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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



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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

Category A	Category B	Category C
	B1 Option	
	B2 Option	
	B3 Option	
	B4 Option	

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.

EXAMPLE: Consistent use of a restricted set of colours, line types, or font styles to differentiate menu levels.

NOTE: The term graphic techniques as used in this part of ISO 9241 refers to the graphical layout of the menu and should not be confused with "graphical user interfaces" (GUIs) which often concern other attributes of the interface in addition to the graphic elements.

6.1.4 Simultaneous display

If the menu structure is hierarchical, and menu panels representing more than one level of the structure are presented at one time, the hierarchical relationship between the panels should be apparent to users.

EXAMPLE: Cascading menus in which the relationship of each menu to the preceding menu is readily apparent.

6.1.5 Menu maps

If menu maps are utilized, these maps should make the menu structure apparent to the user and should be available on demand.

6.2 Rapid navigation

If rapid navigation methods are provided for users who require quick access to the various submenus in the menu structure, these methods should be appropriate to the particular user population and should be compatible with the user's tasks.

6.2.1 Access time

If menus are accessed from a hierarchical structure, they should be presented in the shortest time possible.

NOTE: A recommended upper limit is 500 ms.

6.2.2 Node access

If appropriate for the task, in deeply structured menus (more than three levels), users should be provided with the capability to go from one part (node) of the structure to another without returning to the initial common node.

6.2.3 Returning to initial menu

Users should be provided a simple and consistent means to return to the initial (beginning) menu from any menu in a menu structure.

EXAMPLE 1: Pressing the "home" key to return to the initial menu.

EXAMPLE 2: Moving the pointer outside of a pull-down menu to cancel the menu.

EXAMPLE 3: Pressing the escape key twice when at the lowest level of a three-level menu hierarchy.

NOTE: It is important to define the initial menu in terms of the user's task or flow of work.

6.2.4 Upward level movement

If the menu structure is hierarchical, a simple and consistent means (e.g., a single keystroke) should be provided to move to the next higher level in the menu structure.

EXAMPLE: Pressing the `Esc' (escape) key is used consistently to go to next higher level.

6.2.5 Multiple pathways

If the menus can be structured into a network and it is logical to access levels within the structure by multiple pathways that are both meaningful to users and task relevant, such pathways should be provided to users.

7 Option selection and execution

7.1 Selection methods

The method of selection and the input devices used should facilitate option selection. Whether a selection method or input device is adequate depends on the task at hand and on dialogue requirements, as well as on individual preferences. Feedback should be provided to the user to indicate the selection and/or execution of options.

NOTE: Options are typically selected (and executed) from menus by one or more of the following techniques:

- typing an option number or code (explicit designator), or typing part or all of the option name (implicit designator), usually followed by an execution key stroke;
- pressing an appropriate "function" key or button; pressing appropriate "accelerator" key combinations;
- moving the cursor to the item of choice with a pointing device (e.g. with a mouse) and performing an execution action (e.g. "clicking" on it);
- "flagging" (e.g. typing an "x" next to the option) and pressing an execution key (e.g. "enter" key);
- pointing to the option with a light pen or stylus and performing an execution action;
- touching the option of choice on the screen;
- vocally stating the option or its code.

7.1.1 Alternative methods

If compatible with system constraints, alternative methods or input devices should be provided for the selection of options.

EXAMPLE: Typing in an option designator (e.g. the first letter of the option name) in addition to "clicking" on the option with a mouse.

NOTE: It is beneficial to provide users with guidance as to how options are selected (i.e. the methods available for that particular system).

7.1.2 Separate actions for selection and execution

If fast access is not important to task performance and/or an erroneous execution would have serious consequences, separate actions for selecting and executing menu options should be provided.

EXAMPLE 1: Moving the mouse cursor to select and clicking with the mouse to execute.

EXAMPLE 2: Typing the menu option code for selecting and pressing "return" to execute.

7.1.3 Fast access

If users are experienced and/or need fast access to specific menu options, one or both of the following methods should be applied.

NOTE 1: The methods below can be used in addition to the separate actions approach described in 7.1.2. However, when both separate action methods and combined methods are used together, it is important to make it clear to the user which actions cause immediate execution and which require an additional action for execution.

a) Bypass mechanisms

Mechanisms should be provided for such users to bypass intermediate menus to access desired options.

EXAMPLE 1: Users are able to directly access menus by name or by the use of "macros" (stored strings of keystrokes) which they have created for the menu selections.

NOTE 2: If menu "skipping" is allowed, provide users with information concerning where they are in the structure and how to return to the higher level.

EXAMPLE 2: Users are able to type-ahead menu designators (i.e., the user does not need to wait for intermediate menu panels to be displayed before typing the next level designator).

b) Combining selection and execution

A mechanism should be provided to combine selection and execution.

EXAMPLE 3: An option immediately executes after the user types in the first letter of the option (implicit designator).

EXAMPLE 4: An option immediately executes after the user "double-clicks" on an icon representing the option.

EXAMPLE 5: Although the menu depicting the print option is not displayed, the user presses the "Alt" key in combination with the "P" key ("accelerator keys") and the current file prints.

NOTE 3: It is important to provide an "undo" (i.e., a command to reverse the previous action) if undesirable consequences may result from immediate execution.

7.1.4 Feedback

Consistent feedback should be provided to the user to identify the selected option.

Examples of such techniques include:

- highlighting selected or active option(s);
- moving cursor to selected option;
- echoing the key(s) pressed on a command line;
- a check mark next to the options selected, or a change in the intensity or colour of the options selected, in multiple selection;
- the option selection is indicated by repeating the choice by speech feedback.

NOTE: The technique considered most appropriate for visually displayed menu options is highlighting.

7.1.5 Deselecting options and undoing

A means for deselecting as well as selecting options, prior to execution, or the ability to "undo" the results of the execution should be provided.

EXAMPLE 1: Move the cursor to deselect the option.

EXAMPLE 2: If the user changes his/her mind after making a voice selection, saying "cancel" would cancel the last choice made.

7.1.6 Response delay

If the system response to option execution will be delayed (more than 3 s after initiation), an indication should be provided to the user that the system is processing the request.

7.1.7 Multiple selection

If menus allow for multiple selection, users should be allowed to make all choices and changes before execution.

NOTE: When execution of options has no undesirable consequences, execution of each choice as it is selected is acceptable.

7.2 Alphanumeric keyboard

If an alphanumeric keyboard is used for menu option selection and execution, the techniques used should be consistent, relate to task requirements, conform to user expectations, and should minimize needless user input.

NOTE: Keyboard menu selection is particularly appropriate when the task requires a considerable amount of keyboard input (i.e. the user's fingers are already on the keyboard).

7.2.1 Minimizing keystrokes

The number of keystrokes required to select and execute options should be minimized to those necessary to uniquely identify the desired option.

EXAMPLE: Use of the initial or unique letter in the option names (implicit designators) for selecting menu options.

NOTE: It is important not to minimize keystrokes at the expense of ease of use or other performance considerations.

7.2.2 Command line location

If a command line is used for entering option codes or names, it should be located at a consistent location on the display.

EXAMPLE 1: A command line is located at the bottom of the screen (or window area) and is consistently located in that area throughout the application.

EXAMPLE 2: A command line is located to the right of the menu panel and is consistently located in that position throughout the application.

7.2.3 Case equivalence

Options should be selectable by typed input in either lower case, upper case or mixed case, with equivalence (regardless of the case of the designators).

7.2.4 Key letter designators

If explicit designators are used and the two following conditions apply, options should be designated using one or more key letters (mnemonic). (Also see 8.1.11.)

a) The logic and uniqueness of key letter designators within the menu can be assured without changing the meaning of the options (also see 8.3.2, Keywords).

NOTE 1: In a given menu structure an important consideration is to ensure that designators are unique.

b) Option ordering by a specific sequence is not a primary consideration in task performance (see 7.2.6).

EXAMPLES: c – copy and p = print for key letters.

DO NOT use sequential letter coding (e.g. a=copy, b=print) for menu options.

NOTE 2: If key letter designators are used in cases where there will be a transition from menu-based dialogue to command-based dialogue, ensure that designators are consistent with command abbreviations.

NOTE 3: If key letter designators are used for accelerator key codes (see 8.2.4), it is preferable that such codes are consistent with the designator letters used for menu selection.

7.2.5 Easy rule for designators

If key letter designators are used, designators should be generated by applying a rule that is easy for users to learn.

EXAMPLE : Use of truncation (initial letter or letters of the option name) to generate designators.

NOTE: When the rule results in duplicate designators, use a simple secondary rule (e.g. dropping vowels) to form unique designators.

7.2.6 Number designators

If explicit designators are used and either of the following conditions apply, sequential number designators (starting with "1", not "0") should be used.

a) Option ordering in a specific sequence is important to task performance.

b) The logic and uniqueness of key letter designators cannot be assured (e.g. if letters in the option would need to be used which have little relationship with the meaning of the option such as the p in option).

7.2.7 Designator structure and syntax

The structure and syntax of option designators should be consistent.

EXAMPLE: Use a consistent coding scheme (e.g. truncation) and ensure that the same option is given the same designator throughout the dialogue sequence.

7.3 Function keys

If function keys are used for menu option selection, their use should be obvious to the user and consistent throughout the application.

NOTE: Since function keys can reduce search time for frequently used options during the task, they are often an appropriate method for option selection for options that are used very frequently, or for options that are available to the user from all or most menus.

7.3.1 Designators

Option designators involving function keys should correspond to function key labels (e.g., F1, F2, F3).

NOTE: If the menu application is to be used with different keyboard configurations (on which function keys are labelled differently), consider providing a mechanism for modifying the designators to match the keyboard.

7.3.2 Displaying assignments

If the menu depicting function key assignment is not displayed continually, then quick and easy access to that menu should be provided on demand.

NOTE: It is beneficial to display the means for obtaining that menu continually.

EXAMPLE: The user can obtain the function key assignment menu by pressing the F10 key.

7.3.3 Menu orientation

If rapid user response time is important for task performance, the menu orientation (i.e., horizontal or vertical) should be the same as the function key orientation.

NOTE: In some cases, consistency of menu orientation throughout the application or consistency with other task activities can be more important than spatial consistency of function key and menu orientation.

7.3.4 Consistency of assignment

If a menu option is available from the keyboard function key area, it should be consistently selected and executed by means of the same function key.

EXAMPLE: The same key is always used for help.

7.4 Cursor key selection

Cursor key selection should enable the user to select an option of choice in an efficient, convenient manner that is consistent with the requirements of the task.

NOTE 1: If there are fewer than five options per menu group, selection by cursor key is often the most appropriate method for selecting options.

NOTE 2: Also see 8.1.6 on cursor placement.

7.4.1 Options in columns

a) If options are in vertical columns and up and down arrow keys are available to select options, these keys should move the cursor, respectively, up and down the column of menu options (each key press should move one option).

b) If wrap-around capabilities are available, the down arrow key should move the cursor from the last option to the first option in the column and the up arrow key should move the cursor from the first option to the last option in the column.

