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Ergonomics of human-system interaction —

Part 110: Interaction principles

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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.

The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular the different approval criteria needed for the different types of ISO documents should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights. Details of any patent rights identified during the development of the document will be in the Introduction and/or on the ISO list of patent declarations received (see www.iso.org/patents).

Any trade name used in this document is information given for the convenience of users and does not constitute an endorsement.

For an explanation on the voluntary nature of standards, the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT) see the following URL: www.iso.org/iso/foreword.html.

This document was prepared by Technical Committee ISO/TC 159 Ergonomics, Subcommittee SC 04 Ergonomics of human-system interaction.

This second edition cancels and replaces the first edition (ISO 9241-110:2006), which has been substantially technically revised.

The main changes compared to the previous edition are as follows:

— The principle of individualization was merged into the principle of controllability

— A new principle on user engagement was developed

— Existing principles and general design recommendations were revised

A list of all parts in the ISO 9241 series can be found on the ISO website.

Introduction

This document describes interaction principles (formerly referred to as "dialogue principles") and general design recommendations which are independent of any specific interaction technique and which are applicable in the analysis, design and evaluation of interactive systems

This second version of ISO 9241-110 significantly revises and updates the first version. It incorporates guidance previously contained in ISO 14915-1. The general design recommendations in this document are derived from a combination of ergonomics research and various sources of general and heuristic guidance (including: Dzida, Molich, Nielsen, Scapin and Tognazzini).

These interaction principles and general design recommendations can guide the development and evaluation of user interfaces, leading to improved usability.

The priority with which each interaction principle or general design recommendation is applied will depend on the purpose of the interactive system, the characteristics of the intended and foreseeable users of the system, the tasks, the environment, the specific interaction technique used and the consequences arising from use. Guidance on identifying relevant aspects of the users, tasks and environment of use is given in ISO 9241-11.

The ultimate beneficiary of this document will be the user of an interactive system. Although it is unlikely that the user will read this document or even know of its existence, its application by the developers of the interactive system will lead to user interfaces which are more usable, accessible, consistent and that enable greater productivity and a more positive user experience, and which avoid harm from use. The benefits for suppliers of interactive systems include: increased sales, customer satisfaction and loyalty, decreased costs of providing service.

Applying these interaction principles and the associated general design recommendations also helps prevent users of those products from experiencing usability problems such as:

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

— misleading information,

— insufficient and poor information on the user interface,

— unexpected responses of the interactive system (including those leading to harm from use),

— navigational limitations during use, and

— inefficient error recovery.

This document comprises the following:

a) a framework for applying the interaction principles and general design recommendations;

b) the interaction principles;

c) general design recommendations corresponding to the interaction principles.

Ergonomics of human-system interaction —

Part 110: Interaction principles

1 Scope

This document describes principles for interaction between a user and a system that are formulated in general terms (i.e. independent of situations of use, application, environment or technology). This document provides a framework for applying those interaction principles and the general design recommendations.

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

It is intended for the following audiences:

— analysts of requirements (including market requirements, user requirements, and system requirements);

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

— developers (including user interface designers), who will apply the guidance during the design and development process (either directly, based on training, or by using tools and style guides which incorporate the guidance);

— evaluators, who are responsible for ensuring that products meet the general design recommendations contained in this document;

— buyers, who will reference this document in contracts during product procurement.

This document focuses on interaction principles related to the design of interactions between user and interactive system. ISO 9241-112 provides further guidance on the presentation of information.

This document does not consider any other aspect of design such as marketing, aesthetics and corporate identity.

2 Normative References

There are no normative references.

3 Terms and Definitions

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

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

— IEC Electropedia: available at http://www.electropedia.org/

— ISO Online browsing platform: available at http://www.iso.org/obp

3.1
accessibility
extent to which products, systems, services, environments and facilities can be used by people from a population with the widest range of user needs, characteristics and capabilities to achieve identified goals in identified contexts of use

Note 1 to entry: Context of use includes direct use or use supported by assistive technologies.

[SOURCE: ISO 9241-112:2017, 3.15]

3.2
context of use
combination of users, goals and tasks, resources, and environment

Note 1 to entry: The "environment" in a context of use includes the technical, physical, social, cultural and organizational environments.

[SOURCE: ISO 9241-11:2018, 3.1.15]

3.3
goal
intended outcome

[SOURCE: ISO 9241-11:2018, 3.1.10]

3.4
interactive system
combination of hardware and/or software and/or services and/or people that users interact with in order to achieve specific goals

Note 1 to entry: This includes, where appropriate, packaging, user documentation, on-line and human help, support and training.

Note 2 to entry: The term "system" is often used rather than "interactive system".

[SOURCE: ISO 9241-11:2018, 3.1.5, modified — Note 2 to entry added]

3.5
task
set of activities undertaken in order to achieve a specific goal

Note 1 to entry: These activities can be physical, perceptual and/or cognitive.

Note 2 to entry: While goals are independent of the means used to achieve them, tasks describe particular means of achieving goals.

