



SLOVENSKI STANDARD
SIST EN ISO 9241-940:2022

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Ergonomija medsebojnega vpliva človek-sistem - 940. del: Vrednotenje taktilnih in haptičnih interakcij (ISO 9241-940:2017)

Ergonomics of human-system interaction - Part 940: Evaluation of tactile and haptic interactions (ISO 9241-940:2017)

Ergonomie der Mensch-System-Interaktion - Teil 940: Evaluation taktiler und haptischer Interaktionen (ISO 9241-940:2017)

Ergonomie de l'interaction homme-système - Partie 940: Évaluation des interactions tactiles et haptiques (ISO 9241-940:2017)

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| 13.180 | Ergonomija | Ergonomics |
| 35.180 | Terminalska in druga periferna oprema IT | IT Terminal and other peripheral equipment |

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Ergonomics of human-system interaction - Part 940: Evaluation of tactile and haptic interactions (ISO 9241- 940:2017)

Ergonomie de l'interaction homme-système - Partie
940: Évaluation des interactions tactiles et haptiques
(ISO 9241-940:2017)

Ergonomie der Mensch-System-Interaktion - Teil 940:
Evaluation taktiler und haptischer Interaktionen (ISO
9241-940:2017)

This European Standard was approved by CEN on 13 March 2022.

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This European Standard shall be given the status of a national standard, either by publication of an identical text or by endorsement, at the latest by September 2022, and conflicting national standards shall be withdrawn at the latest by September 2022.

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INTERNATIONAL
STANDARD

ISO
9241-940

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2017-11

**Ergonomics of human-system
interaction —**

**Part 940:
Evaluation of tactile and haptic
interactions**

iTeh STANDARD PREVIEW
Ergonomie de l'interaction homme-système —
(standards.iteh.ai)
Partie 940: Évaluation des interactions tactiles et haptiques

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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).

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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 4, *Ergonomics of human-system interaction*.

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

Introduction

Tactile and haptic interactions are becoming increasingly important as interaction modalities in special purpose computing environments and assistive technologies. This document explains how to evaluate attributes of the haptic device and the user interface, and the outcomes of interaction with a haptic device, along with an assessment of human-centred quality and other and more specific usage qualities.

This document can be used to identify the measures to be used when establishing requirements for haptic interaction, and to evaluate haptic interactions to identify problems, to establish benchmarks or to evaluate whether a haptic system meets requirements.

A haptic interaction involves sensory or motor activity in the skin, muscles, joints and tendons; a tactile interaction refers specifically to touch (sensory activity in the skin).

In a haptic interaction, a user typically employs a device to manipulate objects in the virtual world of the computer and also to feel the result of the manipulation through sensors in the skin and joints. This is the bidirectional sense of haptics. Haptics is important in the design of switches in traditional keyboards and mice, but here, we consider computer interaction by means other than keyboard, mouse and passive joysticks.

Haptic interactions can also work in a passive unidirectional sense, conveying information to the skin without active motion or exploration on the part of the user. A cell phone on vibration mode is one such unidirectional tactile device. They can also work in an active unidirectional sense, as the user makes gestures that send commands or data to a device.

Tactile and kinaesthetic haptic interactions are being developed in university and industrial laboratories in many countries, and a variety of commercial products exist that incorporate tactile and kinaesthetic interactions. Both the developer and the prospective purchaser of such interactions and their associated devices and software need a means of making comparisons between competing choices.

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Other International Standards are cross-referenced in order to understand and point out the specific differences in evaluating haptic interactions. The nature of these interactions, whether bidirectional, unidirectional from the device to the skin or body of the user, or unidirectional as gestures from the body of the user to the device, sets them apart as a group of interactions that needs special consideration in relation to the forms of evaluation which are appropriate.

ISO 9241-910 provides a common set of terms, definitions, and descriptions of the various concepts involved in designing and using haptic interactions. It provides an overview of the range of haptic applications, objects, attributes, and interactions.

ISO 9241-920 provides basic guidance in the design of haptic interactions.

ISO 9241-960 provides guidance for the definition of gestures in human-machine interactions. It explains how to describe their features and what factors to take into account when defining gestures.

This document provides evaluation processes specific to haptic interactions and the devices that enable them. It shows how requirements set out in ISO 9241-910, ISO 9241-920 and other International Standards can be applied to actual haptic systems and specific interactions. In a parallel way, it shows how the usability of a haptic system can be evaluated, taking into account quality attributes such as effectiveness, efficiency, user satisfaction and avoidance of harm from use.