7.4.2 Options in rows

a) If options are displayed in a horizontal row, and left and right arrow keys are available to select options, a single press of the right or left arrow key should move the cursor, respectively, one option right or left in the row of options.

b) If wrap-around capabilities are available, the right arrow key should move the cursor from the last option in the row to the first option in the row and the left arrow key should move the cursor from the first option in the row to the last option in the row.

7.4.3 Option groups

If keystrokes are to be minimized during cursor selection, a key different from the arrow keys should be used to move the cursor between option groups. Each key press should move one group.

EXAMPLE: The "Tab" key is used to move the cursor forward (left-to-right, top-to-bottom) between option groups and the "Tab" + "Shift" key combination is used to move backward between option groups.

7.4.4 Cursor response time

Movement of the cursor on the screen in response to the arrow key depression should match the response requirements for the task.

NOTE: In general, a response time of within 200 ms is appropriate.

7.5 Pointing

If pointing is used as a method for menu option selection, the technique used should be easy and intuitive for the particular user populations and be suitable for the tasks to be performed.

NOTE: Since pointing at an object is often an intuitive method for indicating choice, pointing as a means for selecting menu options in conjunction with an execution act (e.g., clicking) can be appropriate for particular user populations and particular tasks. If pointing devices and technologies (e.g. touch screens, mice and pens) are available, then consider their use as an alternative to keyed selection of options. This technique often can decrease option selection time, particularly for novices.

7.5.1 Pointing area

To maximize pointing accuracy, the selectable area of an option should be large enough to allow users to point to it without difficulty using the provided pointing device (whether it be an on-screen pointing cursor, pen or a finger).

a) Touch screens: If the finger is used for touch screen menu selection, the touch area should be large enough to minimize "misses".

NOTE 1: Consider making the size of the touch area at least the same size as the option label plus a half character distance around the label, or in the range of 20 mm x 20 mm to 30 mm x 30 mm, whichever is greater).

NOTE 2: By maximizing the touch area, options can more likely be selected by either right- or left-handed users without the finger obscuring the option label.

b) Unlabelled area: If the option selection target area is an unlabelled adjoining area (e.g., a checkbox), the size of target area should be large enough to ensure that the contact area of the pointing device of the display pointer does not obscure the target area. For example, the area should be at least twice the contact area of the selecting device (e.g., pen tip) or twice the area of the displayed pointer (e.g., mouse arrow), whichever is greater, and should not be less than 4 mm square.

NOTE 3: Consider using a labelled area as the target area.

NOTE 4: The area of a displayed pointer is considered to be the area of the "arrow head" not including the shaft.

7.5.2 Unintended activation

To minimize unintended activation of undesired options, the following should be ensured.

a) Adequate separation between selectable areas should be provided (a minimum of 3 mm is recommended for touch-selectable areas).

NOTE: If options are selected by dragging the cursor and releasing over the desired option, less separation can be appropriate.

b) Auditory or visual feedback should be provided (e.g., highlighting selected options), particularly when execution is required in addition to selection (see 7.1.2).

NOTE: Consider providing an "undo" if undesirable consequences can result from unintended activation (also see 7.1.3 b).

c) Actions requiring safety on touch screen applications should require at least two dedicated touches, where the first touch opens a confirmation dialogue element for the second touch, and the confirmation dialogue element deactivates/closes automatically after a few seconds if no second touch occurs.

7.5.3 Keyboard equivalence

If a keyboard is available, a keyboard method for selecting and executing options should be provided in addition to the pointing device method.

7.6 Voice

If voice is used to facilitate user input in menu selection (to meet special user needs, or problems, and unique task requirements), words chosen for voice inputs should be distinctive, used consistently, and followed by appropriate feedback. Voice input dialogues should have an error tolerance.

NOTE: If manual input devices are unavailable, or both the user's hands are already occupied, or the user is distant from manual input devices, or the user has a physical disability, consider using voice input. Also, voice can be utilized in addition to other selection techniques to provide the user more flexibility and match individual preferences. However, only consider using voice input when the voice recognizing system is highly reliable.

7.6.1 Phonetic distinction

Option selection words for voice input should be phonetically distinct.

NOTE: Phonetic distinctiveness has been shown to be important in visually as well as auditory presented menus.

7.6.2 Consistency

Voice input for menu selection should be consistently used across task components.

NOTE: If voice is used in combination with other menu selection methods, it is important that voice input be assigned in a consistent way to one component of the task (e.g., a particular menu series) so that the use of voice as the selection method will serve as a cue for the task.

7.6.3 Noise

If environmental noise is high, voice menus should not be used.

NOTE 1: The accuracy of speech recognizers drops to 60 % with a signal-to-noise ratio of 20 dB.

NOTE 2: In the present state of technology, it is particularly important to exclude extraneous speech which can interfere with speech recognizers.

8 Menu presentation

8.1 Option accessibility and discrimination

Menu options should be displayed (either continually or on demand) according to the requirements of the task at hand. The availability of individual options, the category to which they belong, their names, and the means to select them, always should be evident to the user.

NOTE: The recommendations in 8.1 are intended primarily for visually displayed menus and not for auditory menus.

8.1.1 Critical options

If the menu contains critical options, they should be continually displayed. (Also see 8.1.2.)

EXAMPLE: A menu bar contains an "undo" option (which could be used to undo actions when such actions were unintentional).

8.1.2 Frequent usage

If continual, or very frequent reference to menu options is required during the task, such options should be continually displayed in an area of the screen which will not obscure task data or be relocatable by the user.

EXAMPLE: Function keys are used frequently during the task and a function key menu is displayed continually at the bottom of the screen.

NOTE: If very frequent use of menu options is required during a part of the task, consider providing users with the capability of continually displaying a given menu (e.g., "tear off" menus).

8.1.3 Occasional usage

If menu options require occasional reference during the task (e.g., word processing), options should be presented on demand by means of either pop-up/pull-down panels or in a dedicated area of the screen.

EXAMPLE: Function keys are used only occasionally so a pop-up menu depicting the function key assignments is available on demand.

NOTE: Additionally keyboard overlays or other performance aids are often useful as reference for occasionally used function key allocations.

8.1.4 Available options

If information concerning unavailable options is not required for the task or other supporting activities (e.g., training), only options available to the user should be presented.

8.1.5 Unavailable in addition to available options

If currently unavailable options may at some other point in the dialogue become available and consistency of spatial layouts across displays is important, such options may be displayed in addition to available options, but visual coding should be used to differentiate the available from the unavailable options.

EXAMPLE 1: Grey lettering is used for unavailable options (preferred) or bold lettering for available options.

EXAMPLE 2: In a colour system, a different hue or a different luminance intensity is used to discriminate available from unavailable options.

8.1.6 Selection default/highlighting

The option default should be made evident to the users by placing the selection cursor at (or highlighting) one of the following options.

- a) **Most frequent option** (usually the first option): If the frequency of option selection is known and one of the options has a higher probability of selection than the others, the cursor should be placed at that option (or that option highlighted).
- b) **First option**: If repetition of the option selection is not considered important, the cursor should be placed at the first option in the group (or that option highlighted).
- c) **Previous option**: If the capability of repeating the option previously selected is important, the cursor should be placed at the option in the group which was last selected by the user (or that option highlighted).
- d) **Least destructive option**: If execution of any of the options may be destructive, the cursor should be placed at the least destructive option in the group, or that option should be highlighted which usually should be the first option, as described in b) above.

8.1.7 Titles

Menus should be meaningfully titled or their purpose should be evident. The following are examples.

- a) **First menu**: If the menu is the first menu in a series or a non-hierarchical menu
 - 1) the menu should have a short descriptive title, or
 - 2) the purpose of the menu should be evident by its position or association with other parts of the interface (e.g. a menu bar).
- b) **Lower level menu**: If the menu is a lower level menu within a series
 - 1) the menu may be titled as in a)1), or
 - 2) the menu's dependency on the higher level option should be indicated clearly (e.g. by colour coding or spatial proximity to the higher level option choice).

Titles used for lower levels in a hierarchy should have essentially the same wording and syntax as the option names by which they were chosen (also see 6.1.1).

8.1.8 Multiple menus/option groups

If titles are used for multiple menus or option groups, such menu and group titles should be visually distinct from each other and the option names. The approach used to differentiate titles and groups should be used consistently throughout the menu presentation.

EXAMPLE: Separating the title with an additional blank line or by use of different type fonts, foreground or background colour, case, etc.

8.1.9 Multiple selection

If menus allow for multiple selection, users should be provided with visual cues in a consistent location and manner to indicate that multiple selection is allowed.

8.1.10 Explicit designators

If explicit option designators (i.e., separate key letter codes) are used, upper- and lower-case codes should not be mixed (also see 7.2.3 and 7.2.4) and selection and execution should be separated (also see 7.1.2).

EXAMPLE: Use "PR" or "pr" for print, not "Pr"

8.1.11 Implicit designators

If implicit designators (letters within the option name) are used, these letters should be made visually distinct from the remainder of the name by highlighting that letter (by colour, bold type, underlining). and selection and execution should be combined (also see 7.1.3 b).

EXAMPLE: In the menu below, the implicit designators are indicated by the use of bold type.

- print
- restart
- quit

8.2 Placement

Users should be able to locate menu options on the basis of their expectations (e.g., past experience), the intuitiveness of the menu layout, and the consistency and perceptual distinctiveness of the arrangement.

NOTE: The recommendations in 8.2 are intended primarily for visually displayed menus and not auditory menus.

8.2.1 Consistency of layout

a) Fixed length menus: If menus are of fixed length, absolute positioning (i.e., same physical position in each menu) should be used.

EXAMPLE: Frequently used options like "back", "help", "quit" are placed in the same position in all menus.

b) Variable length menus: If menus are of variable length, options should be placed relative to the other options within the option group.

EXAMPLE: The help option is placed at the end of the set of options.

8.2.2 Titles

If menu panels or option groups are titled, such titles should be located at the top of the menu panel (or option group) and be centred or left justified (flush left) with the option group.

NOTE: It is important to apply the approach used for the location of titles consistently across all the menus in the application.

8.2.3 Explicit designator placement

If options have explicit designators, these designators should be located to the left of the option name and spaced appropriately so that the designator is visually distinguishable from, but retains perceptual proximity with, the option name (e.g., between two and three character spaces, or equivalent average character spaces in the case of proportional fonts).

EXAMPLE 1:

- p print
- r restart
- q quit

EXAMPLE 2:

- pr print
- re restart
- qu quit

8.2.4 Accelerator keys

If option "accelerator" or "shortcut" key codes are provided in addition to designators, they should be located to the right of, and in close proximity to, the option name (separated in general by at least three character spaces, or equivalent average character spaces in the case of proportional fonts) and left or right justified.

EXAMPLE:

- print Alt + p
- restart Alt + r
- quit Ctrl + q

NOTE: If letters are used for accelerator key codes (as in the above example), it is beneficial for these letters to be consistent with the designator letters (also see 7.2.4).

8.2.5 Options in columns

If options are placed in columns, options and groups of options should be visually distinct from one another and should be arranged to minimize search time. If textual menus are used, one or more of the following should be applied.

a) Spacing: If sufficient space is available to display options without interfering with task data, options should be double spaced vertically.

NOTE 1: It is important to keep option spacing consistent within a particular menu panel (e.g. avoid placing single-spaced and double-spaced options on the same panel).

