
**Ergonomics of human-system
interaction —**

**Part 971:
Accessibility of tactile/haptic
interactive systems**

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Ergonomie de l'interaction homme-système —
(standards.iteh.ai) **Partie 971: Accessibilité des systèmes interactifs tactiles/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).

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.

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

Introduction

The tactile/haptic modality is the most widely used modality for inputs to interactive systems and is used as an important output modality for many contexts of use. Often, haptic devices and applications are designed for the “typical” or “average” user. It is important that interactive systems and their designs follow general ergonomic practice as well as meet the widest range of user needs, characteristics, and capabilities for tactile/haptic interactions.

Examples of the use of tactile/haptic inputs range from the use of keyboards, pointing devices (such as a mouse or track pad) and direct touch (gestures) to the use of non-touch gestures, eye-tracking, single-switch inputs, and whole-body movements. Examples of tactile/haptic outputs include the use of vibration and tactile pattern (e.g. braille) outputs. Tactile/haptic inputs/outputs can be combined (e.g. force feedback systems).

Achieving accessibility involves good ergonomic practice. This document works with other ISO and ISO/IEC standards relating to tactile/haptic interactions (such as ISO 9241-910, ISO 9241-920 and ISO 9241-960) and to accessibility (such as ISO 9241-171 and ISO/IEC 29136) to collect tactile/haptic-related accessibility requirements and recommendations and to provide more specific guidance relating to the accessibility of tactile/haptic interactions. It provides a means of addressing tactile/haptic-related user needs from ISO/IEC 29138-1. As such, it is intended to provide a comprehensive source of guidance on tactile/haptic accessibility.

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Ergonomics of human-system interaction —

Part 971:

Accessibility of tactile/haptic interactive systems

1 Scope

This document provides both general and specific ergonomic requirements and recommendations for accessible tactile/haptic interactive systems, including accessible tactile/haptic interactions.

This document provides guidance for increasing the accessibility of interactive systems making use of tactile/haptic input/output modalities such as gestures, vibration, and force feedback. The guidance provided also supports alternative input modalities and the use of different output representations.

This document provides guidance for tactile/haptic interactions that is applicable to a variety of interactive systems, including assistive technologies (AT).

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO 9241-171, *Ergonomics of human-system interaction — Part 171: Guidance on software accessibility*

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ISO/IEC 29136, *Information technology — User interfaces — Accessibility of personal computer hardware*

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

assistive technology

AT

hardware or software added to, or incorporated within, a system that increases accessibility for an individual

EXAMPLE Braille display, screen reader, screen magnification software, eye tracking devices.

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[SOURCE: ISO 9241-171:2008, 3.5]

3.3

tactile

appertaining to touch

[SOURCE: ISO 9241-910:2011, 2.5]

3.4

haptic

appertaining to *haptics* (3.5)

Note 1 to entry: While there is no difference between haptic and *tactile* (3.3) in most dictionary definitions, in the area of haptics, researchers and developers use haptic to include all haptic sensations, while tactile is limited to mechanical stimulation of the skin. In ISO 9241, the word haptic covers all touch sensations and tactile is used in a more specific manner. Also, both terms can be used together to assist in searches.

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

3.5

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]

3.6

force feedback

force presented to and detected by a user

Note 1 to entry: Although this does not necessarily involve feedback, the term “force feedback” is commonly used in this context.

[SOURCE: ISO 9241-910:2011, 2.9]

3.7

gesture

movement or posture, of the whole body or parts of the body

[SOURCE: ISO/IEC 30113-1:2015, 3.1]

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

tactile cursor

tactile indication of where the user interaction via input device (e.g. keyboard or equivalent) occurs

3.10

sensory overload

user's experience where sensory experiences from the environment are too great for the individual's nervous system to successfully process or make meaning from

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3.11**personal computer**

microcomputer primarily intended for stand-alone use by an individual

[SOURCE: ISO/IEC 29136:2012, 3.5]

3.12**reach envelope**

<tactile/haptic> three-dimensional space in which a person can reach an interface without discomfort with respect to a specified user position

Note 1 to entry: Different users can use different body parts such as the arm, leg or head to reach for an object while sitting or standing.

Note 2 to entry: Users can augment their reach envelope using different assistive technologies, prosthetics or tools.

4 Conformity

If an organization claims conformity with this document, then the decisions about how it addresses the requirements and recommendations in this document or the justifications for any course of action that deviates from any of the recommendations shall be documented.

Documentation of a claim of conformity with this document shall be specific about the basis on which the claim is made and shall provide evidence to support the claim. An organization can claim conformity based on a self-assessment or an assessment carried out by another party.

