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Ergonomic principles related to mental workload —

Part 1: General issues and concepts, terms and definitions

Principes ergonomiques concernant la charge de travail mental —
Partie 1: Questions et concepts généraux, termes et définitions

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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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For an explanation on 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 the following URL: www.iso.org/iso/foreword.html.

This document was prepared by Technical Committee ISO/TC 159, *Ergonomics*, Subcommittee SC 1, *General ergonomics principles*.

This first edition of ISO 10075-1, together with ISO 10075-2 and ISO 10075-3, cancels and replaces ISO 10075:1991, which has been technically revised.

The main changes compared to the previous edition are as follows:

— Clause 1 has been adjusted;

— Clause 2 and the terms 3.1.2, 3.2.1.2, 3.2.1.3, 3.2.2.1, 3.2.3.2, 3.2.3.2.1, 3.2.3.2.2 and 3.2.3.3 have been technically revised;

— the term 3.2.4.1 has been added;

— the term 3.2.3.2.3 has been corrected;

— Table A.1 has been updated;

— a linkage between ISO 10075-1 and ISO 6385 has been highlighted where applicable;

— Clause 3 has been restructured.

A list of all parts in the ISO 10075 series can be found on the ISO website.

Introduction

This document represents an extension of ISO 6385, with special respect to mental workload, describing general issues, concepts and terms in more detail because of the specific consequences that have to be taken into account in this domain.

These concepts from the field of mental workload include mental stress, mental strain and their effects.

Since there is a variety of different conceptions concerning mental workload, mental stress and mental strain, both in colloquial as well as in scientific usage, a standardization of the relevant concepts and terms in the field of ergonomics is required.

In this document, mental workload is considered as an umbrella term encompassing mental stress and mental strain. Mental stress is considered as a neutral term rather than the negative outcome from workload and other factors adopted in other approaches. In this way, it reflects a parallel with the engineering use of the terms stress and strain. Thus, mental stress refers to the causes of mental strain, and mental strain refers to the effects of that stress in the individual. This is consistent with the use of the terms in other ergonomics standards, e.g. on thermal stress (see ISO 7933).

Ergonomic principles related to mental workload —

Part 1:
General issues and concepts, terms and definitions

1 Scope

This document defines terms in the field of mental workload, covering mental stress and mental strain, and short- and long-term, positive and negative consequences of mental strain. It also specifies the relations between these concepts involved.

In this document, *mental workload* is regarded as an umbrella or generic term, referring to all the concepts and constructs mentioned in the document and does not have a specified or standardized meaning of its own within the document. This is consistent with the use of the term in ergonomics and its applications, where it can refer to mental stress, mental strain and their effects, i.e. both to the causes and the effects. In this document, the term mental workload will thus not be treated as a technical term but only as a reference to the domain of mental workload.

NOTE Annex A gives additional explanations of terms and concepts.

This document applies to the design of working conditions with respect to mental workload and is intended to promote a common usage of terminology between experts and practitioners in the field of ergonomics as well as in general.

This document does not address methods of measurement and principles of task design, which are dealt with in ISO 10075-2 and ISO 10075-3.

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 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 Terms and definitions associated with mental workload

3.1.1
mental stress
total of all assessable influences impinging upon a human being from external sources and affecting that person mentally

Note 1 to entry: Since mental stress in this document refers to the total of all assessable factors impinging upon an individual mentally, the colloquial usage of the term mental stresses (plural) is inconsistent with the definition of mental stress in this document. The "total of all assessable influences" means that mental stress is usually comprised of different factors contributing to this total. The combination of all these factors is the resulting mental stress. Additional factors will change the resulting mental stress, but are not considered as new kinds of mental stress. It is the result of the coaction of all effects that is referenced by the term mental stress. For these reasons, a clear terminological differentiation between mental stress as the total of all impinging effects (as defined above) and single or multiple factors as components of this mental stress is required.

Note 2 to entry: The use of "mental stress" in this document is compatible with the use of the term "work stress" in ISO 6385, where it is synonymously used with the term "external workload".

