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Ergonomic requirements for office work with visual display terminals (VDTs) —

Part 14:
Menu dialogues

Exigences ergonomiques pour travail de bureau avec terminaux à écrans de visualisation (TEV) —

Partie 14: Dialogues de type menu

Reference number
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Contents

Page

International Organization for Standardization
Case postale 56 • CH-1211 Genève 20 • Switzerland
Internet central@iso.ch
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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.

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

International Standard ISO 9241-14 was prepared by the Technical Committee ISO/TC159, *Ergonomics*, Subcommittee SC4, *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

Part 2: Guidance on task requirements

Part 3: Visual display requirements

Part 4: Keyboard requirements

Part 5: Workstation layout and postural requirements

Part 6: Environmental requirements

Part 7: Requirements for display with reflection

Part 8: Requirements for displayed colours

Part 9: Requirements for nonkeyboard input devices

Part 10: Dialogue principles

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

Annexes A to C of this part of ISO 9241 are for information only.

Introduction

International Standard ISO 9241 deals with several aspects of the use of VDTs. Currently, the individual parts can be grouped in the following categories:

ISO 9241-1: Introduction

ISO 9241-2: Guidance on task requirements

ISO 9241-5 and -6: Workstation and environment

ISO 9241-3,-4,- 7,- 8 and -9: Ergonomics pertaining to hardware

ISO 9241-10 through -17: Ergonomics pertaining to software interfaces

ISO 9241-14 is concerned with the ergonomic design of menu dialogues. In menu dialogues, the dialogue system presents one or more groups of options to the user, the user chooses one or more options, and the computer executes the desired process denoted by the option(s).

ISO 9241-14 serves the following types of user:

- the user interface designer, who will apply ISO 9241-14 during the development process;
- the buyer, who will reference ISO 9241-14 during the product procurement process;
- evaluators responsible for ensuring products meet the recommendations in ISO 9241-14,
- designers of user interface development tools to be used by interface designers;
- end users who will gain from the potential benefits provided by the standard.

ISO 9241-14 consists of a number of recommendations, some of which are conditional, concerning menus. Conditional recommendations are recommendations that should be met only within the specific context for which they are relevant (e.g., particular kinds of users, tasks, environments, technology). These recommendations were developed primarily by reviewing the existing relevant literature and empirical evidence, then generalizing and formulating this work into recommendations. The source of the evidence for the individual recommendations can be found in annex C.

Differences in the relative importance of the task, user, environment, and technology in the design process are inevitable and have led to the "if - then" structure of many of the conditional recommendations. For example, "If rapid search time is important, then place as many options and levels as possible on a single menu panel." This method provides practical, usable and unambiguous guidance during user interface design.

Designers and evaluators using ISO 9241-14 need to know that they are developing an interface that will meet the recommendations provided in this part. Likewise, the buyer needs a means to determine how a product matches the recommendations in ISO 9241-14. The elements can be tailored due to the "if - then" structure in ISO 9241-14. Additionally, it is not the intent of ISO 9241-14 that every recommendation should be applied, only those that are relevant.

The application of ISO 9241-14 is expected to improve the overall quality of the menus, but this standard (like any other standard) will not guarantee the quality of the interface. Quality depends on

specific usability criteria as set by the user, buyer or other menu dialogue consumer which may include specifications based on this standard.

It should be noted that ISO 9241-10 describes dialogue principles that are relevant for the design of menu dialogues. These principles should provide the designer and evaluator with additional information concerning the ergonomic rationale for the various recommendations in ISO 9241-14 and, therefore, assist in making tradeoffs. However, it may be necessary to base tradeoffs on other considerations as well.

Ergonomic requirements for office work with visual display terminals (VDTs) —

Part 14:
Menu dialogues

1 Scope

This part of ISO 9241 provides conditional recommendations for menus used in user-computer dialogues to accomplish typical office tasks. The recommendations cover menus presented by various techniques including windowing, panels, buttons, fields, etc. These recommendations can be utilized throughout the design process (e.g., as guidance for designers during design, as a basis for heuristic evaluation, as guidance for usability testing).

Interface design depends upon the task, the user, the environment, and the available technology. Consequently, ISO 9241-14 cannot be applied without a knowledge of the design and use context of the interface and it is not intended to be used as a prescriptive set of rules to be applied in their entirety. Rather, it assumes that the designer has proper information available concerning task and user requirements and understands the use of available technology (this may require consultation with a qualified ergonomics professional as well as empirical testing with real users).

