 9241-142
Dialogue techniques (independent of technical implementation)		
130	Selection and combination of dialogue techniques	Planned to incorporate and replace ISO 9241-1:1997/Amd 1:2001
131	Menu dialogues	Planned
132	Command dialogues	Planned
133	Direct manipulation dialogues	Planned
134	Form filling dialogues	Planned
135	Natural language dialogues	Planned
(Technology-dependent) interface components and technologies		
141	Window interfaces	Planned
142	Controls	Planned to partially revise and replace ISO 14915-2, together with ISO 9241-122
143	Media selection & combination	Planned to revise and replace ISO 14915-3
Application-area specific		
151	Guidance on World Wide Web software user interfaces	Under preparation
152	Virtual reality	Planned

Part no.	Subject/title	Current status
Accessibility		
171	Guidance on software accessibility	Under preparation
Human centred design		
200	Introduction to human-system interaction processes	Planned
201	Business case for human centred design	Planned
202	Terminology for human-centred design	Planned
210	Guidance on Human centred design	Planned
211	Guidance for HCD project managers	Planned to revise and replace ISO 13407
Process		
221	Specification for the process assessment of human-system issues	Planned to revise and replace ISO/PAS 18152
222	Human-centred lifecycle process descriptions	Planned to revise and replace ISO/TR 18529
Methods		
231	Usability methods supporting human-centred design	Planned to revise and replace ISO/TR 16982
Evaluation		
241	Templates for evaluation	Planned
Ergonomic requirements and measurement techniques for electronic visual displays		
300	Introduction to electronic visual display requirements	Under preparation
302	Terminology for electronic visual displays	Under preparation
303	Requirements for electronic visual displays	Under preparation
304	User performance test methods for electronic visual displays	Under preparation
305	Optical laboratory test methods for electronic visual displays	Under preparation
306	Field assessment methods for electronic visual displays	Under preparation
307	Analysis and compliance test methods for electronic visual displays	Under preparation
Physical input devices		
400	Principles and requirements for physical input devices	To be published
410	Design criteria for physical input devices	Under preparation
411	Laboratory test and evaluation methods for the design of physical input devices	Planned
420	Selection procedures for physical input devices	Under preparation
421	Workplace test and evaluation methods for the use of physical input devices	Planned

Part no.	Subject/title	Current status
Workstation		
500	Workstation layout and postural requirements	Planned to revise and replace ISO 9241-5
Work environment		
600	Guidance on the work environment	Planned to revise and replace ISO 9241-6
Control centres		
710	Introduction to ergonomic design of control centres	Planned
711	Principles for the design of control centres	Planned to revise and replace ISO 11064-1
712	Principles for the arrangement of control suites	Planned to revise and replace ISO 11064-2
713	Control room layout	Planned to revise and replace ISO 11064-3
714	Layout and dimensions of workstations	Planned to revise and replace ISO 11064-4
715	Control centre displays and controls	Planned to revise and replace ISO 11064-5
716	Control room environmental requirements	Planned to revise and replace ISO 11064-6
717	Principles for the evaluation of control centres	Planned to revise and replace ISO 11064-7
Tactile and haptic interactions		
900	Introduction to tactile and haptic interactions	Planned
910	Framework for tactile and haptic interactions	Planned
920	Guidance on tactile and haptic interactions	Under preparation
930	Haptic and tactile interactions in multimodal environments	Planned
940	Evaluation of tactile and haptic Interactions	Planned
971	Haptic and tactile interfaces to publicly available devices	Planned

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[6] ISO 9241-5, *Ergonomic requirements for office work with visual display terminals (VDTs) — Part 5: Workstation layout and postural requirements*

[7] ISO 9241-6, *Ergonomic requirements for office work with visual display terminals (VDTs) — Part 6: Guidance on the work environment*

[8] ISO 9241-7, *Ergonomic requirements for office work with visual display terminals (VDTs) — Part 7: Requirements for display with reflections*

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