NOTE 2: Double spacing generally refers to placing text at every other available normal text line space. If other spacing options are available, less than double spacing (e.g. space-and-a-half, or equivalent point size) can be acceptable.

b) Single spacing: If options are single spaced vertically, option distinctiveness should be enhanced by using lower-case letters (e.g. send mail) or lower-case with initial capitals (e.g. Send Mail).

c) Option groups: If options are in groups, the groups should be separated by a vertical spacing that is one and a half to two times the vertical spacing of the options within each group.

EXAMPLE: Use double spacing between groups if options are single spaced.

NOTE: If line separators are used, option group separation could be less (see 8.2.9).

d) Justification: Options (including their designators) should be left justified (flush left) within the column. The exception is numeric data options without designators, which should be decimal justified.

NOTE: If screen "buttons" are vertically configured to represent menu options, consider left justifying all of the labels on such buttons.

e) Multiple columns: If options are in multiple columns, columns should be separated, horizontally, by at least three (but preferably five) character spaces, or equivalent average character spaces in the case of proportional fonts.

f) Designator sequenced: If number or alphabetical designators are used, they should be aligned sequentially in columns.

8.2.6 Options in rows

If options are placed horizontally, such options (together with their respective designators) should be separated sufficiently to be visually distinct from one another.

NOTE: It is useful to separate options generally by at least two character spaces, or equivalent average character spaces in the case of proportional fonts (unless other methods are also used such as colour or commas, in which case a minimum of one space can be acceptable).

8.2.7 Colour

If colour is used to enhance visual distinctiveness of option groups:

a) the same colour coding should be used for options in a particular group;

EXAMPLE: Action option group coded in green, object option group coded in blue.

b) the colours used should contrast adequately with the menu panel background and each other (see colour contrast section of ISO 9241-8). In addition, no more than four colours should be used on a single menu panel.

8.2.8 Fonts

If type fonts or sizes are used to enhance visual distinctiveness of option groups or titles, the following recommendations apply.

a) Legibility: Type fonts and sizes should be legible on the display device to be used and should be distinguishable from each other.

b) Number: The number of unique type font/size combinations (e.g. 10 point bold courier, 12 point bold courier, 12 point italic courier) within a menu should not exceed three (not counting case).

NOTE: If menu options represent actual fonts/sizes, the above limitations do not apply.

8.2.9 Borders and lines

If borders or lines are used to enhance visual distinctiveness of menus (or option groups):

- a) borders and lines should be kept simple so that they do not detract from the options;
- b) borders and lines should be sufficiently separated from the options so as not to interfere with option readability.

NOTE: Borders can be used to differentiate menus which appear on top of other displayed information (e.g. pop-up menus).

8.3 Text option structure and syntax

Identification and discrimination of options should be facilitated by unambiguous, familiar, concise names, consistent option typography and syntax in order to support quick recognition.

8.3.1 Unambiguous names and titles

Option names and group titles should be semantically distinct from others (i.e., unambiguous) both within the same menu and within the same application.

NOTE 1: Distinctiveness achieved by giving new distinctive definitions to words in common language usage (e.g., "stop", "quit" and "exit") is generally not effective.

NOTE 2: If the system is to be used in various countries, the language translation effects on various option names is an important consideration during the design.

8.3.2 Keywords

a) Begin with keywords: Option names should begin with the word most representative of the option function (i.e., keyword), to optimize quick recognition (unless this sequence is unnatural for the language used).

EXAMPLE 1: "Index of system documentation" is used rather than "system documentation index", since "index" is the most representative word for the option.

NOTE 1: The keyword may change depending on the context of the total menu group: e.g., if print document is the only print option, then "print" is the keyword; if there are several print options, then "document" is the keyword.

b) High-imagery: Keywords chosen for options should have a strong cognitive association with the action or object (high-imagery) and keywords having more general connotations (low-imagery) should be avoided.

EXAMPLE 2: "Index" (a high-imagery keyword) is used rather than "information" (a low-imagery keyword) for an option which would provide a listing of documents.

NOTE 2: Avoid high-imagery keywords that are not appropriate to the option meaning.

8.3.3 Option terminology

Terminology used in option names should be familiar to users.

NOTE: In general, it is desirable to adapt terminology from the user's work tasks.

8.3.4 Option phrasing

Options should be phrased consistently and should be stated concisely.

NOTE: To prevent conciseness from compromising distinctiveness, consider adding descriptors and/or examples to enhance user understanding of what the option represents.

8.3.5 Action options

If an option name is to represent an action, it should be stated as a verb (unless this is unnatural for the language used).

EXAMPLE: "DELETE"

NOTE: In designing or checking an action-option name, it is important to determine whether the meaning of the option verb clearly implies the action.

8.3.6 Object options

If an option name is to represent an object, it should be stated as a noun.

EXAMPLE: "FOLDER"

8.3.7 Action and object options

If an option name represents both action and object, a verb - noun syntax should be used (unless this is unnatural for the language used).

EXAMPLE: "DELETE FOLDER"

NOTE: Consistency with other syntax is more important than the verb/noun order.

8.3.8 Transition to command language

If menus are intended to be used in conjunction with, or as a transition aid to, a command language, the capitalization and syntax of the option name should be consistent with command language.

8.3.9 Leading to another option

If an option leads to another menu (rather than to execute an action), consistent cues should be provided to the user.

EXAMPLE: Options leading to a submenu could be followed by a right-pointing arrow at the end of the option label or "menu" might be included in the option name.

NOTE: If most of the menu options lead to other menus, it can be more appropriate to code the exceptions rather than the majority case.

8.3.10 Leading to another dialogue

If an option leads to another dialogue (rather than to the execution of an action), consistent cues should be provided to the user.

EXAMPLE: An ellipse (...) is used to indicate another dialogue.

NOTE 1: If the result of selecting the option is obvious from the option name, additional cues do not necessarily result in improved performance.

NOTE 2: If most of the menu options lead to other dialogues, it can be more appropriate to code the exception rather than the majority case.

8.4 Graphic option structure and syntax

If icons (pictorial representations) are used to enhance user recognition of the option's action, object or name, such icons should be unambiguous, conform to user expectations, and be suitable for the task.

NOTE: Icons can represent object options, action options, or both.

8.4.1 Icon labels

If there is a possibility of icon ambiguity, a textual label should accompany each icon.

NOTE 1: If labels are attached to icons, see the conditional recommendations for textual option structure and syntax (8.3). (Also see ISO/IEC 11581 in annex C).

NOTE 2: Textual labels are not needed if the icons are self-descriptive (e.g. patterns painted on objects).

NOTE 3: Textual labels are necessary if several objects have the same icon (e.g., all files created by the same applications).

8.4.2 Grouping

Object icons and action icons should be placed in different groups within a menu, unless such groups conflict with other task requirements.

8.4.3 Visual distinctiveness

Icons selected to represent options should be visually distinct from each other and their meaning should be easily recognized by users.

NOTE 1: Consider using existing pictorial representations for use as icons. Also, if the menus will be used by different cultures, consider cultural differences in the meanings of the icons.

NOTE 2: Visual distinctiveness may result from the use of unique text labels (see 8.4.1).

8.5 Auditory option structure and syntax

The structure and syntax of auditory option menus should be consistent with both task requirements and the user's capability to process voice input.

8.5.1 Number of options

An auditory menu should be limited to a small number of options (e.g., three or four).

NOTE: If more than four options are required, consider providing a very obvious mnemonic structure.

8.5.2 Syntax

If option designators are used in auditory menus, the option should be presented before the designator.

EXAMPLE: "For help, press F1; to quit, press F2; to display attributes, press F3; for additional actions, press F4".

NOTE: It is beneficial to take special care in designing the syntax of auditory menus since the syntax associated with visually presented material does not generally apply to auditory presented material.

8.5.3 Acoustic distinction

Auditory menus should be comprised of aurally distinct, single word or short phrase options, sufficiently spaced (in time) to allow adequate discrimination by the user.

EXAMPLE: "Choose one of the following: ----installation ----applications-----utilities-----help".

8.5.4 Replay capability

A means should be provided to allow the user to "replay" the auditory menu.

EXAMPLE: The auditory menu would be replayed when the user said "repeat".

Annex A (informative)

Sample procedure for assessing applicability and adherence

A.1 General

This annex provides an example of a procedure for determining whether the applicable recommendations in ISO 9241-14 have been met. It should be noted that the procedure described is provided as guidance and is not a rigid process to be used as a substitute for the standard itself. This procedure provides a two stage process for:

- 1) determining which recommendations are relevant, and
- 2) whether those relevant recommendations have been adhered to.

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 could require consultation with a qualified ergonomics professional as well as empirical testing with real users).

The evaluation procedure should be based on an analysis of typical users, their typical and critical tasks, and their typical usage environments. Menu dialogue evaluations generally fall into the two following categories.

- a) When users and user tasks are known, evaluators evaluate the product or observe representative users of the product in the context of accomplishing typical and critical user tasks in a typical usage environment.
- b) When specific users and user tasks are not known, evaluators evaluate all menus used in the product being evaluated.

Determination of whether a product meets a given recommendation should be based on the set of menus encountered during the evaluation described above. Menus that can be shown to be better than ones that meet the recommendations described in this part of ISO 9241 would also be accepted as meeting the recommendations of the standard.

Users of ISO 9241-14 could demonstrate how they met the recommendations by listing the menus evaluated (e.g., all menus or a task-derived subset of menus); the method used to judge applicability (as described in A.3); the method used to judge adherence (as described in A.4); and the results.

A.2 Applicability

The applicability of a recommendation is based on the following two factors.

- a) Whether the conditional statement, if included as part of the provision, is true. A particular recommendation is (or is not) applicable when the conditional if-statement is (or is not) true. For example, if rapid search time is not important, recommendation 5.1.4 would not be applicable.

b) The design environment. A particular recommendation may not be applicable because of user, task, environment and technology constraints, such as unknown user community, variations in tasks, noisy office, screen resolution, lack of a pointing device. However, if the design environment did involve user characteristics, tasks, or technology features addressed by a particular recommendation, that recommendation would be applicable. For example, if menu selection were allowed by means of a pointing device, conditional recommendations in 7.5 should be evaluated to determine their applicability.

The methods which are appropriate to determine the applicability of a particular recommendation are:

- system documentation analysis
- documented evidence
- observation
- analytical evaluation
- empirical evaluation

For example, documented evidence might be used as a method to determine that natural categories are appropriate for structuring menus (recommendation 5.1.1). The following section (A.3) describes each of the applicability methods in more detail.

A.3 Description of applicability methods

A.3.1 System documentation analysis

System documentation analysis refers to the analysis of any documents which may describe the general and specific properties of the menu system. Such documents may include design documents containing system and user requirements, manuals, user guides, etc. For example, according to system requirements for a particular application, only the alphanumeric keyboard will be used for menu selection.

A.3.2 Documented evidence

Documented evidence refers to the analysis of any relevant documented information about the task requirements or characteristics, flow of work, user skills, user aptitudes, existing user conventions or biases, test data from the design of similar systems, etc. Such information may be used to determine whether a given recommendation is applicable. For example, task analysis data may have indicated that rapid response time was an important consideration in the use of the menu system within a particular task environment.