Although this is an International Standard, some of the conditional recommendations are based on Latin-based language usage and may not apply, or may need to be modified, for use with a different language. For example, in right-to-left languages those conditional recommendations oriented towards left-to-right reading may need to be modified and adapted. In applying those conditional recommendations that assume a specific language base (e.g., alphabetic ordering of menu options, compound titles), care should be taken concerning the intent of the standard when translation is required to a different language.

The recommendations relate to the three major design components of user interfaces, i.e., dialogue, input, and output.

Dialogue design determines the way in which a user is guided by the system to make inputs and influences the amount of control the user has over the dialogue. The dialogue should be designed to support the user in his/her actual work without the user being bothered by additional work caused by system peculiarities. Menu dialogue design is covered in this part of ISO 9241 in terms of designing the menu structure, providing facilities for menu navigation and defining the selection methods for menu options.

Input design is concerned with how users input information into the system using various input devices. Menu options can be selected by means of one or more input devices such as an alphanumeric keyboard, function keys, cursor keys, pointing devices and voice (other devices are not excluded) depending on the task at hand and dialogue requirements, as well as on individual preferences. ISO 9241-14 provides conditional recommendations for the use of each of the input devices listed above.

Output design is concerned with how data should be presented consistently and perceptibly distinct on the display. ISO 9241-14 provides conditional recommendations for the placement of options and

option groups, the structure and syntax for textual, graphic and auditory options and presentation techniques to indicate option accessibility and discrimination.

Providing users with the capability to alter the interface to suit their own needs has become a popular approach to software interface design. This is often a desirable feature of the interface. However, providing users with customization capabilities is not an acceptable substitute for ergonomically designed initial menus (i.e., default menus). It should be noted that customization of the menus may result in deviations from ISO 9241-14. Therefore, customization options also should be evaluated with respect to the recommendations in ISO 9241-14.

2 Normative reference

The following standard contains provisions which, through reference in this text, constitute provisions of this part of ISO 9241. At the time of publication, the edition indicated was valid. All standards are subject to revision, and parties to agreements based on this part of ISO 9241 are encouraged to investigate the possibility of applying the most recent edition of the standard indicated below. Members of IEC and ISO maintain registers of currently valid International Standards.

ISO 9241-8:—,[1] *Ergonomic requirements for office work with visual display terminals (VDTs) — Part 8: Requirements for displayed colours.*

3 Definitions

For the purposes of this part of ISO 9241, the following definitions apply.

3.1 accelerator keys: Key combinations (sometimes called "shortcut keys") which invoke a menu option without displaying the menu on which the option appears or intermediate menus.

3.2 cascading menu panels: Menu panels in a menu hierarchy displayed so that each submenu originates adjacent to the choice selected from the higher level menu (suggesting a "cascading" effect).

3.3 critical option: Option with significant positive impact on system or task performance, or which can halt or reverse significant degradation to system or task performance (e.g. save the user or the system from disaster).

3.4 destructive option: Option which can seriously degrade system or task performance, or destroy work or data (e.g. deleting a file).

3.5 hierarchical menus: Series of menus which are structured in a hierarchical or "tree-like" manner, where the selection of an initial option leads to another menu containing additional options, which may lead to another menu, etc., until the desired results are obtained.

3.6 level: Nesting order within a menu hierarchy. The first choice level (initial, or main menu) in the hierarchy would be level 1, the next choice level (obtained by a selection of a level 1 option) would be level 2, etc.

NOTE 1 See figure 1 for an example of a two-level hierarchy displayed on the same menu panel.

NOTE 2 If several groups of options are presented on a menu panel, but a selection from any of these groups would lead to a lower level menu, these groups would be considered as at the same level.

[1] To be published.

3.7 level of experience: The relative amount of experience of (different) user segments of the user population.

NOTE: The experience level of the user on computer systems as well as the experience level with the task domain are important considerations when deciding upon appropriate menu dialogue techniques.

3.8 list: Horizontal or vertical presentation of "data" items in a display which usually changes according to the states of the application.

NOTE: Although in some cases items can be selected from a list, only where items in the list are arranged or structured to optimize item choice such lists are considered menus. Additionally, those lists of items which exceed the display area (often called "scrollable menus") should be considered lists and not menus. (Lists are covered in ISO 9241-12.)

