INTERNATIONAL STANDARD

ISO 9241-210

Second edition
2019-07

Ergonomics of human-system interaction —

Part 210: Human-centred design for interactive systems

Ergonomie de l'interaction homme-système —

Partie 210: Conception centrée sur l'opérateur humain pour les systèmes interactifs

Reference number
ISO 9241-210:2019(E)

ISO copyright office
CP 401 • Ch. de Blandonnet 8
CH-1214 Vernier, Geneva
Phone: +41 22 749 01 11
Fax: +41 22 749 09 47
Email: copyright@iso.org
Website: www.iso.org

Published in Switzerland

Contents

Page

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 of 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 www.iso.org/iso/foreword.html.

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

Any feedback or questions on this document should be directed to the user's national standards body. A complete listing of these bodies can be found at www.iso.org/members.html.

This second edition cancels and replaces the first edition (ISO 9241-210:2010), of which it constitutes a minor revision. The changes compared to the previous edition are as follows:

— Figure 1 has been updated for clarity;

— additional information about accessibility has been added in 7.1;

— editorial changes have been made to align with the ISO/IEC Directives, Part 2.

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

Introduction

Human-centred design is an approach to interactive systems development that aims to make systems usable and useful by focusing on the users, their needs and requirements, and by applying human factors/ergonomics, and usability knowledge and techniques. This approach enhances effectiveness and efficiency, improves human well-being, user satisfaction, accessibility and sustainability; and counteracts possible adverse effects of use on human health, safety and performance.

There is a substantial body of human factors/ergonomics and usability knowledge about how human-centred design can be organized and used effectively. This document aims to make this information available to help those responsible for managing hardware and software design and re-design processes to identify and plan effective and timely human-centred design activities.

The human-centred approach to design described in this document complements existing systems design approaches. It can be incorporated in approaches as diverse as object-oriented, waterfall and rapid application development.

The principles of human-centred design and the related activities have not changed substantially since ISO 13407 was produced and have been validated by ten years of application. This document reflects this by making requirements as well as recommendations.

Ergonomics of human-system interaction —

Part 210:
Human-centred design for interactive systems

1 Scope

This document provides requirements and recommendations for human-centred design principles and activities throughout the life cycle of computer-based interactive systems. It is intended to be used by those managing design processes, and is concerned with ways in which both hardware and software components of interactive systems can enhance human–system interaction.

NOTE Computer-based interactive systems vary in scale and complexity. Examples include off-the-shelf (shrink-wrap) software products, custom office systems, process control systems, automated banking systems, Web sites and applications, and consumer products such as vending machines, mobile phones and digital television. Throughout this document, such systems are generally referred to as products, systems or services although, for simplicity, sometimes only one term is used.

This document provides an overview of human-centred design activities. It does not provide detailed coverage of the methods and techniques required for human-centred design, nor does it address health or safety aspects in detail. Although it addresses the planning and management of human-centred design, it does not address all aspects of project management.

The information in this document is intended for use by those responsible for planning and managing projects that design and develop interactive systems. It therefore addresses technical human factors and ergonomics issues only to the extent necessary to allow such individuals to understand their relevance and importance in the design process as a whole. It also provides a framework for human factors and usability professionals involved in human-centred design. Detailed human factors/ergonomics, usability and accessibility issues are dealt with more fully in a number of standards including other parts of ISO 9241 (see Annex A) and ISO 6385, which sets out the broad principles of ergonomics.

The requirements and recommendations in this document can benefit all parties involved in human-centred design and development. Annex B provides a checklist that can be used to support claims of conformance with this document.

2 Normative references

There are no normative references in this document.

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:

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

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

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* (3.1) needs, characteristics and capabilities to achieve identified goals in identified *contexts of use* (3.10)

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
effectiveness
accuracy and completeness with which users achieve specified goals

[SOURCE: ISO 9241-11:2018, 3.1.12]

3.4
efficiency
resources used in relation to the results achieved

Note 1 to entry: Typical resources include time, human effort, costs and materials.

[SOURCE: ISO 9241-11:2018, 3.1.13]

3.5
ergonomics
human factors
scientific discipline concerned with the understanding of interactions among human and other elements of a system, and the profession that applies theory, principles, data and methods to design in order to optimize human well-being and overall system performance

[SOURCE: ISO 6385:2016, 2.3]

3.6
goal
intended outcome

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

3.7
human-centred design
approach to systems design and development that aims to make interactive systems more usable by focusing on the use of the system and applying human factors/ergonomics and usability knowledge and techniques

Note 1 to entry: The term "human-centred design" is used rather than "user-centred design" in order to emphasize that this document also addresses impacts on a number of stakeholders, not just those typically considered as users. However, in practice, these terms are often used synonymously.

Note 2 to entry: Usable systems can provide a number of benefits, including improved productivity, enhanced user well-being, avoidance of stress, increased accessibility and reduced risk of harm.

3.8
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.

