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Graphical symbols — Test methods —

Part 2: Method for testing perceptual quality

Symbols graphiques — Méthodes d'essai —

Partie 2: Méthode d'essai de la qualité perçue

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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.

International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 2.

The main task of technical committees is to prepare International Standards. Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75 % of the member bodies casting a vote.

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.

ISO 9186-2 was prepared by Technical Committee ISO/TC 145, *Graphical symbols*, Subcommittee SC 1, *Public information symbols*.

This first edition of ISO 9186-2, together with ISO 9186-1, cancels and replaces ISO 9186:2001, which has been technically revised.

ISO 9186 consists of the following parts, under the general title *Graphical symbols — Test methods*:

— *Part 1: Methods for testing comprehensibility*

— *Part 2: Method for testing perceptual quality*

Introduction

In addition to being comprehensible, a graphical symbol should have sufficient perceptual quality to enable the eventual user population in a practical situation to identify its elements correctly. If the symbol's ultimate meaning is to be understood, it is essential that its elements be identifiable. As an example to clarify this concept of identifiability, consider Figure 1. A person who sees this “lost and found” symbol should be able to report that the symbol consists of a question mark, a glove and an umbrella. If, for example, the glove is seen as a hand, the symbol's identifiability is insufficient. On the other hand, the umbrella would be correctly identified by the description “triangle apex down with a curved line at the top”. Stated more generally, an element is considered to be identified correctly, if either an accurate, shape-wise description is given, or the object intended to be depicted is named.

Figure 1 — Graphical symbol for the referent “lost and found” or “lost property”

For designers of graphical symbols, ISO provides guidelines and requirements to support the realization of optimal perceptual quality, such as ISO 22727 and ISO 3864-3.

However, applying requirements and criteria can never guarantee an optimal design outcome. There may be times when there is a need to examine empirically key aspects of proposed graphical symbols. Such a need may arise, for example, during initial design in order to determine how elements within a symbol are identified when the symbol subtends a small visual angle (due to small symbol size and/or large viewing distance), or after comprehension testing has shown there to be difficulties in interpreting a symbol and it is desired to scrutinize the elements making up the symbol as an aid in generating improvements. This part of ISO 9186 describes a test method for assessing the identifiability of symbol elements. The core of this test method is to show a symbol to appropriately representative respondents and have them describe what they see. The respondents' task is to name the elements of the symbol's image content. This procedure will assist in locating those elements within a symbol that may be the source of difficulty.

Graphical symbols — Test methods —

Part 2:
Method for testing perceptual quality

1 Scope

This part of ISO 9186 specifies a method for testing the perceptual quality of graphical symbols, to verify that the elements that constitute a graphical symbol are readily identifiable by the eventual user population.

2 Normative references

The following referenced documents are indispensable for the application 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 17724:2003, *Graphical symbols — Vocabulary*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 17724 and the following apply.

3.1
identifiability
property of a graphical symbol which enables its elements to be perceived as the objects or shapes depicted

3.2
graphical symbol
visually perceptible figure with a particular meaning used to transmit information independently of language

[ISO 17724:2003, definition 31]

3.3
graphical symbol element
part of a graphical symbol with a particular meaning

[ISO 17724:2003, definition 32]

3.4
image content
written description of the elements of a graphical symbol and their relative disposition

[ISO 17724:2003, definition 38]

3.5
referent
idea or object that a graphical symbol is intended to represent

[ISO 17724:2003, definition 61]

3.6
factor of distance
z
relationship between the height (h) of a sign and the observation distance (l), used to determine observation distances of signs

$$z = l/h$$

[ISO 17724:2003, definition 28]

3.7
visual acuity
capacity for seeing distinctly fine details that have very small angular separation

[ISO 17724:2003, definition 82]

3.8
visual angle
angle subtended by two lines drawn from the eye of the observer to the two extremes of the longest axis of the symbol being viewed

[ISO 17724:2003, definition 83]

3.9
corner marking
part of a graphical symbol original, four of which define its corners

[ISO 17724:2003, definition 17]

3.10
field of application
context or sphere of activity in which a graphical symbol is to be used

[ISO 17724:2003, definition 29]

3.11
comprehension test
procedure for quantifying the degree of understanding of a proposed graphical symbol

[ISO 17724:2003, definition 14]

4 Principle

This test method is used to assess whether the perceptual quality of a graphical symbol enables the eventual user population to identify correctly the element(s) constituting the symbol. Respondents are instructed to name the elements of the symbol. The final outcome of the test is the percentage of the respondents who describe correctly *all* elements of the symbol (the “correct identification percentage”). The test uses two or more presentation sizes of the symbols, keeping all other conditions constant. With the larger presentation size, the test assesses whether the elements are at all identified as intended by the designer. The other smaller size(s) serve(s) to simulate the minimal subtended visual angle(s) at which the symbol should function properly when used. With the smaller size(s), the test assesses whether the symbol is identifiable when it subtends such a smaller visual angle.