3.9 menu: Set of selectable options.

NOTE: Menu options may be presented to the user by means of visual display devices (textually or symbolically), or audibly. A menu may contain multiple option groups, but unless only one choice is allowed across groups, each group would be considered a menu. Highlighted words, symbols, or other material in texts (sometimes called "implicit" or "embedded" menus) are not considered menus within the context of ISO 9241-14.

3.10 menu access: Method by which the user obtains the menu.

NOTE: Typical means for accessing menus include:

- keying in keywords or command words or their abbreviations (e.g., command-line input);
- pressing an appropriate key or button (e.g. function key, mouse button);

- locating and selecting a specific position or object on the screen with a pointing device (or directly with the finger);
- vocal request.

3.11 menu bar: Horizontal set of options, usually located at the top of a work area or window, which invoke lower-level pull-down menus or initiate specific actions.

3.12 menu map: Graphical representation of a menu structure.

3.13 menu option: Selectable choice presented (textually, symbolically, or auditory) within a menu panel.

3.14 menu panel: Portion of the menu structure presented to the user at a given point in time

NOTE 1: Menu panel also pertains to the portion of an auditory menu (sequence of options) presented to a user in a time segment.

NOTE 2: In figure 1, two complete levels of the menu structure are displayed on a menu panel. In figure 2, although the full top level of the same structure is displayed, only the lower level of Category B is displayed.

Menu Title		
Category A	Category B	Category C
A1 Option	B1 Option	C1 Option
A2 Option	B2 Option	C2 Option
A3 Option	B3 Option	C3 Option
A4 Option	B4 Option	C4 Option
A5 Option		C5 Option

Figure 1 — Menu Panel depicting two levels of the menu hierarchy

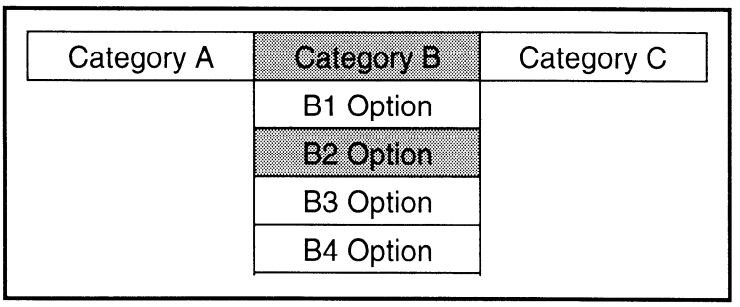

Figure 2 — A pull-down menu panel with the "Category B" option selected and displayed

3.15 menu structure: Relationships among a set of menus.

EXAMPLE: Hierarchical tree structure or network structure.

3.16 multiple selection: Selection of more than one option at a time from a menu before execution.

3.17 navigation: Orientation within a menu structure, movement from option to option within a menu panel and movement from menu panel to menu panel within a menu structure.

3.18 network menus: Series of menus structured as a network (consisting of a set of nodes and a set of links connecting the related nodes) providing redundant pathways to either all or some of the menus within the structure.

EXAMPLE: In a financial information system, consumer spending option categories that can be accessed both from the financial and the consumer higher-level menus.

3.19 option designator: Code, abbreviation, or a portion of the option name used to designate uniquely each option on a menu.

NOTE: An option designator may be explicit or implicit.

An explicit designator is an option code or abbreviation, set apart (usually to the left) from the option name, typed in for selection.

EXAMPLE: **P** Print

An implicit designator is the portion of an option name which can be used for keyboard selection (e.g., indicated by highlighting this portion).

EXAMPLE: **print**

3.20 option execution: Action used to execute the selected option(s) (i.e., the requested function is performed).

NOTE: Option selection and execution may be performed by the same user act (e.g., key press). (Also see "option selection", below.)

3.21 option group: Group of options within a menu.

NOTE: Menus and menu panels may contain more than one option group.

3.22 option label: Name displayed in a menu to identify a specific menu option.

3.23 option selection: Action by which the user indicates his/her choice of one or more options from the menu. (Also see "option execution" above.)

3.24 pop-up menu: Menu displayed ("popped-up") at a specific location on the screen (e.g., near an object or next to a pointer) when a particular condition occurs, a button is engaged, or a command is executed.

