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Ergonomics of human-system interaction

Part 620: The role of sound for users of interactive systems

bsi.

National foreword

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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.

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.

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Introduction

In physics, sound is a vibration that propagates as an acoustic wave, through a transmission medium such as a gas, liquid or solid. In human physiology and psychology, sound is the reception of such waves and their perception by the brain. Unwanted sound is referred to as noise and is often perceived as the most serious disturbance factor at office workstations. In many industrial environments, sound can be a serious threat to health in general, not limited to auditory effects alone.

While sound is a measurable physical reality, acoustic noise is a psychoacoustical concept. The main goal of this document is minimizing the impact of noise while operating interactive systems, for example on the behaviour of users, their well-being and/or performance. This can be accomplished by technical measures, organizational means, interventions at the personal level and any combinations thereof.

The overall concept T-O-P (technical – organizational – personal) indicates the reasonable order of measures that can be taken to control the impact of the acoustic environment on human work. In this context, technical solutions have priority over organizational measures and personal protective equipment (PPE).

Psychoacoustics is the branch of psychophysics involving the scientific study of sound perception and audiology – how humans perceive various sounds. More specifically, it is the branch of science studying the psychological responses associated with sound (including noise, speech and music). This document deals with the undesired effects of sound, which can be classified as follows:

— impaired hearing;

— undesired responses of the central and autonomic nervous system;

— hindrance of verbal and other communication;

— reduced performance and cognitive functioning;

— annoyance.

Acoustic satisfaction of a space cannot be guaranteed without consideration of each of the three principle parameters of architectural acoustic design, formalized and established in the early 1900s by Sabine.[28] The three principle parameters are known as the 'ABCs' of architectural acoustics: A for absorption – Sufficient absorption in the built environment; B for blocking – Sufficient isolation of the built environment; and C for control – Control of sound levels in the built environment. For a given space, various measures in combinations can be taken to control the acoustic environment to achieve satisfaction. In ISO 9241-6 such measures are briefly listed and partly explained. Experience now suggests that a more thorough consideration of the acoustic environment is required because of the changes to work organization and tasks.

Controlling the acoustic environment is considered part of the T-O-P concept. It can comprise, for example:

— reducing the rating level

  — insulation in structural components;

  — reducing noise emission from equipment;

  — increasing sound absorption;

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  - reducing the ambient noise level;
- optimizing the signal-to-noise ratio
  - reducing the sound level in speech frequencies;
- sound reduction within use environments
  - sound-absorbing ceilings;
  - partitions;
  - adequate distances between workstations;
  - reducing reverberation.

While all these measures are of a technical nature (T of the T-O-P principle, Figure 1), the impact of sound events on persons and work can require organizational measures, such as holding small meetings dedicated to certain tasks outside the workspace. The final argument comprises measures at a personal level, including training to cope with adverse environments.



Figure 1 — T-O-P principle for controlling the impact of the acoustic environment on human work

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Ergonomics of human-system interaction —

Part 620: The role of sound for users of interactive systems

1 Scope

This document provides users with a summary of the existing knowledge about ergonomics considerations for the influence of sound in use environments on humans. It describes how unwanted effects of sound (noise) can be controlled. The main goals for controlling the acoustic use environment are reducing the rating level of sound in general, optimizing signal-to-noise ratio and sound reduction within the workspace.

This document also provides users with organizational measures that can be taken if and when technical measures do not help sufficiently. Also included are measures on a personal level.

This document deals with sound events that can cause extra-aural effects. Noise-induced hearing loss prevention and the ways to eliminate or reduce hazardous noise exposure are not covered by this document.

The intended users of this document include:

— developers of systems, products and services;

— public and corporate purchasers;

— occupational health and safety professionals;

— architects and interior designers;

— human resource professionals;

— usability, ergonomics or human factors professionals;

— users of interactive systems.

2 Normative references

There are no normative references in this document.

3 Terms and definitions

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

ISO and IEC maintain terminology databases for use in standardization at the following addresses:

— ISO Online browsing platform: available at https://www.iso.org/obp

— IEC Electropedia: available at https://www.electropedia.org/

3.1
irrelevant speech effect
ISE
negative effect of verbal sound level

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