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5 Physical accessibility (standards.iteh.ai)

While most users can use tactile/haptic interactions to some extent, users vary considerably in their tactile/haptic capabilities. Some important tactile/haptic capabilities which can vary across users and across contexts of use include:

- a) reach;
- b) range of motion;
- c) accuracy of motion;
- d) coordination of motion;
- e) speed of interaction;
- f) strength;
- g) stamina/endurance;
- h) sensitivity to physical stimulation;
- i) attention to physical stimulation;
- j) processing of the physical stimuli.

While there can be many causes for limitations in these capabilities, the important goal for developers of tactile/haptic interactions is to create systems that remain accessible despite any such limitations.

6 General requirements and recommendations

6.1 Compatibility with other standards

6.1.1 General

This document is intended to work with other more general International Standards.

NOTE 1 The main International Standards dealing with the ergonomics of tactile and haptic interactions are ISO 9241-910 and ISO 9241-920.

NOTE 2 International Standards dealing with the accessibility of interactive systems are identified in various sub-clauses below.

6.1.2 Hardware accessibility

ISO/IEC 29136 shall apply for issues relating to personal computer hardware.

6.1.3 Software accessibility

ISO 9241-171 shall apply for issues relating to software accessibility.

6.2 Approachability of tactile/haptic interactive systems

6.2.1 Size and space for approach and use of tactile/haptic interactive systems

The environment of use should provide people with the widest range of user needs, characteristics and capabilities with:

- a) adequate room to fit themselves and their assistive products or assistive technologies;
- b) an accessible path and a means to position oneself within reach of installed products;
- c) the ability to adjust the location and position of devices and controls.

NOTE 1 ISO/IEC Guide 71 describes the goal of approachability as “a system is approachable if diverse users can overcome any physical or psychological barriers and physically or remotely access it to accomplish the task”.

NOTE 2 Further approachability-related user accessibility needs applying to tactile/haptic interactions are found in ISO/IEC 29138-1 and other International Standards and in related research literature.

NOTE 3 ISO 9241-500:2018, 4.2.3, states that “an environment of use shall be planned to enable the intended user population to perform a range of tasks comfortably and efficiently”. Further information on the design of environments of use is available in ISO 941-500.

6.2.2 Reachability

When the user is physically interacting with the system (including AT), tactile/haptic inputs and outputs should be located within the reach envelope of the user.

Users with the widest range of needs, characteristics, and capabilities should be considered when determining the expected reach envelope.

NOTE 1 It is important to consider standing as well as sitting positions when determining the user’s reach envelope.

NOTE 2 The use of AT can modify the user’s reach envelope. AT can be used to provide support of all or part of their body when reaching. For example, a user can use a prosthesis to support and stabilize their arm. This affects their reach envelope.

NOTE 3 ISO/IEC 29136:2012, 5.4.2, states that “a control to turn the device on/off should be placed in a position where it is easy to locate and activate but not to activate accidentally”.

6.2.3 Reachability by remote control

Users should be enabled to use a device to interact with the system remotely if inputs and outputs are not reachable.

6.2.4 Stability

Devices involving tactile/haptic components should provide stability for the system when positioned so that:

- a) they are stable during intended use;
- b) they are not unintentionally activated or deactivated due to instability;
- c) they remain reachable and usable in their position.

EXAMPLE A control panel that can be tilted is a tactile/haptic component. When used, it provides sufficient resistance that the tilt is not changed.

6.3 Presentation of tactile/haptic information

6.3.1 Presentation of physical information

Tactile/haptic systems should support the presentation of some or all information (including feedback and cues) in tactile form.

NOTE 1 This can be accomplished either directly or via the connection of a tactile/haptic output device to the system.

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NOTE 2 It can be important to ensure that tactile alerts are available to notify users of the existence of critically important information (regardless of the modality of the information itself).

6.3.2 Multiple formats for presenting tactile/haptic information

Systems should support the presentation of tactile/haptic information in various formats.

NOTE Providing connectivity to a range of tactile/haptic output devices can increase the range of possible output formats.

EXAMPLE Formats of tactile/haptic information include embossed symbols, braille notations, pulses and vibrations.

6.3.3 Encoding of tactile/haptic information

The encoding of information within a tactile/haptic format should be designed to support the widest possible range of users.

NOTE 1 ISO 9241-920:2009, 4.2, provides guidance on specific tactile/haptic attributes for encoding information. ISO 9241-920:2009, 4.2.2 and 4.2.3, discuss human limits on the number of attribute values to use and attribute value discrimination.

NOTE 2 Individualization of tactile/haptic encoding is dealt with in [6.6](#).

EXAMPLE There are conditions (e.g. diabetes) where a person’s haptic discrimination can be lowered so that they need stronger stimuli.