NOTE 1 The terms and concepts used in this part of ISO 9186 are clarified in Annex A.

NOTE 2 The organization to which the graphical symbol is submitted as a proposal for standardization, such as ISO, CEN, national or industry standards bodies, will specify whether the graphical symbol has to obtain a particular correct identification percentage before it can be accepted for standardization, and, if so, what this percentage is.

5 Pre-test information

Before initiating a test programme, the test administrators shall ensure that the submitter of the graphical symbol has checked the information required by the relevant standards organization or industry organization to which the findings may have to be submitted when the graphical symbol is proposed for standardization.

The submitter of the symbol shall provide information which includes the following:

— the name and contact details of the organization to which the test findings are to be submitted;

— details of the information that is required from the submitter and test administrators by that organization;

— a completed application form for each symbol as required by the standards organization. Where the standards organization does not have a specified application form for the submission of graphical symbols for standardization, the submitter shall complete an application form for each symbol as required by the test administrators.

NOTE 1 Application forms for submission of public information symbols for standardization by ISO/TC 145/SC 1 are available on www.iso.org/tc145/sc1 or from the ISO/TC 145/SC 1 Secretary. Application forms for submission of symbols to be used on safety signs for standardization by ISO/TC 145/SC 2 are available on www.iso.org/tc145/sc2 or from the ISO/TC 145/SC 2 Secretary. Application forms for submission of symbols for use on equipment for standardization by ISO/TC 145/SC 3 are available on www.iso.org/tc145/sc3 or from the ISO/TC 145/SC 3 Secretary.

The following items should be provided in addition to the completed form:

a) a description of the image content defining all elements of the symbol and their disposition;

b) the minimum subtended visual angle(s) at which the symbol's elements should be identifiable. These values can be deduced from the symbol sizes and viewing distances expected to exist when the graphical symbol is in use;

c) confirmation that the proposed graphical symbol has been designed in accordance with the relevant design principles, design requirements or design criteria;

NOTE 2 Design principles and design criteria for public information symbols for standardization in ISO 7001 are specified in ISO 22727; design principles and design criteria for safety signs for standardization in ISO 7010 are specified in ISO 3864-1 and ISO 3864-3.

d) an EPS (or TIFF) computer file of the symbol as required by the standards organization.

6 Test method

6.1 Apparatus and test material

6.1.1 The symbols shall be shown to respondents using a printed presentation, taking care that contrast and resolution of the printed material are adequate. If using an office printer, the resolution shall be at least 24 dots/mm (or 600 dots/inch).

6.1.2 Symbols shall be presented to respondents in a vertical plane at a viewing distance of (2 ± 0,04) m. The respondent's line of sight shall be (90 ± 10)° to the plane of the symbol. To ensure that this distance and the correct head position are maintained throughout the test, the respondent shall be instructed to adopt a comfortable sitting posture and to maintain this during the test.

A smaller viewing distance might be more practical but should be avoided because small, inevitable, head and body movements would have a relatively large effect on the actual viewing distance.

6.1.3 Lighting in the test room shall be between 95 lux and 105 lux, measured in the vertical plane at the symbol's location. The illuminance level used shall be recorded. Daylight shall be excluded from the test room.

NOTE The lighting level specified can be expected to simulate critical viewing conditions in actual use.

6.1.4 Symbol sizes shall be chosen from the following series: 80 mm × 80 mm, 40 mm × 40 mm, 28 mm × 28 mm, 20 mm × 20 mm, 14 mm × 14 mm, and 10 mm × 10 mm, except that, if the relevant standards organization or industry organization requires a different symbol size, this size shall be used in the test. The symbol's corner marking shall be used as reference.

NOTE 1 Given the viewing distance of 2 m, these six sizes correspond, respectively, to factor of distance z-values of 25, 50, 71, 100, 143 and 200 and visual angles of 2,30°, 1,15°, 0,80°, 0,57°, 0,40° and 0,29°.

NOTE 2 For safety signs, a z factor of 40 may be required. This can be achieved by using 50 mm × 50 mm symbols.

6.1.5 Identifiability shall be assessed for at least two symbol sizes. Each symbol shall be tested in the 80 mm × 80 mm size. One or more smaller symbol sizes shall be selected from the series given in 6.1.4. Such size (or sizes) shall be chosen so that the subtended visual angle equals or is smaller than the minimum visual angle (or angles) for identifiability as provided by the submitter of the symbol.

