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Ergonomics of human-system interaction

Part 960: Framework and guidance for gesture interactions (ISO 9241-960:2017)

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A list of organizations represented on this committee can be obtained on request to its secretary.

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European foreword

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Document Sharing Hub
Full document details: BS EN ISO 9241-960:2017

Contents

Page

Foreword ... **v**
Introduction ... **vi**
1 Scope ... **1**
2 Normative references ... **1**
3 Terms and definitions ... **1**
4 General ... **2**
4.1 Need for a standard on gesture usability ... 2
4.2 Usage ... 2
4.3 Intentional and unintentional gestures ... 3
4.4 Matching gestures and functionality ... 3
5 Ergonomics of gestures ... **4**
5.1 Ergonomic constraints and features ... 4
5.2 Device capabilities ... 4
5.3 Device constraints ... 4
6 Guidance in defining gestures ... **5**
6.1 Process for gesture definition ... 5
6.1.1 General ... 5
6.1.2 Exploring the design space ... 5
6.1.3 Identifying purposes ... 6
6.1.4 Designing gestures and gesture commands ... 7
6.1.5 Organizing gesture sets ... 7
6.1.6 Evaluating gestures ... 7
6.1.7 Iterating the gesture interface ... 8
6.1.8 Documenting gestures ... 8
6.1.9 Explaining gestures ... 8
6.2 Features of gestures ... 8
6.2.1 Mapping of gesture commands to functions ... 8
6.2.2 Nested gestures ... 8
6.2.3 Feedback for stroke gestures ... 9
6.2.4 Continuous feedback for gesture commands ... 9
6.2.5 Use of feedforward information for stroke gestures ... 9
6.2.6 Parameters of gesture commands ... 10
6.3 Timing and speed ... 10
6.3.1 Recognition of a gesture at different speeds ... 10
6.3.2 Use of the speed of a gesture ... 10
6.4 Tolerance of gesture interface ... 10
6.5 Sequences of gestures ... 10
6.5.1 Beginning a gesture ... 10
6.5.2 Feedback on gesture initiation ... 10
6.5.3 Completing the purpose of a gesture ... 10
6.5.4 Feedback on gesture completion ... 10
6.5.5 The need for transition between gestures ... 11
6.5.6 The effect of transitions between gestures ... 11
6.5.7 Overlapping gestures ... 11
6.5.8 State changes ... 11
6.6 Gesture sets ... 11
6.6.1 General ... 11
6.6.2 Purpose of a set of gestures ... 11
6.6.3 Consistency among gestures ... 11
6.6.4 Discriminability of gestures ... 12
6.6.5 Subsets within a gesture set ... 12
6.6.6 Alternative subsets within a gesture set ... 12

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Full document details: BS EN ISO 9241-960:2017

6.7 Documentation of gestures ... 12
6.7.1 Documentation ... 12
6.7.2 Naming a gesture ... 13
6.7.3 Visualization of gestures ... 13
6.7.4 Textual documentation of a gesture ... 13
6.7.5 Describing the purpose of the gesture ... 14
6.7.6 Documenting a gesture set ... 14
6.7.7 Documenting gestures with common movements ... 14

Annex A (informative) **When to use applications of gestures and gesture commands** ... **15**

Annex B (informative) **Taxonomies for documentation of gestures** ... **21**

Bibliography ... **23**

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Foreword

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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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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.

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Introduction

Tactile and haptic interactions are becoming increasingly important as candidate interaction modalities in computer systems such as special purpose computing environments (e.g. tablets), wearable technology (e.g. tactile arrays, instrumented gloves), and assistive technologies.

Tactile and haptic devices are being developed in university and industrial laboratories in many countries. Both the developer and the prospective purchaser of such devices need a means of making comparisons between competing devices and common design of interactions.

This document focuses on gestures and identification of gesture sets as a specific type of tactile/haptic interaction. It explains how to describe their features, and what factors to take into account when defining gestures.

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

ISO 9241-920 provides basic guidance (including references to related standards) in the design of tactile/haptic interactions.

ISO 9241-940 (under preparation) is to provide ways of evaluating tactile/haptic interactions for various aspects of interaction quality (such as haptic device attributes, logical space design and usability).

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Ergonomics of human-system interaction —

Part 960: Framework and guidance for gesture interactions

1 Scope

This document gives guidance on the selection or creation of the gestures to be used in a gesture interface. It addresses the usability of gestures and provides information on their design, the design process and relevant parameters that are to be considered. In addition, it provides guidance on how gestures should be documented. This document is concerned with gestures expressed by a human and not with the system response generated when users are performing these gestures.

NOTE 1 Specific gestures are standardized within ISO/IEC 14754 and the ISO/IEC 30113 series.

NOTE 2 Input devices such as tablets or spatial gesture recognition devices can capture gestures in 2D or 3D. All human gestures are 3D.

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 9241-910, *Ergonomics of human-system interaction — Part 910: Framework for tactile and haptic interaction*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 9241-910 and the following 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
feedforward gesture information
information provided by the *gesture interface* (3.4) to maintain consistency of a body part's movement with predicted single or multiple gesture trajectories

EXAMPLE A gesture might be visualized through inking the trajectory on the display. Several choices of possible future trajectories can be inked, thereby helping the user to complete the gesture.

Note 1 to entry: Feedforward gestural information improves self-explanation of the gestural interface.

3.2
gesture
movement or posture, of the whole body or parts of the body

Note 1 to entry: Operation of a physical keyboard is not addressed in this document.