[SOURCE: ISO 9241-11: 2018, 3.1.5]

3.9
prototype
⟨interactive system⟩ representation of all or part of an interactive system, that, although limited in some way, can be used for analysis, design and evaluation

Note 1 to entry: A prototype may be as simple as a sketch or static mock-up or as complicated as a fully functioning interactive system with more or less complete functionality.

3.10
satisfaction
extent to which the user's physical, cognitive and emotional responses that result from the use of a system, product or service meet the user's needs and expectations

Note 1 to entry: Satisfaction includes the extent to which the user experience that results from actual use meets the user's needs and expectations.

Note 2 to entry: Anticipated use can influence satisfaction with actual use.

[SOURCE: ISO 9241-11:2018, 3.1.14]

3.11
stakeholder
individual or organization having a right, share, claim or interest in a system or in its possession of characteristics that meet their needs and expectations

[SOURCE: ISO/IEC/IEEE 15288:2015, 4.1.44, modified — The example and Note 1 to entry have been omitted.]

3.12
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.

[SOURCE: ISO 9241-11:2018, 3.1.11]

3.13
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]

3.14
user
person who interacts with a 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]

3.15
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]

3.16
user interface
all components of an interactive system (software or hardware) that provide information and controls for the user to accomplish specific tasks with the interactive system

[SOURCE: ISO 9241-110:2006]

3.17
validation
confirmation, through the provision of objective evidence, that the requirements for a specific intended use or application have been fulfilled

Note 1 to entry: Validation is the set of activities ensuring and gaining confidence that a system is able to accomplish its intended use, goals and objectives (i.e. meet stakeholder requirements) in the intended operational environment.

[SOURCE: ISO 9000:2015, 3.8.13, modified — Note 1 to entry has been replaced and Notes 2 and 3 to entry have been removed.]

3.18
verification
confirmation, through the provision of objective evidence, that specified requirements have been fulfilled

Note 1 to entry: Verification is a set of activities that compares a system or system element against the required characteristics. This can include, but is not limited to, specified requirements, design description and the system itself.

[SOURCE: ISO 9000:2015, 3.8.12, modified — Note 1 to entry has been replaced and Notes 2 and 3 to entry have been removed.]

4 Rationale for adopting human-centred design

Using a human-centred approach to design and development has substantial economic and social benefits for users, employers and suppliers. Highly usable systems and products tend to be more successful both technically and commercially. In some areas, such as consumer products, purchasers will pay a premium for well-designed products and systems. Support and help-desk costs are reduced

when users can understand and use products without additional assistance. In most countries, employers and suppliers have legal obligations to protect users from risks to their health, and safety and human-centred methods can reduce these risks (e.g. musculoskeletal risks). Systems designed using human-centred methods improve overall quality, for example, by:

a) increasing the productivity of users and the operational efficiency of organizations;

b) being easier to understand and use, thus reducing training and support costs;

c) increasing usability (effectiveness, efficiency and satisfaction)

d) increasing accessibility (for people from a population with the widest range of user needs, characteristics and capabilities);

e) improving user experience;

f) reducing discomfort and stress;

g) providing a competitive advantage, for example by improving brand image;

h) contributing towards sustainability objectives.

The human-centred approach can lead to increased human-centred quality (usability, accessibility, user experience, avoidance of harm from use) as defined in ISO 9241-220.

The complete benefits of human-centred design can be determined by taking into account the total life cycle costs of the product, system or service, including conception, design, implementation, support, use, maintenance and, finally, disposal. Taking a human-centred design approach contributes to other aspects of system design, for example, by improving the identification and definition of functional requirements. Taking a human-centred design approach also increases the likelihood of completing the project successfully, on time, and within budget. Using appropriate human-centred methods can reduce the risk of the product failing to meet stakeholder requirements or being rejected by its users.

Examples of outputs from human-centred design activities are illustrated in Table 1.

Table 1 — Examples of outputs from human-centred design activities

Activities	Outputs from human-centred design	Examples of information contained in outputs
Understand and specify the context of use	Context of use description	— User group profiles — As-is scenarios — Personas
Specify the user requirements	User needs description User requirements specification	— Identified user needs — Derived user requirements — Required design guidance
Produce design solutions to meet these requirements	User-system interaction specification User interface specification Implemented user interface	— Scenarios of use — Low-fidelity prototypes — High-fidelity prototypes
Evaluate the designs against requirements	Evaluation results Conformance test results Long-term monitoring results	— Usability-test report — Field report — User survey report
NOTE More detailed information on each output can be found in ISO/IEC TR 25060.		

5 Principles of human-centred design

5.1 General

This document provides a framework for human-centred design. It does not assume any particular design process, nor does it describe all the different activities necessary to ensure effective systems design. It is complementary to existing design methodologies and provides a human-centred perspective that can be integrated into different design and development processes in a way that is appropriate to the particular context. All the human-centred design activities identified in Clause 7 are applicable (to a greater or lesser extent) at any stage in the development of a system.