NOTE 1 With the larger presentation size, the test assesses whether the symbol's elements are identified as the objects or shapes intended by the designer. The aim of the smaller size(s) is to establish the identifiability of the elements under conditions that simulate viewing conditions in normal application.

There may be separate criterion percentages for the larger presentation size and the smaller sizes. Because the viewing conditions with the larger presentation size are optimal, the criterion percentage for this size should be high, e.g. 90 %. The criterion percentages for the smaller sizes can be lower and may depend on the symbol's type. For safety symbols, for instance, the criterion might be stricter than for public information symbols.

NOTE 2 As a test method mimicking all possible practical conditions cannot be devised, only presentation size is varied and other variables are kept constant.

6.1.6 By default, symbols shall be presented as black elements on a white background. However, if the test is carried out with graphical symbols that in practice always use one or more particular colours, e.g. symbols for use in safety signs, this colour (these colours) shall be used in the test materials.

6.1.7 If two or more symbols are presented to a respondent, these symbols shall all have the same size. If two or more symbols are tested, the presentation order of the symbols shall be randomized for each respondent. To avoid fatigue, the number of symbols presented to a respondent should not exceed 15.

6.1.8 The respondent shall have a means of entering a description of the symbol element or elements. The respondent can write down the description on a paper form or, alternatively, a computer keyboard can be used for the respondent to type the description. If necessary, e.g. when the respondent has illegible handwriting, the test administrator may enter the respondent's description.

6.2 Respondents

6.2.1 For each symbol size tested, an independent group of at least 25 respondents shall be used. The respondents should form a representative sample of the eventual user population in terms of age, sex, educational level, cultural or ethnic background and (when relevant) physical ability. Particular attention should be paid to the inclusion of vulnerable sectors of the population when testing graphical symbols to be used in a safety context.

NOTE The information collected from the respondents allows a judgement to be made concerning whether the sample is representative of the eventual user population.

6.2.2 All respondents shall have at least normal or corrected-to-normal visual acuity, unless the symbol will be used in an environment where the eventual user population will not be wearing spectacles or contact lenses.

NOTE Someone having “normal visual acuity” is able to see details subtending a visual angle of 1 minute of visual arc. This situation is also named “20/20 vision” or “6/6 vision”. “Corrected-to-normal” means that someone needs and is wearing glasses or contact lenses to reach this level of visual acuity.

6.2.3 Conducting the test with respondents from one country is sufficient. Consideration should be given, however, to the question of whether a graphical symbol's image content or specific field of application might require testing in more than one country.

6.2.4 Respondents shall not be exposed to the symbol(s) prior to the test. People who were involved in the design of a symbol shall not be used as respondents. If a judgement or comprehension test has already been conducted for a symbol, the respondents of such test shall not be used as respondents for a perceptual quality test.

6.3 Test administrator

Test administrators shall be appointed who are trained and experienced in running behavioural experiments. For consistency, having one test administrator is preferred.

6.4 Test procedure

6.4.1 Each respondent's visual acuity shall be assessed. A standard test should be used for measuring visual acuity, e.g. a Snellen letter chart or a Landolt ring chart, applying the illumination level prescribed for the test.

6.4.2 The task of the respondents shall be to produce a short description of all elements of the symbol. The instruction given to the respondents shall be in accordance with Annex B.

NOTE The respondents' task is derived from what is known in the literature as a naming task. Background information can be found in Reference [6] and Reference [7] in the Bibliography.

6.4.3 The task shall be self-paced, i.e. respondents shall be able to take as much time as they require to produce a description.

6.4.4 The symbol shall remain visible until the respondent indicates that she/he has finished entering a description.

7 Analysis and scoring

7.1 One judge shall be appointed to analyse and score the sentences produced by the respondents to describe each symbol. The judge shall be a behavioural scientist or somebody with comparable knowledge and experience of conducting tests with human subjects and analysing their responses. A test administrator (see 6.3) may also act as judge.

7.2 Starting from the submitted description of the elements of the image content, the judge shall develop a list of equivalent, correct descriptions for each element, preferably based on the outcomes of a pilot test with a limited number of respondents or otherwise drawn up in cooperation with one or more colleagues. People serving as respondents of the pilot test shall not be used in the main test. Two principles shall underlie the list of correct descriptions of an element:

a) any accurate shape-wise description of an element is correct; and

b) a description in which the right object, i.e. the object intended to be depicted, is named and is correct.