3.25 pull-down menu: Menu displayed ("pulled-down") by selecting an option from a horizontal menu (typically from a menu bar) at the top of the screen or window.

NOTE: Pull-down menus can have multiple levels.

3.26 screen button: Labelled screen graphic, intended to represent control buttons, typically selected by means of a pointing device or cursor keys, and executed by a pointing device button or the "Enter" key.

NOTE: Screen buttons may represent menu options or commands.

4 Application of ISO 9241-14

4.1 Appropriateness of menu dialogues

Menu dialogues are especially appropriate for one or more of the following conditions, which have been grouped to reflect user, task and system issues. The applicability of menus becomes greater as more conditions are met.

a) User and organizational characteristics

1. Training needs to be minimized.
2. Users have little or no typing skills.
3. Users have little or no experience with the application.

b) Task characteristics

1. Use of the system application is infrequent and the user typically needs guidance as to available options.

2. A limited number of choices are relevant for accomplishing the task within a specific context. (Some task sequences may, however, be such that a menu dialogue is not appropriate.)

3. The primary task requires the use of non-keyboard pointing devices.

4. Default or current options must be displayed to perform the task effectively.

5. The command set is too large to commit all commands to memory in the overall application.

c) System capabilities

1. The system has a limited keyboard.

2. System response time to acknowledge the activation of the menu choice(s) is appropriate for the task (e.g. within 2 s).

4.2 Applying the recommendations

General ergonomic design objectives are provided in each of clauses 5 through 8. The individual recommendations aimed at achieving these objectives should be applied within the specific context for which they are relevant (e.g., particular kinds of users, tasks, environments, technology). The format for the individual recommendations is: statement of the recommendation, example (if appropriate), and notes (if appropriate). In addition, those clauses in clause 7 (Option selection and execution) that provide recommendations concerning a particular selection method also contain notes at the beginning of the subclause pertaining to the appropriateness of that particular method. Examples provided for the various recommendations generally depict an implementation that embodies the recommendation. Some examples also indicate preferred solutions.

Individual recommendations should be evaluated for their applicability and, if judged to be applicable, should be implemented in the relevant menu dialogue unless there is evidence that to do so would cause deviation from the design objectives or would result in an overall degradation in usability. When determining applicability, the recommendations generally should be evaluated in the order presented in the relevant clause or subclause. In judging whether applicable recommendations have been met, evaluators should evaluate the product or observe representative users of the product in the context of accomplishing the user's tasks via the menu system. Sample procedures which support the determination of applicability and for determining whether a recommendation has been followed are provided in annex A.

4.3 Evaluation of products

If a product is claimed to have met the applicable recommendations in this part of ISO 9241, the procedure used in establishing requirements for, developing, and/or evaluating the menus shall be specified. The level of specification of the procedure is a matter of negotiation between the involved parties.

Users of this part of ISO 9241 can either utilize the procedures provided in annex A, or develop another procedure tailored to their particular development and/or evaluation environment.

5 Menu structure

Usually the number of options is too large to present them efficiently in a single menu panel. Therefore it is often necessary to design a menu structure (hierarchical, network, or other logical structure) and to place options into groups. It should be noted that while option categorization may appear logical to the designer, that categorization may not necessarily be evident to the user.

5.1 Structuring into levels and menus (overall structure)

Subclause 5.1 covers overall structure, 5.2 pertains to the grouping of options and their presentation in menu panels, and 5.3 concerns the sequencing of options within a group.

Menu structures should reflect user expectations and facilitate the user's ability to find and to select menu options relevant for the task and should support the user's flow of work.

5.1.1 Conventional categories

If options can be arranged into conventional or natural groups known to users, options should be organized into levels and menus consistent with that order.

NOTE: In an inventory system, office machines, furniture and expendables are the first level options and each of these are broken down into options representing the specific inventory item types.

EXAMPLE: Office machines is broken down into computers, typewriters, printers, copiers.

5.1.2 Logical categories

If options have no conventional grouping or structure, but can be grouped or ordered in a manner which is unambiguous and easily learned by the user population, options should be organized to minimize the number of levels and maximize the number of options per menu.

EXAMPLE: Placing "object" options in one group and "action" options in another is an example of structuring into logical categories based on functional relationships.

NOTE: The number of options placed in a given menu depends both on the display space available and the discriminability of the individual options.