Note 3 to entry: The term "task" is used here, as in ISO 9241-11, in its widest sense, rather than in reference to the specifics of use of the interactive system.

[SOURCE: ISO 9241-11:2018, 3.1.11, modified — Note 3 to entry added]

3.6
usability
extent to which a system, product or service can be used by specified users to achieve specified goals with effectiveness, efficiency and satisfaction in a specified context of use

Note 1 to entry: The "specified" users, goals and context of use refer to the particular combination of users, goals and context of use for which usability is being considered.

Note 2 to entry: The word "usability" is also used as a qualifier to refer to the design knowledge, competencies, activities and design attributes that contribute to usability, such as usability expertise, usability professional, usability engineering, usability method, usability evaluation, usability heuristic.

[SOURCE: ISO 9241-11:2018, 3.1.1]

3.7
use error
user action or lack of user action while using the system, product or service that leads to a different result than that intended by the manufacturer or expected by the user

Note 1 to entry: Use error includes the inability of the user to complete a task.

Note 2 to entry: Use errors can result from a mismatch between the characteristics of the user, user interface, task, or use environment.

Note 3 to entry: Users might be aware or unaware that a use error has occurred.

Note 4 to entry: A malfunction of an interactive system that causes an unexpected result is not considered a use error.

Note 5 to entry: The term use error is used in preference to user error or human error in order to avoid the implied assignment of responsibility for the error to the user.

[SOURCE: ISO 9241-11:2018, 3.3.3]

3.8
user
person who interacts with the system, product or service

Note 1 to entry: Users of a system, product or service include people who operate the system, people who make use of the output of the system and people who support the system (including providing maintenance and training).

[SOURCE: ISO 9241-11:2018, 3.1.7]

3.9
user experience
user's perceptions and responses that result from the use and/or anticipated use of a system, product or service

Note 1 to entry: Users' perceptions and responses include the users' emotions, beliefs, preferences, perceptions, comfort, behaviours, and accomplishments that occur before, during and after use.

Note 2 to entry: User experience is a consequence of brand image, presentation, functionality, system performance, interactive behaviour, and assistive capabilities of a system, product or service. It also results from the user's internal and physical state resulting from prior experiences, attitudes, skills, abilities and personality; and from the context of use.

[SOURCE: ISO 9241-11:2018, 3.2.3]

3.10
user interface
all components of an interactive system that provide information and controls for the user to accomplish specific tasks with the interactive system

3.11
user-system interaction
user interaction
exchange of information between a user and an interactive system via the user interface to complete the intended task

Note 1 to entry: User-system interaction represents a subset of human-system interaction that only focusses on intended users and not other humans who can be affected by the interactive system.

[SOURCE: ISO/IEC 25060:2010, 2.22, modified — Note to entry added]

4 Introduction to the interaction principles

4.1 Overview

This clause introduces the interaction principles. Seven principles have been identified as being important for the design and evaluation of interactive systems:

— **Suitability for the user's tasks:** An interactive system is suitable for the task when it supports the user in the completion of the task, i.e. when the operating functions and the user-system interactions are based on the task characteristics (rather than the technology chosen to perform the task).

— **Self-descriptiveness:** The interactive system presents appropriate information, where needed by the user, to make its capabilities and use immediately obvious to the user without the need for unnecessary user-system interactions.

— **Conformity with user expectations:** The interactive system's behaviour is predictable based on the context of use and commonly accepted conventions.

— **Learnability:** The interactive system supports discovery of its capabilities and how to use them, allows exploration of the interactive system, minimizes the need for learning and provides support when learning is needed.

— **Controllability:** The interactive system allows the user to maintain control of the user interface and the interactions, including the speed and sequence and individualization of the user-system interaction.

— **Use error robustness.** The interactive system assists the user in avoiding errors and in case of identifiable errors treats them tolerantly and assists the user when recovering from errors.

— **User engagement:** The interactive system captures the users´ attention and motivates the users to continue to use the interactive system.

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

For each of the principles, this document provides a list of general design recommendations. These recommendations help in the identification and specification of user requirements relevant to specific contexts of use (see ISO/IEC 25065).

The application of a single recommendation does not mean that the application of a principle has been fully satisfied.

4.2 Coverage of this set of interaction principles and general design recommendations

The principles and general design recommendations identified in this document are generic and are not tied to any particular system or context of use. General design recommendations are organized under the principles to which they appear to be most relevant. However, it is recognized that since the principles can overlap, recommendations might relate to more than one principle. Each recommendation is presented under only a single principle, since understanding and using the recommendations is more important than categorizing them.

While the recommendations presented in this document summarize important guidance obtained from current knowledge, it is possible that additional guidance will become important as technology and ergonomics develop and will be added to future versions of the document.

The guidance in this document applies to most interactive systems in most contexts of use. It is up to individuals using this guidance to determine any system and contexts of use where they do not apply. Not every recommendation within this document is applicable in every context of use.