3.1.2
mental strain
immediate effect of *mental stress* (3.1.1) within the individual depending on their current condition

EXAMPLE Examples of relevant conditions can be age, gender, skills, coping strategies, fatigue, mood.

Note 1 to entry: Considerations in 3.1.1, Note 1 to entry also apply to the concept of mental strain, which refers to the total, immediate impact within the individual resulting from mental stress.

3.2 Consequences of mental strain

NOTE The order of the following terms and definitions does not imply any functional relationships.

3.2.1 Facilitating effects resulting from short-term exposure

3.2.1.1
warming-up effect
frequent consequence of *mental strain* (3.1.2) which, soon after an activity has started, results in a reduction of the effort required to perform that activity relative to the effort initially required

3.2.1.2
activation
internal state resulting in increased mental and physical activity

Note 1 to entry: *Mental strain* (3.1.2) can lead to different degrees of activation, depending on its duration and intensity. There is a range in which the activation level is optimal, e.g. neither too low nor too high, ensuring best functional efficiency.

3.2.1.3
learning
process based on (work) experiences that leads to enduring changes in behaviour or behavioural potential, e.g. plans, attitudes and values

3.2.2 Facilitating effects resulting from long-term or repeated exposure

3.2.2.1
practice effect
enduring change in individual performance, associated with *learning* (3.2.1.3) processes, following from repeated experience of the same kind of *mental strain* (3.1.2)

3.2.2.2
competence development
complex form of learning involving the acquisition, consolidation, enhancement and/or differentiation of cognitive, emotional, social and motor skills and abilities, as strain-related consequence of an active engagement with a task

Note 1 to entry: Competence development can have different facets, e.g. factual, methodological and/or social ones.

Note 2 to entry: Competence development is a facilitating long-term effect of the exposure to mental stress (3.1.1).

3.2.3 Impairing effects resulting from short-term exposure

NOTE Impairing effects can be distinguished by the temporal pattern of their emergence and recovery, including the means necessary to achieve this recovery (which can require taking time for recuperation or variation in activity). They can also be distinguished by their symptoms which can be general or more specific.

3.2.3.1
mental fatigue
temporary impairment of mental and physical functional efficiency, depending on the intensity, duration, and temporal pattern of the preceding *mental strain* (3.1.2)

Note 1 to entry: In contrast to *fatigue-like states* (3.2.3.2) recovery from mental fatigue is achieved by rest rather than changes in activity.

Note 2 to entry: This reduced functional efficiency becomes apparent, e.g. in feelings of tiredness, less favourable relationships between performance and effort, type and frequency of errors. The extent of this impairment is also determined by individual preconditions.

3.2.3.2
fatigue-like states
states within the individual as effects of *mental strain* (3.1.2) resulting from situations offering little variety, which, in contrast to fatigue, quickly disappear after changes in the task and/or the environment/situation

Note 1 to entry: As a rule common with *mental fatigue* (3.2.3.2), feelings of tiredness also occur in fatigue-like states. However, they differ from mental fatigue by their transitoriness. Particularly marked interindividual differences can be found with these fatigue-like states.

3.2.3.2.1
monotony
slowly developing state of reduced *activation* (3.2.1.2) which is mainly associated with drowsiness, tiredness, decrease and fluctuations in performance, reductions in adaptability and responsiveness, as well as an increase in variability of heart rate often associated with/facilitated by long, uniform, repetitive task performance

EXAMPLE Monotony can be found in long, uniform, repetitive tasks or activities, e.g. assembly tasks, data input.

Note 1 to entry: Symptoms of monotony usually develop more slowly than in the development of *reduced vigilance* (3.2.3.2.2). Recovery from this state does not necessarily occur immediately after a change in the environment or the task.

Note 2 to entry: Monotony and *reduced vigilance* (3.2.3.2.2) can be differentiated with respect to the circumstances of their causal conditions, not with respect to their effects on performance and symptoms of alertness. Monotony can be found in uniform tasks with a high degree of repetitiveness.

3.2.3.2.2
reduced vigilance
state with reduced activation and detection performance mainly associated with monitoring tasks offering only little variation

EXAMPLE Reduced vigilance can be found in monitoring or inspection tasks, e.g. when monitoring radar screens or instrument panels.