A.3.3 Observation

Observation means simply to examine or inspect the menu system for the presence of a particular observable property (e.g., menu options have explicit designators, a pointing device is used for selection). Observations can be made by anyone who has the necessary skill to systematically check the menu system and determine if it has the particular properties associated with the applicability of given conditional recommendations. Due to their obvious nature, such observations can readily be confirmed by another person.

A.3.4 Analytical evaluation

Analytical evaluation pertains to "informed" judgments concerning the properties of a menu system by a relevant expert (i.e., of those properties). This method is typically used for the evaluation of properties which can be judged only in the context of other information or knowledge. In addition, analytical evaluation may be appropriate when the system exists only in terms of design documents, user populations are not available for empirical evaluation, or time and resources are constrained. Analytical evaluation can be used to determine whether a particular recommendation is applicable (e.g., to determine if options can be arranged into conventional or natural groups known to the users, if rapid search time is important, etc.). For example, in determining the applicability of arranging options into conventional groups known to users, the analytical evaluation would be based upon the knowledge of the expert concerning typical users and the grouping of information.

Analytical evaluation can be performed by any suitably qualified person who has the necessary skill and experience to judge the relevant property of the menu system. Where these properties concern the application of ergonomic principles, the expert needs to possess appropriate skills in software ergonomics. If the properties concern the work environment, system characteristic, or other aspects of the design, the person needs to be an expert in the particular relevant domain.

A.3.5 Empirical evaluation

Empirical evaluation refers to the application of test procedures using representative end users to determine the applicability of a recommendation. This method is most appropriate when a prototype or the actual system is available and potential or actual user population representatives are available. Many kinds of test procedures could be used, but in each case the test subjects need to be representative of the end user population and be of sufficient number that the results can be generalized to the user population as a whole. For example, empirical evaluation to determine whether rapid search time is important can involve a study of users using the menu system to perform a number of representative job tasks. Special tests also can be designed to measure the applicability of a particular recommendation. For example, the "card sorting method" (a classification task) could be applied to test if there are any natural or conventional option groups known to the users (see 5.1.1).

It should be noted that empirical evaluation needs to be conducted by individuals possessing appropriate skills in testing methodology and evaluation techniques.

A.4 Adherence

If a recommendation is applicable on the basis of the criteria described in A.2, it is then necessary to determine whether or not the recommendations have been met. Adherence is determined by using one or more of the methods listed below.

NOTE: The methods which are appropriate to determine adherence for a particular recommendation are listed in conjunction with that recommendation in the Checklist in table A.1.

- measurements
- observation
- documented evidence
- analytical evaluation
- empirical evaluation

For example, if documented evidence were used as a method to determine that natural categories were applicable (see A.3), the adherence test would consist of observing that the menu options are grouped according to such categories. It is important to note that the results of applicability tests are often important in determining adherence. The various adherence methods are further described below.

A.5 Description of adherence methods

A.5.1 Measurements

Measurements refers to measuring or calculating a variable concerning properties of the menu system. Examples of such properties are response time, touch area on touch screens, calculations of option group size using the given formula, etc. Adherence is determined by comparing the obtained value from the measurement with the value stated in the recommendation.

A.5.2 Observation

Observation means simply to examine or inspect the menu system to confirm that a particular observable condition has been met (e.g., that no more than four colours are used, that menu titles are consistently left justified or centered, that each option leading to a submenu has a right-pointing arrow, etc.). Observations could be made by anyone who has the necessary skill to systematically check the menu system and determine if a statement concerning an observable property has been consistently applied. The observed property is compared with the stated recommendation to determine adherence.

A.5.3 Documented evidence

For adherence, documented evidence refers to any relevant documented information related to the menu system's adherence to the appropriate conditional recommendations. Such evidence may include existing user conventions or biases, prototype test data, test data from the design of similar systems, etc. For example, test data from a similar system may have indicated that the grouping of menu options into the categories utilized in the menu system currently being evaluated was appropriate for the types of users and tasks relevant to the application. In this case, adherence is essentially determined on the basis of documented evidence of adherence for that recommendation for the similar system.

A.5.4 Analytical evaluation

As stated in A.3.4, analytical evaluation pertains to "informed" judgments concerning the properties of a menu system by a relevant expert (i.e., of those properties). This method is typically used for the evaluation of properties which can be judged only in the context of other information or knowledge. In addition, analytical evaluation can be an appropriate adherence method when the system exists only in terms of design documents, user populations are not available for empirical evaluation, or time and resources are constrained. For example, analytical evaluation might be used to determine adherence for using a "simple means to return to the initial menu" (6.2.3) and "distinctive menu titles" (6.1.1). In the above cases, "simple" and "distinctive" are the judgmental aspects; i.e. whether there is a method for returning to the initial menu, or whether there are menu titles can be assessed by observation. An expert, however, is needed to assess whether they are simple or distinctive.

In A.3.4, it was noted that analytical evaluation can be performed by any suitably qualified person who has the appropriate skill and experience to judge the relevant property of the menu system. For adherence, the expert also needs to have the skills and knowledge necessary to reliably judge the appropriateness and usability of a menu design solution. It also should be noted that analytical evaluation can verify the tenability of a design, but cannot validate the design. Validation can be accomplished only by using empirical evaluation.

A.5.5 Empirical evaluation

Empirical evaluation refers to the application of test procedures using representative end users to determine the adherence of a recommendation. As stated in A.3.5, this method is most appropriate when a prototype or the actual system is available and potential or actual user population representatives are available. Many kinds of test procedures could be used, but in each case the test subjects need to be representative of the end user population and be of sufficient number that the results can be generalized to the user population as a whole. The task performance of end users using the menu system could be analysed to determine adherence with the various conditional recommendations. For example, excessive search time to find menu options might indicate that a natural ordering scheme was not used (see 5.1.1). By analysing learning time and keying time and errors, it would be possible to determine if designators are easily learned (see 7.2.5). Such tests could be performed both during the development process (e.g., by rapid prototyping) and after the design and implementation of the system (e.g., by system evaluation techniques) and could be based on both objective and subjective user data. Special tests also could be designed to measure the adherence to a particular recommendation. For example, a learning study could be designed to determine if the rules used for key letter designators are easily learned (see 7.2.5).

Typically, empirical evaluations are used to determine adherence by comparing the test results against specific menu recommendations. However, it is often necessary to also evaluate test results in terms of effectiveness (e.g., the menu system supports the user in his/her task in a manner which leads to improved performance, results in a difficult task being performed with less difficulty, or enables the user to accomplish a task that he/she would not have been able to otherwise).

A.6 Procedure

The following procedure (also see figure A.1) can be followed in evaluating a particular menu system with respect to the recommendations in ISO 9241-14:

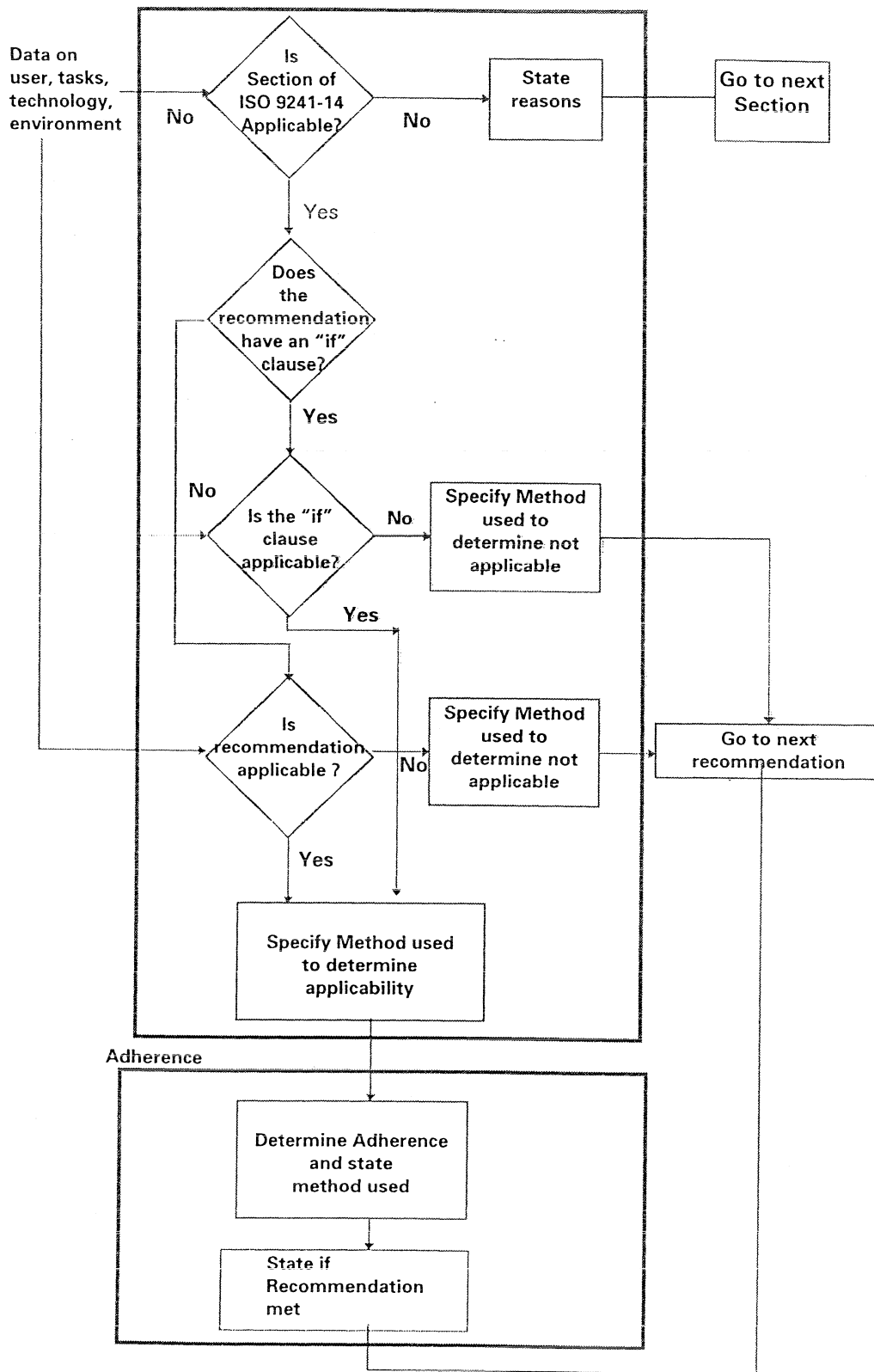


Figure A.1 — Decision process — Evaluation situation

A.6.1 "If clause" conditional recommendations

a) Applicability: Each conditional recommendation has an if-condition either in the statement itself (e.g. 5.1.1), or implied in the title to a subclause (e.g. subclause 7.2). For each conditional recommendation, the applicability of the if-statement should be determined using the methods proposed to test if the if-condition is true or not (e.g. in 5.1.4, documented evidence, analytical evaluation, or empirical evaluation is appropriate to determine whether rapid search time is important). Also, when there is a set of optional conditional recommendations such as in 5.1.1, 5.1.2, and 5.1.3, or 5.2.1 and 5.2.2, the applicable approach should be determined using the proposed method(s). In this annex, the different sets of optional conditional recommendations are further depicted in the checklist (table A.1) by the use of and/or logic connectors.

b) Adherence: For each applicable conditional recommendation as defined in a), the adherence of the recommendation should be determined using the proposed methods (e.g. if 5.1.4 is applicable, then analytical evaluation or empirical evaluation should be used to determine that as many options and levels as possible are placed on a single menu panel).