5.1.3 Arbitrary grouping

If options cannot be grouped into categories which are unambiguous or apparent to users (typically, because users are unsure of how the desired option will be described), options should be arranged consistently (e.g., alphabetically, numerically) into groups of four to eight options per level. Breaking options into small groups may facilitate search strategies when option comparisons take time (e.g. when options are lengthy or the user is unsure of how the desired option will be described).

EXAMPLE: An information system (e.g., a text-TV information retrieval system) where users are not sure of how information of interest will be described.

NOTE: Although many levels can result using the above approach in some cases, the effect of such depth is less important in arbitrary grouped options than in logically grouped options.

5.1.4 Search time considerations

If rapid search time is important, as many options and levels as possible should be placed on a single visually displayed menu panel. Individual options and option groups should be visually distinct. (Also see 8.2.)

NOTE: Since scrollable lists (sometimes called "scrollable menus") would increase search time, consider not using them where rapid search time is important.

5.2 Grouping options within a menu

Menu options should be grouped within a menu to reflect user expectations and facilitate option search.

5.2.1 Logical groups

If the menu contains a large number of options (eight or more) and these options can be logically grouped, options should be grouped by function or into other logical categories which are meaningful to users.

EXAMPLE: Grouping the commands in a word processing system into such categories as customize, compose, edit, print.

5.2.2 Arbitrary groups

If 8 or more options are arranged arbitrarily in a menu panel, they should be arranged into equally distributed groups utilizing the following equation:

$$g = \sqrt{n}$$

where

g is the number of groups,
n is the number of options on the panel.

EXAMPLE: Given 19 options in a menu panel, arrange them in four groups of about five options each.

5.3 Sequencing of options within groups

Options should be sequenced within an option group to facilitate option search and task performance.

NOTE: Except for consistency (5.3.1), it may be necessary to compare the relative appropriateness of the sequencing approaches (i.e. perform "tradeoffs") for the users and tasks for which the menu system is intended.

5.3.1 Consistency

Options should be placed consistently in the same relative order within the option group. (Also see 5.2.1.)

EXAMPLE: Options in a menu panel are ordered "file, edit, insert, print" and these options appear in that same order when that group is presented again (or another panel containing that same group of options is presented).

NOTE: If users have the capability to reorder menu options, it is important that any new option order selected by a user is preserved until the user makes another change or reverts to the default order.

5.3.2 Importance

If particular options have great importance, these options should be placed first in the group.

EXAMPLE: Save file.

NOTE: If it is important to prevent accidental option execution, the above recommendation may not apply.

5.3.3 Conventional order

If a conventional ordering (i.e., in general usage) for options is possible, options should be placed in that order.

EXAMPLES: Days of the week, numeric quantities and physical properties.

5.3.4 Existing order

If an existing option ordering sequence is widely used (i.e., within a specific context) by typical users, that existing ordering scheme should be used.

EXAMPLE: Business fiscal year with month, in certain countries, beginning with July rather than January.

5.3.5 Order of use

If the order of option usage is known, options should be arranged in that order.

EXAMPLE: In an edit menu, "copy" is placed before "paste".

5.3.6 Frequency of use

If the frequency of option use is known (or can be determined) and option groups are small (eight or less), the most frequently used options should be placed first.

5.3.7 Alphabetical order

If the frequency cannot be determined or the groups are large and users know the name of the desired option, options should be placed in alphabetical order.

6 Menu navigation

6.1 Navigational cues

Navigational cues should be provided which can help users learn the menu structure and orient and move within the structure.

NOTE: Methods for providing such cues include: distinctive and compoundable titles, numbering schemes, graphic techniques, simultaneous display of menu panels, and menu maps.

6.1.1 Titles

If titles are used for navigation purposes, they should be:

- **distinctive and descriptive:** short and descriptive of the option (e.g., "keyword" names);
- **compoundable:** can be put together into multiple word titles (e.g., Animals/Birds) to represent the menu structure.

6.1.2 Numbering schemes

If a numbering scheme is used, the structure should be apparent and obvious to the user.

EXAMPLE: 1. for the highest level, 1.1 for the next level, and continuing in a manner similar to the subparagraph numbering of this part of ISO 9241.

NOTE: The option numbers also could be used for direct selection of options.

6.1.3 Graphic techniques

If graphic techniques are utilized, they should be consistently applied and their purpose should be obvious to the user.