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

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3.3
gesture command
instruction to the system resulting from a gesture input by the user, e.g. select, move, delete

[SOURCE: ISO/IEC 14574:1999, 4.5]

3.4
gesture interface
user interface that provides information and controls for a user to accomplish specific tasks with the interactive system by his/her *gestures* (3.2)

[SOURCE: ISO 9241-171:2008, 3.29 — Modified]

3.5
gesture set
grouping of gestures and their mapping to *gesture commands* (3.3)

EXAMPLE The conductor of a virtual orchestra uses a gesture set for a music performance.

3.6
intentional gesture
movement of the body or parts of the body to achieve a purpose

3.7
stroke gesture
intentional gesture (3.6) consisting of a movement trajectory of any part of the body

Note 1 to entry: As with other gestures, the definition refers to the movement itself, rather than its effect. Different gesture commands, including direct manipulation, could be defined for a stroke gesture.

Note 2 to entry: The gesture command is not dependent on the extent of the movement trajectory.

Note 3 to entry: Pressure can be used as a parameter of the gesture.

3.8
direct manipulation
dialogue technique by which the user has the impression of acting directly on objects on the screen; for example by pointing at them, moving them and/or changing their physical characteristics (or values) via the use of an input device

[SOURCE: ISO 9241-16:1999, 3.6]

4 General

4.1 Need for a standard on gesture usability

When pointing devices such as the mouse were developed in the 1960s, movement of the human hand became part of interactive systems. It took until the mid-1980s for the mouse to become standard in the office context. With the advent of multi-touch displays and 3D cameras, gestures appear to be a highly usable alternative to a tiny keyboard on a mobile device. The wide use of gestural interfaces makes it important to consider their usability.

4.2 Usage

Gestures may accompany language in order to strengthen what has been said. Such gestures are described in linguistics as “deixis” (pronounced “dīk-sis” or “dāk-sis”). The term “deixis” refers to words such as in “Put that there” which require contextual information provided by pointing in order to be fully understood. Gestures may convey their own meaning inherent to the actual movement of some body part and independent of some tangible physical object such as a pen or mouse. When using a pointing device while gesturing, the information and communication technology (ICT) system often

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restricts the movements because of limitations in the ability of the movement-tracking device. Gestures, like language, are culture-specific and misunderstandings may arise from inappropriate use of them.

4.3 Intentional and unintentional gestures

In designing gesture sets, emphasis is often placed on adopting gestures that are intentional or unintentional with respect to the system. A typical example of an intentional gesture is pointing at an object in order to select it, or waving your hand in front of a door to open it. Unintentional gestures in this context are gestures made for some other purpose (e.g. walking towards an automatic door, sitting down in the driver seat of a car), or gestures made subconsciously (e.g. body language). Such unintentional learnable gestures are particularly suited to general situations where the user might not be trained, when the user must learn the system quickly, or when the user must use the system under conditions of stress (e.g. time pressure).

Intentionality in gestures could also enable increased discriminability between them, thereby reducing inadvertent activation. For example, when it is desired not to activate an automatic door, many people stand still and avoid gesturing in front of the doors, knowing they are prone to open unintentionally.

4.4 Matching gestures and functionality

A gesture is the result of the user's intention to create a message for a recipient or computer while mapping it to the movement of the body or parts of the body, typically the upper limbs. Figure 1 illustrates variations of the intention applicable when gestures are expressed to an ICT system. The user on the left is interacting with a gesture interface on the right, using a selection of gestures from a gesture set. The user has an intention to transmit, and can make use of posture and movement. His choice of gestures may be intentional, or unintentional, depending on the situation. The gesture interface could provide feedback on the system's interpretation of the gesture, or even feedforward information to aid the user in completing the gesture (see 6.2 for further guidance on gesture features).

There is a continuum between interpreting gestures when controlling physical artefacts, such as directly manipulating a slider, and interpreting a gesture as some abstract symbol. Another continuum of mappings exists between matching gesture sets with the functionality of an interactive system overall and its context of use.

Identification of unintentional gestures is often avoided by requiring the user to signal the start and end of a gesture explicitly through some technical approach such as touching/releasing a screen with the fingers. All such touches will be interpreted as intentional gestures.

Mappings should take existing manual operations such as handwriting into account. Simple handwriting might be applicable to gestural interpretation but, typically, handwritten language is far more complex than a gesture vocabulary.

The matching process is applicable to user-centred design principles and, therefore, evaluation methods can be applied. ISO 9241-940 provides guidelines on how to evaluate gestures to be used with tactile/haptic devices. Some user groups can have special needs. In addressing them, a special set of gestures might be required, or completely different input alternatives might be needed.

EXAMPLE 1 A multi-touch gesture consisting of circulating thumb and forefinger around each other while touching a screen can be interpreted as a gesture command to change the orientation of an image. However, it can also be seen as the direct manipulation of the image's orientation if its presentation is updated continuously.

EXAMPLE 2 Switching between intentional and unintentional gestures occurs commonly on haptic devices. Blind people read braille with a finger while touching a braille display. At the same time such finger movements can express some intentional or unintentional gesture, if the braille display is touch sensitive. Technically, disambiguation can be based on the position or speed of movement of the finger over the tactile display. On one hand the reader can read braille being not aware of any such monitoring, on the other hand the intention can be formed to turn reading movements into gestural input.

NOTE The overall gestural interaction between the user and the ICT system is not discussed here and requires further guidance.

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