A.6.2 Other conditional recommendations

a) Applicability: Non-conditional "if statement" recommendations are generally appropriate to any menu system. However, a number of the guideline subclauses (e.g. 7.3) are applicable only if the menu system utilizes such features. If the menu system does use function keys for menu selection, the conditional recommendations in that subclause would be applicable (and applicability of the "if statements" would be determined as in A.6.1).

b) Adherence: For each non-conditional "if statement" recommendation as determined in a), information about adherence to the recommendation as described in A.6.1 b) above is necessary. For example, analytical evaluation or empirical evaluation would both be appropriate methods to determine adherence with respect to whether users are provided with a simple means to return to the initial menu (6.2.3). If there are valid reasons for not following the proposed recommendation, both the reasons and the design solution chosen also would be of interest to users of this standard.

As an aid for applying the procedures described above, a checklist (described below) is provided as part of this annex. In addition, examples of applying ISO 9241-14 are provided in annex B.

A.7 Checklist

NOTE: Users of this part of ISO 9241 may freely reproduce the checklist in this annex so that it can be used for its intended purpose and may further publish the completed checklist.

The checklist in table A.1 is intended as an aid for both designers and evaluators of menu systems in evaluating both the applicability of, and adherence to, the conditional recommendations in ISO 9241-14. This checklist contains a "short version" of all of the ISO 9241-14 recommendations and provides a logical structure to assist users in determining applicability. Many of the conditional recommendations allow a number of alternative solutions. The checklist depicts such interdependencies by means of "and" "or" connectors. These connectors are shown only for conditional recommendations within a particular section (it is assumed that the sections have inherent "ands" to the degree that the section is applicable). In some cases, "and/or" is specified because the choices are not mutually exclusive.

A.7.1 Description of the checklist

A.7.1.1 Recommendations column

The first column of the checklist contains the "short version" conditional recommendations, connected by the logic connectors, and separated by subclause. Since each conditional recommendation is numbered with its subclause number, users can look up the full text easily in the relevant clauses of ISO 9241-14.

A.7.1.2 Applicability columns

The first two columns of the Applicability portion of the checklist are provided for recording the result of the applicability determination by a checkmark in the "Y" or "N" column. In addition, this part of the checklist indicates which of the applicability methods are relevant for each of the conditional recommendations and provides space to "check off" the method used by the designer or evaluator. Those methods that are not relevant for a particular recommendation are shaded to make the checklist easier to use. The codes used for the applicability methods are:

- S = System documentation analysis
- D = Documented evidence
- O = Observation
- A = Analytical evaluation
- E = Empirical evaluation
- DM = Different Method (method other than above used)

If a different method is used (i.e., "DM" is checked), that method can be described in the Comments column. It also should be noted that checking off the applicability methods used is considered an optional feature of the checklist.

A.7.1.3 Adherence columns

This part of the checklist indicates which methods are appropriate for determining adherence to each of the conditional recommendations and provides space for designers or evaluators to "check off" the method used. If the result of the adherence test is positive, the "P" column is checked (for "passed") and if the result is negative, the "F" column is checked (for "failed"). The codes used for the adherence methods are:

- M = Measurement
- O = Observation
- D = Documented evidence
- A = Analytical evaluation
- E = Empirical evaluation
- DM = Different Method (method other than above used)

As for applicability, if a different method is used ("DM" checked), that method can be described in the Comments column. Also as noted for applicability, checking off the methods used to evaluate adherence is considered an optional feature of the checklist.

A.7.1.4 Comments

The comment column provides space for additional statements and comments pertaining to each of the conditional recommendations and can be used to indicate the source of the assessment (e.g., name of expert, title of documented evidence) as well as for describing "Different Methods" when used.

Since different solutions (methods) can be appropriate, in specific situations it is best to describe such unique solutions in the comments column. This description can include how these solutions relate to the menu design recommendations and appropriate dialogue principles.

A.7.2 Summary data

Users of the applicability and adherence checklist could summarize the results of the evaluation by computing an adherence rating (AR). The AR is the percentage of the applicable recommendations successfully adhered to (i.e., the number of checkmarks in the "P" column divided by the number of checkmarks in the "Y" column). It is highly recommended that all of the data (i.e., number of Ps and the number of Ys) be reported in conjunction with the ARs. Depending on the complexity of the menu system, it may be useful to complete a checklist for each menu in the system and then average the ARs across the menus to determine the average AR for the menu system. However, it should be noted that the AR is no more than an arithmetic count which cannot be used as a reliable measurement of the degree of adherence with applicable recommendations without taking into account the respective weights of the items (both by themselves and in the context of use).

Table A.1 — Applicability and adherence checklist

RECOMMENDATIONS	APPLICABILITY						ADHERENCE						COMMENTS (including sources)				
	Results		Method Used				Method Used				Results						
	Y	N	S	D	O	A	E	DM	M	O	D	A		E	DM	P	F
5																	
5.1																	
5.1.1																	
Options arranged into conventional or natural groups, or																	
5.1.2																	
Logical categories																	
Ordered in a manner which is unambiguous and easily learned by the user population, levels minimized, number of options maximized, or																	
5.1.3																	
Arbitrary categories																	
If logical groups not possible, options arranged into groups of four to eight options per level, and																	
5.1.4																	
Search time considerations																	
If important, as many options and levels as possible should be placed on a single menu panel. Also see 8.2.2.																	
5.2																	
Grouping options within a menu																	
5.2.1																	
Logical groups																	
Options should be grouped by function or into logical categories, or																	
5.2.2																	
Arbitrary groups																	
8 or more options should be arranged into arbitrary groups utilizing the following equation $g = \sqrt{n}$																	
5.3																	
Sequencing of options within groups																	
5.3.1																	
Consistency																	
Options placed consistently in the same order within the option group. (Also see 5.2.1), and																	
5.3.2																	
Importance																	
Important options placed first, and/or																	

RECOMMENDATIONS	APPLICABILITY										ADHERENCE						COMMENTS (including sources)			
	Results		Method Used								Method Used							Results		
	Y	N	S	D	O	A	E	DM	M	O	D	A	E	DM	P	F				
5.3.3 Conventional order If conventional order possible, or																				
5.3.4 Existing order If existing ordering scheme widely used, or																				
5.3.5 Order of use If order known, arrange in that order, or																				
5.3.6 Frequency of use If groups are small (eight or less), or																				
5.3.7 Alphabetical order If frequency not known or groups are large																				
Menu navigation																				
5.4 Navigational cues																				
5.4.1 Titles																				
5.4.1.1 a) Distinctive and descriptive, and																				
5.4.1.2 b) Compoundable, and/or																				
5.4.2 Numbering scheme Structure obvious to the user, and/or																				
5.4.3 Graphic techniques Consistently applied and their purpose should be obvious to the user, and/or																				
5.4.4 Simultaneous display Hierarchical relationship between simultaneously displayed panels should be apparent to users, and																				
5.4.5 Menu maps Clearly represent the menu structure and should be available on demand																				
5.4.6 Rapid navigation																				
5.4.6.1 Access time If menus are accessed from hierarchical structure, presented in shortest time as possible (within 500 ms, recommended), and																				

RECOMMENDATIONS	APPLICABILITY						ADHERENCE						COMMENTS (including sources)			
	Results		Method Used				Method Used				Results					
	Y	N	S	D	O	A	E	DM	M	O	D	A		E	DM	P
6.2.2 Node access Users provided with the capability to go from one part (node) to another without returning to initial common node, and																
6.2.3 Returning to initial menu Simply and consistently provided, and																
6.2.4 Upward level movement Simple and consistent means provided to move to the next higher level in the menu structure																
6.2.5 Multiple pathways Provided if logical and meaningful.																
7 Option selection and execution																
7.1 Selection methods																
7.1.1 Alternative methods If compatible with system constraints, alternate method or input devices provided, and																
7.1.2 Separate actions for selection and execution Of options unless fast access important and/or errors inconsequential, and/or																
7.1.3 Fast access If users are experienced and/or need fast access to specific menu options																
a) Bypass mechanisms - provided for intermediate menus, and/or																
b) Combining selection and execution - with undo provided, and																
7.1.4 Feedback Consistent feedback provided on the selected option, and																
7.1.5 Deselecting options and undoing Means provided for deselecting options, prior to execution or undo provided, and																

RECOMMENDATIONS	APPLICABILITY										ADHERENCE						COMMENTS (including sources)
	Results		Method Used						Method Used						Results		
	Y	N	S	D	O	A	E	DM	M	O	D	A	E	DM	P	F	
7.1.6 Response delay If the response is delayed more than 3 seconds, indication provided that the computer is processing the request, and																	
7.1.7 Multiple selection If multiple selection allowed; allow all choices and changes to be made before execution.																	
7.2 Alphanumeric keyboard																	
7.2.1 Minimizing keystrokes, and																	
7.2.2 Command line location At a consistent location on the menu panel and across menu panels, and																	
7.2.3 Case equivalence Options should be selectable by user-typed input in either lower case, upper case or mixed, and																	
7.2.4 Key letter designators Options designated using one or more key letters (mnemonic) (Also see 8.1.1), if a) Logicalness and uniqueness of key letters can be assured, and b) Option ordering by sequence is not important, and																	
7.2.5 Easy rule for designators Key letter designators generated by applying a rule that is easy for users to learn, or																	
7.2.6 Number designators Starting with "1" not "0", and																	
7.2.7 Designator structure and syntax Consistent throughout designators.																	
7.3 Function keys																	
7.3.1 Designators Should correspond to function key labels, and																	
7.3.2 Displaying assignments If key assignment not displayed continually, then provided on demand, and																	

RECOMMENDATIONS	APPLICABILITY						ADHERENCE						COMMENTS (including sources)			
	Results		Method Used				Method Used				Results					
	Y	N	S	D	O	A	E	DM	M	O	D	A		E	DM	P
7.3.3 Menu orientation Same as the function key orientation when rapid user response time important, and																
7.3.4 Consistency of assignment Option consistently selected and executed by the same function key.																
7.4 Cursor key selection																
7.4.1 Options in columns a) The up and down arrow keys move the cursor up and down a vertical column of menu options, and b) If wrap-around capability, down arrow key moves cursor from last option to 1st option in column and up arrow key moves cursor from 1st option to last in column, and																
7.4.2 Options in rows a) The left and right arrow keys move the cursor right or left within a horizontal row of menu options, and b) If wrap-around capability, right arrow key moves cursor from last option in row to 1st option on the row and left arrow key moves cursor from 1st option in row to last option in row, and																
7.4.3 Option groups A different key than the arrow keys used to move the cursor between option groups, and																
7.4.4 Cursor response time Cursor movement on the screen in response as quick as possible (within 200 ms is appropriate)																
7.5 Pointing																