Whatever the design process and allocation of responsibilities and roles adopted, a human-centred approach should follow the principles listed below (and described in 5.2 to 5.7):

a) the design is based upon an explicit understanding of users, tasks and environments (see 5.2);

b) users are involved throughout design and development (see 5.3);

c) the design is driven and refined by user-centred evaluation (see 5.4);

d) the process is iterative (see 5.5);

e) the design addresses the whole user experience (see 5.6);

f) the design team includes multidisciplinary skills and perspectives (see 5.7).

5.2 The design is based upon an explicit understanding of users, tasks and environments

Products, systems and services should be designed to take account of the people who will use them as well as other stakeholder groups, including those who can be affected (directly or indirectly) by their use. Therefore, all relevant user and stakeholder groups should be identified. Constructing systems based on an inappropriate or incomplete understanding of user needs is one of the major sources of systems failure.

The extent to which products are usable and accessible depends on the context, i.e. the specified users, having specified goals, performing specified tasks in a specified environment (see ISO 9241-11). For example, the kind of interface that provides good user experience for a young person downloading music on a phone may be completely inappropriate for accessing corporate data on a PDA (personal digital assistant). The characteristics of the users, tasks and environment are called the *context of use*. Guidance on how to gather relevant information is provided in 7.2. The context of use is a major source of information for establishing requirements (see 7.3) and an essential input to the design process.

5.3 Users are involved throughout design and development

Involving users in design and development provides a valuable source of knowledge about the context of use, the tasks, and how users are likely to work with the future product, system or service. User involvement should be active, whether by participating in design, acting as a source of relevant data or evaluating solutions. The people who are involved should have capabilities, characteristics and experience that reflect the range of users for whom the system is being designed. The nature and frequency of this involvement can vary throughout design and development, depending on the type of project. The effectiveness of user involvement increases as the interaction between the developers and the users increases.

When custom-made systems are being developed, the intended users and the tasks performed can be directly linked to the development process. The organization procuring the system has the opportunity to have a direct influence on the design as it emerges, and those who are actually going to be working with the future system can take part in evaluating proposed solutions. Such involvement and participation can also increase user acceptance and commitment.

When generic or consumer products are being developed, the user population is dispersed and products can be targeted at groups of users with particular characteristics. It is still important that users or appropriate representatives be involved in development so that the user and task requirements relevant to the intended user group(s) can be identified for inclusion in the system specification to provide feedback through testing of the proposed design solutions.

5.4 The design is driven and refined by user-centred evaluation

Feedback from users is a critical source of information in human-centred design. Evaluating designs with users and improving them based on their feedback provides an effective means of minimizing the risk of a system not meeting user or organizational needs (including those requirements that are hidden or difficult to specify explicitly). Such evaluation allows preliminary design solutions to be tested against "real world" scenarios, with the results being fed back into progressively refined solutions. User-centred evaluation should also take place as part of the final acceptance of the product to confirm that requirements have been met. Feedback from users during operational use identifies long-term issues and provides input to future design.

NOTE The term "user-centred" is used here to emphasize that this evaluation is made from the user's perspective.

5.5 The process is iterative

The most appropriate design for an interactive system cannot typically be achieved without iteration.

NOTE 1 In this context, iteration means repeating a sequence of steps until a desired outcome is achieved.

NOTE 2 In development methods that consist of mini-development cycles, human-centred activities can be iterated for individual parts of the system and again at a macro level across the whole product, system or service.

Iteration should be used to progressively eliminate uncertainty during the development of interactive systems. Iteration implies that descriptions, specifications and prototypes are revised and refined when new information is obtained in order to minimize the risk of the system under development failing to meet user requirements.

The complexity of human–computer interaction means that it is impossible to specify completely and accurately every detail of every aspect of the interaction at the beginning of development. Many of the needs and expectations of users and other stakeholders that will impact on the design of the interaction only emerge in the course of development, as the designers refine their understanding of the users and their tasks, and as users are better able to express their needs in response to potential solutions.

Iteration of proposed solutions incorporating feedback from a user perspective provides a means of mitigating risk.

EXAMPLE 1 Feedback from a user perspective is used to update the intended context of use, to revise the requirements and to refine proposed design solutions.

EXAMPLE 2 The requirements specification is refined iteratively by using scenarios, early mock-ups, and prototypes, to obtain feedback from users on whether these incorporate the user requirements correctly and completely.

The interaction between human-centred and other aspects of the design can also result in the need for iteration — for example to take account of the manufacturability of a product, the impact on the production environment or changes in the market-place.

5.6 The design addresses the whole user experience

User experience is a consequence of the presentation, functionality, system performance, interactive behaviour, and assistive capabilities of an interactive system, both hardware and software. It is also a consequence of the user's prior experiences, attitudes, skills, habits and personality. There is a common misconception that usability refers solely to making products easy to use. However, the concept