Ergonomics of human-system interaction —

Part 940:

Evaluation of tactile and haptic interactions

1 Scope

This document

- describes the types of methods that can be used for the evaluation of haptic devices and of systems that include haptic devices,
- specifies a procedure for the evaluation of haptic interactions by a usability walkthrough or usability test (see [Annex J](#)), and
- provides guidance on the types of methods that are appropriate for the evaluation of specific attributes of haptic systems, cross-referenced to the guidance in the relevant clauses of other International Standards (see [Annexes A, B, C, D, E, F and G](#)).

It applies to the following types of interaction:

- augmented reality — information overlaid on a real scene, e.g. vibrating belt indicating distance;
- gesture control of a device or a virtual scenario;
- unidirectional interaction such as a vibrating phone or a vibrating belt;
- virtual environment — virtual space with which a user can interact with the aid of a haptic device.

This document applies to the following types of devices:

- gesture sensor, e.g. video that discerns 3D hand movements, touch screens that sense 2D touches;
- kinaesthetic haptic device, e.g. desktop haptic interface;
- tactile display, e.g. vibrating phone.

This document is not applicable to standard input devices such as keyboards, mice or track balls.

NOTE ISO 9241-400 covers standard input devices, and ISO 9241-411 applies to the evaluation of input devices such as keyboards and mice.

This document can be used to identify the types of methods and measures for

- establishing benchmarks,
- establishing requirements for haptic interaction,
- identifying problems with haptic interaction (formative evaluation), and
- use of the criteria to establish whether a haptic system meets requirements (summative evaluation).

2 Normative references

There are no normative references in this document.

ISO 9241-940:2017(E)

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 <http://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 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 formative evaluation

evaluation designed and used to improve the object of evaluation, especially when it is still being developed

[SOURCE: ISO/TS 18152:2010, 4.6]

3.3 haptics

sensory and/or motor activity based in the skin, muscles, joints and tendons

Note 1 to entry: Haptics consists of two parts: touch and kinaesthesia.

[SOURCE: ISO 9241-910:2011, 2.1]

3.4 haptic

appertaining to haptics

Note 1 to entry: In this document, “haptics” includes all touch sensations; “tactile” is used more specifically to refer to skin stimulation without kinaesthetic stimulus.

[SOURCE: ISO 9241-910:2011, 2.2, modified]

3.5 haptic interaction

sensory or motor activity in the skin, muscles, joints and/or tendons as part of human-computer interaction

3.6 haptic user interface HUI

one or more haptic effects that are designed in software to allow a user to experience a haptic interaction

3.7 requirement

condition or capability that must be met or possessed by a system, system component, product, or service to satisfy an agreement, standard, specification, or other formally imposed documents

Note 1 to entry: Requirements include the quantified and documented needs, wants, and expectations of the sponsor, customer, and other stakeholders.

[SOURCE: ISO/IEC/IEEE 24765:2010, 3.2506, modified]

3.8**summative evaluation**

evaluation designed to present conclusions about the merit or worth of the object of evaluation

Note 1 to entry: The results can be used to produce recommendations about whether it should be retained, altered, or eliminated.

Note 2 to entry: It is possible to design a method to provide a combined formative and summative evaluation.

Note 3 to entry: A summative test method is used to perform a summative evaluation.

[SOURCE: ISO/TS 20282-2:2013, 4.17]

3.9**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

[SOURCE: ISO 9241-210:2010, 2.13]

3.10**usability requirement**

required level of usability expressed in terms of measures of effectiveness, efficiency, and satisfaction in a specified context of use

[SOURCE: ISO/TS 20282-2:2013, 4.20]

3.11**user**

person who interacts with a system, product, or service

Note 1 to entry: The person who uses a service provided by a work system, such as a customer in a shop or passenger on a train, can be considered a user.

[SOURCE: ISO/TS 20282-2:2013, 4.22]

3.12**user experience**

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

Note 1 to entry: User experience includes the user's 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 and personality, and from the context of use.

Note 3 to entry: Usability, when interpreted from the perspective of the users' personal goals, can include the kind of perceptual and emotional aspects typically associated with user experience. Usability criteria can be established to assess aspects of user experience.

[SOURCE: ISO 9241-210:2010, 2.15, modified — Reworded for clarification.]

3.13**user group**

<usability> group of users differentiated by characteristics of the users, tasks, or environments that are expected to influence usability

[SOURCE: ISO/TS 20282-2:2013, 4.24, modified — Note removed.]