RECOMMENDATIONS	APPLICABILITY						ADHERENCE						COMMENTS (including sources)			
	Results		Method Used				Method Used							Results		
	Y	N	S	D	O	A	E	DM	M	O	D	A		E	DM	P
7.5.1 Pointing area a) Touch screens - Large enough to minimize "misses" (e.g. the same size as the option label plus a half character distance around the label, or in the range of 20 mm x 20 mm to 30 mm x 30 mm square, whichever is greater), or b) Unlabelled area - Large enough to ensure pointing device does not obscure target (e.g. at least twice the active area of the selecting device or the display area of the pointer, but not be less than 4 mm square), and																
7.5.2 Unintended activation Minimized by such means as: a) Providing adequate separation between selectable areas, and b) Providing auditory or visual feedback (see 7.1.2), and																
7.5.3 Keyboard equivalence Keyboard method for selecting and executing options provided in addition to the pointing device.																
7.6 Voice																
7.6.1 Phonetically distinct Option selection words for voice input phonetically distinct, and																
7.6.2 Consistency Options consistently applied across task components, and																
7.6.3 Noise Environmental noise reduced.																
8 Menu presentation																
8.1 Option accessibility and discrimination																
8.1.1 Critical options Continually displayed, and																
8.1.2 Frequent usage Options placed in a screen area which will not obscure task data, and/or																
8.1.3 Occasional usage Menus presented on demand, and																

RECOMMENDATIONS	APPLICABILITY						ADHERENCE						COMMENTS (including sources)			
	Results		Method Used				Method Used				Results					
	Y	N	S	D	O	A	E	DM	O	D	A	E		DM	P	F
8.1.4 Available options Presented only unless information concerning other options required, or																
8.1.5 Unavailable in addition to available options Presented if these options may at some other point in the dialogue become available, such options displayed with appropriate visual coding), and																
8.1.6 Selection default/highlighting At one of the following options: a) Most frequent option - if probability of selection known, or b) First option - in the group, if repetition not important, or c) Previous option - if repeating previous option important, or d) Least destructive option, and																
8.1.7 Titles a) First menu - short descriptive title, or the purpose should be evident by its positions or association, and/or b) Lower level menu - in series, either: 1) Title as in a), or 2) Depict dependency to higher level option, and																
8.1.8 Multiple menus/option groups Menus/option groups should be visually distinct and used consistently, if titled, and/or																
8.1.9 Multiple selection Visual cues provided in consistent location, and/or																
8.1.10 Explicit designators Upper and lower case codes not mixed (also see 7.2.3 and 7.2.4), or																
8.1.11 Implicit designators Letters used highlighted and selection and execution combined (see 7.1.3b)																
8.2 Placement																

RECOMMENDATIONS		APPLICABILITY										ADHERENCE						COMMENTS (including sources)
		Results		Method Used						Method Used		Results						
		Y	N	S	D	O	A	E	DM	M	O	D	A	E	DM	P	F	
8.2.1	<p>Consistency of layout</p> <p>a) Fixed length menus - absolute positioning used, or</p> <p>b) Variable length menus - relative positioning used, and</p>																	
8.2.2	<p>Titles</p> <p>Consistently located at top and centre, or left justified, and</p>																	
8.2.3	<p>Explicit designators</p> <p>Located to left of option name (separate from option name by two or three character spaces), and</p>																	
8.2.4	<p>Accelerator keys</p> <p>Codes located to the right of the option name (and preferably right justified), and</p>																	
8.2.5	<p>Options in columns</p> <p>a) Spacing - if available, options should be double spaced vertically, or</p> <p>b) Single spacing - if options single spaced, lower case letters or lower case with initial caps used, and</p> <p>c) Option groups - separated by a vertical spacing that is one and a half to two times the vertical spacing of the options within each group, and</p> <p>d) Justification - Options should be left justified (flush left), and</p> <p>e) Multiple columns of options should be separated by at least three character spaces, and</p> <p>f) Designators sequenced - number or alphabetical designators aligned sequentially in columns, and</p>																	
8.2.6	<p>Options in rows</p> <p>If placed horizontally, separated sufficiently to be visually distinct, and/or</p>																	
8.2.7	<p>Colour</p> <p>The same colour coding should be used for options in a particular group (should limit to four colours), and/or</p>																	

RECOMMENDATIONS	APPLICABILITY						ADHERENCE						COMMENTS (including sources)			
	Results			Method Used			Method Used			Results						
	Y	N	S	D	O	A	E	DM	M	O	D	A		E	DM	P
8.3.9 Leading to another option If an option leads to another menu rather than to execution, appropriate cues provided, or																
8.3.10 Leading to another dialogue If option leads to another dialogue, consistent cues provided.																
8.4 Graphic option structure and syntax																
8.4.1 Icon labels If icon ambiguity possible, and																
8.4.2 Grouping Object icons and action icons placed in different groups within a menu, and																
8.4.3 Visual distinctiveness Icons selected to represent options visually distinct and their meaning easily recognized.																
8.5 Auditory option structure and syntax																
8.5.1 Number of options As few as possible (3 or 4), and																
8.5.2 Syntax Option/designator syntax preferred, and																
8.5.3 Acoustic distinction Voice menu options comprised of aurally distinct, single word options, sufficiently spaced (in time) to allow adequate discrimination by the user, and																
8.5.4 Replay capability Provided.																

Key:
 Y = Yes (if applicable)
 N = No (if not applicable)
 S = System documentation analysis
 D = Documented evidence
 O = Observation
 A = Analytical evaluation
 E = Empirical evaluation
 DM = Different method
 M = Measurement
 P = Pass (met recommendation)
 F = Failed (did not meet recommendation)

Annex B (informative)

Examples of applying ISO 9241-14

B.1 Designer example

During the early stages of dialogue design, the designer makes use of ISO 9241-14 as an aid to making design decisions concerning menus. Data have been collected on user characteristics, task requirements, and the environment (both physical and organizationally) in which the menu system will be used.

The designer reads through each of the conditional recommendations in ISO 9241-14 and decides which ones apply within his/her design context and checks off (Y/N) those that are appropriate on the checklist (see annex A). The method used to support the decision is also checked off (i.e., S, D, O, A, or E). For example, there are no conventional categories (5.1.1) according to task analysis data, so the designer would check "N" in the results column and "D" for the method used. The same data do indicate that it should be possible to structure menu options into logical categories (5.1.2) so the designer would check "Y" in the results column and "D" for the method used.

After deciding and checking off which conditional recommendations are applicable, the designer designs the menu system and refers to each of the applicable recommendations during the design to check whether proposed solutions would satisfy the stated recommendations.

After completing the menu system design, the designer goes through the checklist and for each applicable recommendation, he/she indicates the method used to determine adherence and the results (i.e., whether the recommendation was satisfied). For example, to check whether the options were grouped into logical categories (5.1.2) the designer had asked a group of potential users to sort options into like piles and group the options accordingly. The "E" column would be checked on the adherence methods section of the checklist and the "P" would be checked in the Results column.

B.2 Procurer example

A procurer requires that a menu system to be used in a certain context should meet the recommendations in ISO 9241-14. The procurer and the developer first negotiate about what kind of methods should be used for evaluation. They decide that the requirements specification and a task analysis should be used as the main basis for decisions about applicability and that two ergonomic experts should be used for analytical evaluation (one from the procurer organization and one from the developer organization).

The developer designs the menu system in accordance with ISO 9241-14. He/she determines first the applicability of each conditional recommendation for each subtask using the checklist (in annex A). He/she notes the reasons for the decisions and in those cases where there are no simple yes or no answers makes appropriate comments.

After implementing the menu system, the developer determines whether each applicable recommendation has been satisfied for each menu in the system using the checklist. The developer detects several cases in which the recommendations were not satisfied and modifies the menu system accordingly.

Finally, the developer presents the results of the evaluation to the procurer by means of the checklist. The procurer questions some of the applicability decisions, but after the developer presents the reasons for the recommendations not being applicable, the procurer accepts the decisions made. Thus

the developer was able to state that the menu system satisfied the recommendations in ISO 9241-14 in that all of the individual recommendations that were applicable were met.

B.3 Evaluator example

The IT department of a company has developed a software application where a major part of the human computer interaction is done via menus. The IT department now wants to know whether their menu system satisfies the recommendations in ISO 9241-14 and orders an evaluation by an independent ergonomic expert.

Case A

The IT department has developed its menu system without using ISO 9241-14, so no decisions have been made by the developers as to which recommendations apply for their particular tasks and environment. Therefore, the evaluator requests that the IT department provide as much information as possible concerning the users, their tasks, and the operational environment so that he/she can judge which recommendations should have been applied and how the software satisfies those recommendations. The identified applicable recommendations are then discussed with the IT department for confirmation before the evaluation.

The evaluator overviews the complete menu system so that he/she can determine which menus must be checked with respect to the recommendations. Since some recommendations apply to every single menu in the system, a complete check is very expensive. The evaluator decides to evaluate the menus which will be used during the user's most important tasks and also to randomly select menus from other tasks and make a spot check on these. When writing a report, the evaluator specifies which menus were checked and notes the agreements with the developer concerning the number of applicable recommendations and indicates the degree of adherence (e.g., which menus and what aspects) and indicates which recommendations were not met and estimates whether the non-adherence is critical.

Case B

The IT department has already decided during the design process which recommendations in ISO 9241-14 were applicable in their particular design context. Therefore, the evaluator has to confirm the judgments about the applicable recommendations and the associated rationale for the decisions.

The evaluator then determines the adherence to the applicable recommendations as in Case A.

Annex C
(informative)

Bibliography

ISO 9241-3:1992, *Ergonomic requirements for office work with visual display terminals (VDTs) - Part 3: Visual display requirements.*

ISO 9241-10:1996, *Ergonomic requirements for office work with visual display terminals (VDTs) - Part 10: Dialogue principles.*

ISO/IEC 11581, *Information Technology - User System Interfaces - Icon symbols and functions. (To be published).*

KEY: SOURCES:

ARE87 Arend, U., Muthig, K-P, Wandmacher, J., Evidence for global feature superiority in menu selection by icons. *Behav. and Information Technology*, 1987, 4, 411-426

AUC86 Aucella, A.F. and Ehrlich, S. F., Voice messaging: Enhancing user interface design based on field performance, *Proceedings of Conference on Human Factors in Computer Systems*, NY, ACM, 1986, 156-161.

BAR77 Barnard, P.J., Morton, J., Long, J.B., and Ottley, E.A., "Planning menus for displays: Some effects of their structure and content on user performance". International Conference on Displays for Man-Machine Systems, London, April, 1977, pp. 130-133, *IEE Conference Publication No. 150*.

BAR81 Barnard, P.J., Hammond, N.V., Long, J.B. and Clark, I.A. "Consistency and copatability in human-computer dialogue." *Int. J. Man-Machine Studies*, 1981, 15, pp. 87-134.

BAT85 Final Report on Menu and Display Literature Search to US Army Human Engineering Lab, Jan. 1985 and "*Human Factors Aspects of Computer Menus and Displays in Military Equipment*", Feb, 1985 Tijerina, L. et.al., Battelle Columbus Laboratories

BAY88 Bayerl, J. P., Millen, D. R., Lewis, S. H., Consistent layout of function keys and screen labels speeds user responses, *Proceedings of the Human Factors Soc.*, Annual Meeting, Anaheim, CA., 1988, 344-346

BCR86 Bell Communications Research, "*Guidelines for Dialog and Screen Design*", JA-ST5-000045, Sept., 1986. Piscataway, N.J. (based on course "Dialog and Screen Design", Bell Communications Research, 1985.

