TECHNICAL REPORT

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Unwanted reflections from the active and inactive areas of display surfaces visible during use

Réflexions non désirées des zones actives et inactives des surfaces de l'écran visibles durant l'utilisation

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Foreword

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The committee responsible for this document is ISO/TC 159, *Ergonomics*, Subcommittee SC 4, *Ergonomics of human-system interaction*.

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Unwanted reflections from the active and inactive areas of display surfaces visible during use

1 Scope

This Technical Report provides users a summary of the existing knowledge about ergonomics requirements for unwanted reflections on electronic displays. The document furthermore provides some guidance on specification of unwanted reflections.

NOTE ISO 9241 contains normative requirements related to unwanted reflections. It is possible that the information contained in this Technical Report will be used for a future update of ISO 9241.

2 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

2.1
asthenopia
weakness or tiring of the eyes accompanied by pain, headache, and dim vision

Note 1 to entry: Symptoms include pain in or around the eyes; headache, usually aggravated by using the eyes for close work; fatigue; vertigo; and reflex symptoms such as nausea, twitching of facial muscles, or migraine.

[SOURCE: Taber's Medical Dictionary]

2.2
disability glare
glare that impairs the vision of objects without necessarily causing discomfort

2.3
direct glare
glare caused by self-luminous objects located in the visual field, especially near the line of sight

2.4
discomfort glare
glare that causes discomfort without necessarily impairing the vision of objects

2.5
glare
condition of vision in which there is discomfort or a reduction in the ability to see details or objects, caused by an unsuitable distribution or range of luminance, or by extreme contrasts

2.6
glare by reflection
glare produced by reflections, particularly when the reflected images appear in the same or nearly the same direction as the object viewed

2.7
gloss (of a surface)
mode of appearance by which reflected highlights of light sources of objects are perceived as superimposed on the surface due to the directionally selective properties of that surface

2.8
glossmeter
instrument for measuring the various photometric properties of a surface giving rise to gloss

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2.9
reflectometer
instrument for measuring quantities pertaining to reflection

2.10
specular gloss
ratio of the luminous flux reflected from an object in the specular direction for a specified source and receptor angle to the luminous flux reflected from glass with a refractive index of 1,567 in the specular direction

2.11
veiling glare (imaging)
light, reflected from an imaging medium, that has not been modulated by the means used to produce the image

3 Unwanted reflections within the context of the ISO 9241-3xx series

3.1 Glare and unwanted reflections

At various places in the ISO 9241-3xx series, we specifically adopt the CIE definition of glare, which includes both discomfort glare and disability glare. We note that the CIE defines discomfort glare verbally as:

> "glare which causes discomfort without necessarily impairing the vision of objects",[11]

and disability glare as

> "glare that impairs vision".[13]

Glare is commonly classed as direct glare, in which the eye is directly illuminated by some object, such as a display, a luminaire or the sun, and indirect glare, in which the eye is illuminated by light reflected from a surface such as that of a display screen.

3.2 Direct glare in the context of the ISO 9241-3xx standards series

ISO 9241-6 discusses two types of glare in the context of office working environments. Direct glare is described thusly:

> "Direct glare from daylight can typically be caused by a direct view of the sun or clouds and by their reflections on adjacent buildings.",[2]

and

> "Direct glare from artificial lighting can be caused by luminaires or illuminated room surfaces with high luminance".

Clearly, direct glare is seen to be associated with reflections as well as luminance sources directly in the user's line of sight.

In general, room lighting as a source of direct glare has been studied extensively and appropriate designs are well specified. However it is important to note that the recent introduction of new technologies such as luminaires composed of Light Emitting Diodes (LED) has stimulated reconsideration of both the concept of comfortable lighting,[14] and questions about the applicability of existing standards to environments illuminated by LEDs.[14][15] Although we will not discuss direct glare in detail in this paper, the specification of limits for the ambient illuminance for office computer workplaces in standards such as EN 12464-1 overlaps with the discussion of unwanted reflections from the inactive and active areas of displays that are visible during use.

Moreover, there is at least one specification within the ISO 9241-3xx series that deals specifically with the issue of direct glare as defined and discussed by CIE and ISO 9241-6:1999, 3.9, 5.4, Clause 10 and Annex A.

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