BEV71 Bevan, W. and Stegar, J.A., "Free recall and abstractness of stimuli," *Science*, 1971, 172, 597-599.

BIL82 Billingsley, P., "Navigation through Hierarchical Menu Structures: Does it Help to Have Maps?" *Proceedings of the H.F. Soc. Conf.*, 1982, pp 103-7

BRO88 Brown, C. Mariin, "*Human-Computer Interface Design Guidelines*", Ablex Publishing, Norwood, NJ, 1988

CAK86 Cakir, Ahmet, Towards an ergonomic design of software, *Behaviour and Information Technology*, 1986, Vol 5, No. 1, 63-70.

- CAR82 Card, S., "User Perceptual Mechanisms in the Search of Computer Command Menus," *Proceedings, Human Factors in Computer Systems Conf.*, Wash DC, ACM, Mar. 1982, pp. 190-196.
- CHE86 Cherry, J.M., "An experimental evaluation of prefix and postfix notation in command language syntax," *Int. J. Man-Machine Studies*, 1986, 24, 365-374.
- CHR85 Christie, Bruce, editor, *Human Factors of Information Technology in the Office*, Chpt 10, *Dialogue Design Guidelines*, John Wiley & Sons, NY, 1985.
- DIN86 DIN 66 234, Part 8, *Display Work Stations Principles of Dialog Design*. Deutsches Institut für Normung., 1986.
- DUN81 Dunsmore, 1981, Unpublished memo, Purdue University; referenced in Shneiderman, *Designing the User Interface*, 1987.
- EHR82 Ehrenreich, S. L. and Porcu, T, Abbreviations for Automated Systems: Teaching operations and rules, in Badre, Al & Shneiderman, Ben (Editors) "*Directions In Human Computer Interaction*", Ablex Publishers, Norwood, NJ (1982), pg 11-136.
- ENG75 Engle, S. and Granda, R., *Guidelines for Man/Display Interfaces*, Tech Report TR 27200, IBM Poughkeepsie, N.Y., Dec. 1975.
- ENG90 Engelbeck, G. and Roberts, T., The effects of several voice-menu characteristics on menu selection performance, CHI '90 Poster session, Seattle, WA, April 1990; *U.S. West Tech Report ST0401*, 1989.
- FOL81 Foley, J., Wallace, V. & Chan P., "*The Human Factors of Interaction Techniques*," The George Washington University, Inst. for Info Sci. & Tech. Report GWU-IIST-81-03, Wash.D.C. 1981.
- FOL82a Foley, J. D. and Van Dam, A. "*Fundamentals of Interactive Computer Graphics*," Addison-Wesley, Reading, MA, 1982.
- FOL82b Foley, J. D., *Lecture Notes, Human Factors of User-Computer Interfaces*, Computer Graphics Consultants, Inc., Washington, D.C., 1982.
- FRA87 Francik, E. P., and Kane, R.M., Optimizing visual search and cursor movement in pulldown menus, *Proceedings of Human Factors Soc.* - 31st Annual Mtg., 1987, pg 722-726.
- GAL81 Gallaway, G. R., Response times to user activities in interactive man/machine computer systems, *Proc. Human Factors Soc.* 25th Meeting, 1981, 754-758.
- GAL85 Galitz, W. O., "*Handbook of Screen Format Design*". QED Information Sciences, Inc. Wellesley, MA , 1985. (revised addition)
- GIL85 Gilmore, W. E., "*Human Engineering Guidelines for the Evaluation and Assessment of Video Display Units*," Idaho National Engineering Laboratory, NUREG/CR-4227, EGG-2388, EG&G, Idaho, July 1985
- GIR86 Giroux, L. and Belleau, R., "What's on the menu? The influence of menu content on the selection process," *Behaviour and Information Technology*, 1986, 5, 169-172.
- GIT86 Gittins, D., "Icon-based human-computer interaction". *Int. J. Man-Machine Studies*, 1986, 24, 519-543.

- GRA86 Gray, J., "The role of menu titles as a navigation aid in hierarchical menus," *SIGCHI Bulletin*, Jan. 1986, pp 33-35
- GRU84 Grudin, J., Barnard, P., The cognitive demands of learning and representing command names for text editing, *Human Factors*, 1984, 26, 407-422.
- HAL88 Hall, Cannich, Roche & Cox, Factors affecting performance using touch entry systems, *Journal of Applied Psychology*, 1988, 73, 711-720.
- HEM82 Hemenway, "Psychological issues in the use of icons in command menus," *Proc. of Human Factors in Computer Systems Conference*, Wash. D.C., ACM, 1982, pp. 20-24.
- HIR82 Hirsh-Pasek, K., Nudelman, S., and Schneider, M.L., An experimental evaluation of abbreviation schemes in limited lexicons. *Behaviour and Information Technology*, 1982, 1, 359-369.
- IBM89 Systems Application Architecture, Common User Access, Advanced Interface Design Guide, IBM Corp. June, 1989.
- JON89 Jones, D., Hapeshi, K. and Frankish, C., Design guidelines for speech recognition interfaces, *Applied Ergonomics*, 1989, 20.1, 47-52.
- KIG84 Kiger; "The Depth/Breadth Tradeoff in the Design of Menu Driven User Interfaces", *International J. of Man-Machine Studies*, 1984, Vol. 20, pp. 201-213.
- KOF86 The Koffler Group, "*VDT Ergonomics*," Santa Monica, California, Second Edition, August, 1986.
- LAN85 Landauer and Nachbar; "Selection from Alphabetic and Numeric Menu Trees Using a Touch Screen: Breadth, Depth, Width", *CHI '85 Proceedings*, ACM, NY, pp 73-78
- LAT81 Latremouille, S. and Lee, E., "The design of videotex tree indexes: The use of descriptors and enhancement of single index pages," *Telidon Behav. Research II: The Design of Videotex Tree Indexes*, edited by D. Phillips (Ottawa, Canada: Dept. of Commun, 1981, pp. 65-112.
- LIE82 Liebelt, L.S., McDonald, J.E., Stone, J.D., and Karat, J., "The Effect of Organization on Learning Menu Access." *Proceedings of the Human Factors Society - 26th Annual Meeting* (1982) pp. 546-550 Santa Monica, Cal.
- LOS84 Inform User Interface Guidelines, Fall, 1984, Los Alamos National Laboratory, New Mexico.
- MAC85 MacGregor, J., Lee, E., Lam, N., "The user search process in menu retrieval and its implication for the structuring of menu indexes." Report for the Dept. of Commun., Ottawa, Canada, Contract No. OER83-01065, 1985.
- MAC86 MacGregor, J., Lee, E., Lam, N., "Optimizing the structure of data base menu indexes: A decision model of menu search," *Human Factors*, Vol 28, 1986, pp 387-399.
- MAC87 MacGregor, J. and Lee, E., "Performance and preference in videotex menu retrieval: a review of the empirical literature." *Behav. and Information Technology*, 1987, 6, pp 43-68.
- MAR73 Martin, James, *Design of Man-Computer Dialogues*, Prentice-Hall, Englewood Cliffs, N.J. 1973.
- MCD83 McDonald, J., Stone, J. and Liebelt, L., Searching for items in menus: The effects of organization and type of target. *Proceedings of H.F. Soc. 27th Annual Mtg.*, 1983, pp 834-837.

- MIL68 Miller, R. B., Response times in man-computer conversational transactions, *AFIPS Conference Proceedings*, Fall Joint Computer Conference, Vol 1, 33, 267-277.
- MIL81 Miller, D. P., The depth/breadth tradeoff in hierarchical computer menus., *Proc. Human Factors Soc.*, 25th Annual Mtg, 1981, 296-300.
- MOR87 Morrison, P. and Noble, G., "Individual differences and ergonomic factors in performance on a videotex-type task." *Behav. and Information Technology*, 1987, 6, pg 69-88.
- MUT86 Muter, P. and Mayson C., "The role of graphics in item selection from menus," *Behaviour & Information Technology*," 1986, Vol 5, pp 89-95.
- NIE89 Nielsen, J., What do users really want?, *Int. J. Human-Computer Interaction*, 1989, 1, 2, 137-147.
- NOR87 Norman, K.L., Conflicts in Design Preference for Menu Selection: Programmers vs. Novice Computer Users., *Poster Session Paper, CHI '87*, Human Factors in Computing Conference, ACM, Toronto.
- OSF89 OSF/Motif Style Guide, Open Software Foundation, Cambridge, MA, July 13, 1989.
- PAA86 Paap, K. R. and Roske-Hofstrand, R. J. , "The optimal number of menu options per panel," *Human Factors*, Vol 28, 1986, pp 377-385
- PAI69 Paivio, A., "Mental imagery in associative learning and memory," *Psych. Review*, 1969, 76, 241-263.
- PAR80 Parrish, R.N., "*Development of Design Guidelines and Criteria for User/Operator Transactions with Battlefield Automated Systems*". Synetics, Fairfax, Virginia, August 1980.
- PAR83 Parrish, R., Gates, J., Munger, S., Towstopiat, O., Grimma, P., and Smith, L., "*Development of design guidelines and criteria for user/operator transactions with battlefield automated systems: Phase III. Final report, volume III.*" Report No. WF-82-AD-00. 1983, Alexandria, VA: U.S. Army Research Institute for the Behavioral and Social Sciences.
- PAR85a Parton, D., Huffman, K., Pridgen, P., Norman, K. and Shneiderman, B., Learning a menu selection tree: Training methods compared, *Behav. and Information Technology*, 1985, 4, 81-91.
- PAR85b Parkinson, S., Sisson, N. and Snowberry, K., Organization of broad computer menu displays, *Int. J. of Man-mach. Studies*, 1985, 23, 689-697.
- PER84 Perlman, G., *Making the right choices with menus*, Proceedings of the INTERACT '84 First IFIP conference on Human-Computer Interaction, Amsterdam: Elsevier Science Publishers B.V., 1984.
- PER88 Perlman, G., Sherwin, L., Designing menu display format to match input device format, *SIGCHI Bulletin*, Oct. 1988, 78-82.
- PUR82 Purdy, J.E. and Luepnitz, R.R., "Immediate and long-term retention for pictorial and verbal stimuli," *Percept & Motor Skills*, 1982, 55, 1078-82.
- RAM79 Ramsey, H. & Atwood, M. *Human Factors in Computer Systems: A Review of the Literature*, Tech Report SAI-79-111-DED, Science Applications, Inc. 1979.
- ROS86 Roske-Hofstrand, R. J. and Paap, K. R., Cognitive networks as a guide to menu organization: An application in the automated cockpit, *Ergonomics*, 1986, 11, 1301-1311

- RUB84 Rubinstein, R. and Hersh, H.; *The Human Factor: Designing Computer Systems for People*, Digital Press, Burlington, MA, (1984)
- SCH86 Schwartz, J. P. and Norman, K. L., "The importance of item distinctiveness on performance using a menu selection system," *Behaviour & Information Technology*, 1986, Vol 5, pp 173-182.
- SEP85 Seppala, P and Salvendy, G.; "Impact of Depth of Menu Hierarchy of Performance Effectiveness of Supervisory Task: Computerized Flexible Manufacturing System," *Human Factors*, 1985, Vol 27, pp 713-722.
- SHI85 Shinar, D., Stern, H. I., Bubis, G., and Ingram, D., The relative effectiveness of alternative selection strategies in menu driven computer programs. *Proceedings of the Human Factors Society 29th Annual Meeting*, Santa Monica, CA., Human Factors Soc., 1985.
- SHI87 Shinar, D. and Stern, H.I., Alternative option selection methods in menu-driven computer programs, *Human Factors*, 1987, 29, 453-459.
- SHN86 Shneiderman, B., Designing menu selection systems, *Journal of the Amer. Soc. for Information Science*, 1986, 37(2), 57-70.
- SHN87 Shneiderman, Ben, *Designing the User Interface*, Addison-Wesley, Reading, Mass, 1987.
- SIM82 Simpson, H., "A human-factors style guide for program design," *Byte*, Vol 7, 1982, 108-132.
- SIS86 Sisson, N., Parkinson, S., Snowberry, K., Considerations of menu structure and communication rate for the design of computer menu displays, *Int. J. Man-Mach. Studies*, 1986, 25, 479-489.
- SMI84 Smith, S and Mosier, J. *Design Guidelines for the User Interface for Computer-based Information Systems*, The Mitre Corporation, Bedford, MA 01730, Electronic Systems Div. (Sept. 1984)
- SMI86 Smith, S. and Mosier, J., *Guidelines for Designing User Interface Software.*, The Mitre Corporation, Bedford, MA, 1986, MTR 10090; Electronic Systems Div. AFSC, ESD-TR-86-278.
- SNO83 Snowberry, Parkinson, and Sisson; "Computer Display Menus", *Ergonomic*, 1983, Vol. 26, pp 699-712.
- SOM87 Somberg, B. L., A comparison of rule-based and positionally constant arrangements of computer menu items, *Proc. of CHI + GI '87 Conference*, Toronto: ACM, 1987, 255-260.
- TEI83 Teitelbaum, R.C. and Granda, R.E., "The effects of positional constancy on searching menus for information," *Proc. Human Factors in Computing Systems*, Dec. 1983, ACM, pp 150-153.
- THO84 Thomas, J. C. and Rosson, M. B., Human factors and synthetic speech, *Human-Computer Interaction - Interact '84*, 1984, pp 219-224.
- TUL85 Tullis, T. ; "Designing a Menu-Based Interface to an Operating System," *CHI '85 Proceedings*, ACM, NY, pp. 79-94.
- VAN90 Van Hoe, R., Poupeye, K., Vandierendonck, A., De Soete, G., "Some effects of menu characteristics and user personality on performance with menu-driven interfaces," *Behaviour & Information Technology*, 1990, 9, pp 17-29.
- WIL81 Williges, B. H. and Williges, R. C., "User considerations in computer-based information systems," Report No. CSIE-81-2, 1981, Arlington, VA: Office of Naval Research.

WIL88 Williams, J. R., "The effects of case and spacing on menu option search time," *Proceedings of the Human Factors Society 32nd Annual Meeting*, 1988, 341-343

YAN90 Yang, Y., Interface usability engineering under practical constraints: A case study in the design of undo support, *Proc. IFIP INTERACT '90*, 549-554.

Table C.1 — Cross references — Recommendations and source documents

Recommendation	Source Documents
	Key: R = Research studies, G = Guidelines, E = Experts
5 Menu-structure	
5.1 Structuring into levels/menus	
5.1.1 Conventional categories	R: BAR77, MCD83; G: LAN85, PAA86, SHN87, BCR86
5.1.2 Logical categories	R: SNO83, KIG84, LAN85, TUL85, FOL81, SEP85, VAN90; G: FOL82
5.1.3 Arbitrary grouping	R: MAC86; G: MAC87, PAA86
5.1.4 Search time considerations	R: KEY90, TUL85, PAR88; G: PAA86, MAC86
5.2 Grouping options within	
5.2.1 Logical groups	R: MEH89, TUL85, SEP85, SCH86, MCD83, LIE82; G: GAL85, PAA86, BCR86, SHN87
5.2.2 Arbitrary groups	G: PAA86
5.3 Sequencing of options	
5.3.1 Consistency	R: SOM87; G: RAM79, PAR83, BCR86, SMI86
5.3.2 Importance	G: BCR86; E
5.3.3 Conventional order	G: RAM79, SMI84, SHN87
5.3.4 Existing order	G: RUB84, BCR86
5.3.5 Order of use	E
5.3.6 Frequency of use	G: ENG75, RAM79, WIL81, PAR83, LOS84, SMI84, RUB84, GIL85, GAL85, CHR85, BCR86
5.3.7 Alphabetical order	R: CAR82, MEH89, PER84; G: FOL82, RUB84, GAL85, BCR86
6 Menu navigation	
6.1 Navigational cues	
6.1.1 Titles	R: GRA86; G: MAC87, GAL85, MAR73, SIM82
6.1.2 Numbering schemes	G: SHN87, BCR86
6.1.3 Graphic techniques	G: SHN87, BCR86
6.1.4 Simultaneous display	E
6.1.5 Menu maps	R: BIL82, PAR85a; G: SMI84, RUB84, BCR86
6.2 Rapid navigation	
6.2.1 Access time	G: CHR85
6.2.2 Node access	G: FOL82, SHN87
6.2.3 Returning to initial menu	R: VAN90; G: SMI84, LOS84, CHR85
6.2.4 Upward level movement	G: SMI84, CHR85, BCR86
6.2.5 Multiple pathways	R: CHR85, ROS86; G: SHN87

7 Option selection and execution

7.1 Selection methods

7.1.1 Alternative methods	E
7.1.2 Separate actions	G: FOL82
7.1.3 Fast access	
a) Bypass mechanisms	G: FOL82, SHN87, BCR86, SMI84, GIL85
b) Combine selection/execution	E
7.1.4 Feedback	R: DUN81; G: SMI86, BCR86, JON89; E
7.1.5 Deselecting options and undoing	R: YAN90, NIE89; G: DIN86; E
7.1.6 Response delay	G: RUB84, GAL81, CAK86, CHR85
7.1.7 Multiple selection	G: FOL82, SHN87, BCR86

7.2 Alphanumeric keyboard

7.2.1 Minimizing keystrokes	G: FOL82, BCR86; E
7.2.2 Command line location	G: RAM79, WIL81, PAR83, SMI84, BCR86, LOS84, BAT85, GIL85
7.2.3 Case equivalence	G: LOS84; E
7.2.4 Key letter designators	R: PER84, NOR87, SHI85; G: ENG75, GAL85, SMI86, FOL82, BCR86, SHI87
7.2.5 Easy rule for designators	R: HIR82, EHR82, EHR85; G: SMI86
7.2.6 Number designators	R: PER84; G: ENG75, GAL85, SMI86
7.2.7 Designator structure/syntax	G: RAM79, WIL81, PAR83, SMI84, GIL85, BCR86

7.3 Function keys

7.3.1 Designators	E
7.3.2 Displaying assignments	G: SMI86
7.3.3 Menu orientation	R: PER88, BAY88; E
7.3.4 Consistency of assignment	G: FOL82, SMI84, BCR86

7.4 Cursor key selection

7.4.1 Options in columns	E
7.4.2 Options in rows	E
7.4.3 Option groups	E
7.4.4 Cursor response time	G: MIL68, ENG75, CAK86

7.5 Pointing

7.5.1 Pointing area	
a) Touch screens	R: HAL88; G: SMI84; E
b) Unlabeled area	G: PAR80; E
7.5.2 Unintended activation	E
7.5.3 Keyboard equivalence	E
7.6 Voice	
7.6.1 Phonetically distinct	G: SMI86, KOF86
7.6.2 Consistency	G: JON89
7.6.3 Noise	G: JON89; E
8 Menu presentation	
8.1 Option accessibility and discrimination	
8.1.1 Critical options	E
8.1.2 Frequent usage	E
8.1.3 Occasional usage	E
8.1.4 Available options	R: FRA87, BRO88; G: SMI84, BCR86, CHR85, LOS84, RAM79
8.1.5 Unavailable + available	R: BRO88, SOM87
8.1.6 Selection default/highlighting	
a) Most frequent option	G: FOL82, BCR86
b) First option	E
c) Previous option	E
d) Least destructive option	E
8.1.7 Titles	
a) First menu	G: GAL85, BCR86, SHN87, BRO88
b) Lower level menu	G: GAL85, BCR86, SHN87, BRO88
8.1.8 Multiple menus/option grps	G: ENG75, GAL84, BCR86
8.1.9 Multiple selection	E
8.1.10 Explicit designators	E
8.1.11 Implicit designators	E
8.2 Placement	
8.2.1 Consistency of layout	R: TEI83, SHI87, SOM87; G: SMI84, LOS84, BCR86, RAM79, SHN87; E
8.2.2 Titles	G: GAL85
8.2.3 Explicit designators	G: GAL85
8.2.4 Accelerator keys	E
8.2.5 Options in columns	
a) Spacing	R: WIL88; G: BCR86; E
b) Single spacing	R: WIL88; G: BCR86; E
c) Option groups	G: GAL85, BCR86
d) Justification	G: GAL85, BCR86
e) Multiple columns	G: GAL85, BCR86
f) Designator sequence	E
8.2.6 Options in rows	E
8.2.7 Colour	G: SHN87, GAL85, CHR85
8.2.8 Fonts	
a) Legibility	E
b) Number	G: SHN87

8.2.9 Borders or lines	E
8.3 Textual option structure and syntax	
8.3.1 Unambiguous names, titles	R: SCH86; G: BCR86, LOS84, SCH87
8.3.2 Keywords	
a) Begin with keywords	G: SHN87
b) High-imagery	R: BRY90, PAI69, BEV71, ROG85
8.3.3 Option terminology	G: SHN87
8.3.4 Option phrasing	G: SHN87, BCR86, SMI84, RAM79, LOS84
8.3.5 Action options	G: SMI8; E
8.3.6 Object options	E
8.3.7 Action and object options	R: BAR81; G: FOL82, SHN87; E
8.3.8 To command language	G: RAM79, WIL81, FOL82, PAR83, SMI84, GIL85, BCR86
8.3.9 Leading to another option	E
8.3.10 Leading to another dialogue	E
8.4 Graphic option structure and syntax	
8.4.1 Icon labels	G: SMI86; E
8.4.2 Grouping	E
8.4.3 Visual distinctiveness	R: ARE87; E
8.5 Auditory option structure and syntax	
8.5.1 Number of options	R: ENG90; G: THO84, AUC86
8.5.2 Syntax	R: ENG90; G: JON89
8.5.3 Acoustic distinction	G: JON89, ENG90
8.5.4 Replay capability	G: THO84

ICS 13.180; 35.180

Descriptors: ergonomics, office machines, data processing equipment, text processing, data terminal equipment, display devices, specifications, operating requirements.

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