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Cognitive accessibility —

Part 1: General guidelines

Accessibilité cognitive —

Partie 1: Lignes directrices générales

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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 of 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 www.iso.org/iso/foreword.html.

This document was prepared by Technical Committee ISO/TC 173, *Assistive products*.

A list of all parts in the ISO 21801 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.

Introduction

Cognitive impairment can affect anyone. It can be temporary or permanent. Cognitive impairment might affect a person's ability to

— perceive information including visual, auditory and haptic (e.g. reduced visual perception which can cause problems recognizing words, pictures or other visual input),

— sustain, direct and divide attention (e.g. reduced ability to filter unwanted stimuli, such as light or sound, or difficulties multi-tasking),

— register and store information and retrieve it as needed, including: store and maintain new episodes, knowledge and skills, and retrieve and maintain former episodes, knowledge and skills,

— communicate, including understand and express oneself both verbally and non-verbally,

— orientate oneself, and navigate spatially and topographically,

— execute activities, including solve problems; organize; plan; hold on to a plan or strategy and change strategy when appropriate; initiate, carry out, and terminate activities appropriately,

— think and reason in an abstract manner (e.g. understand generalizations and associations and causal connections), or

— understand and manage numbers and time (e.g. calculate or comprehend concepts of money, size, or lapses of time).

Activity limitations and participation restrictions for people with cognitive impairment can be reduced significantly through the design of systems and the built environment. The adoption of Universal Design (UD) approaches in standards and policies is key to facilitate access to mainstream systems. Strategies and principles consistent with the UD approach strive to promote features in systems and the built environment that are functional and comfortable for everyone.

Mainstream systems are often considered to be more affordable and socially acceptable than assistive products. Unlimited access to mainstream technologies and systems, including information technologies, contributes to the inclusion of people with the widest range of cognitive needs, in the widest range of life situations. Knowledge about the widest range of cognitive needs and how activities and environmental factors can be modified to increase participation is extensive but not easy to comprehend and transfer to the design and delivery of systems. Designers and manufacturers of mainstream systems who are aware of those needs can significantly contribute to accessible and usable systems.

Although named cognitive 'accessibility', this document also adopts the concept of 'usability' to ensure that design principles are based on the unique experiences of users rather than on assumptions of human abilities.

This document is structured around three concepts, each presenting a set of guidelines:

— Motivation and focus;

— Representation and understanding;

— Action.

This document is a general guideline on cognitive accessibility for all systems. In a specific domain or in a specific context there, can be more detailed standards and guidelines addressing cognitive accessibility, see References [5] and [6].

It is important to engage people with cognitive impairments and their significant others, in the development of mainstream and assistive products for people with cognitive impairments.

Cognitive accessibility —

Part 1:
General guidelines

1 Scope

This document presents guidelines for the design and development of cognitively accessible systems, including products and services and built environments.

This document is relevant to mainstream systems as well as those designed specifically for people with disability.

Within the broad field of accessibility, this document is limited to guidance related to cognitive accessibility.

NOTE 1 It acknowledges, however, that diverse sensory perceptions can impact cognitive accessibility.

NOTE 2 While the following guidance in this document can benefit all users, it is included here because failure to follow it could lead to barriers that would prevent some potential users from being able to use the system at all.

This document is relevant to all types of systems. However, some particular recommendations can only be followed for some types of systems:

— Some of the guidance is relevant to a fixed system (e.g. a non-computerized consumer product or a user manual);

— Some of the guidance applies to systems containing some level of computer-based processing (e.g. a microwave oven or an ICT-system);

— Some of the guidance applies to systems that use advanced computer processing that supports individualization (e.g. an application in a smart phone);

— Some guidance applies to combinations of the above.

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 https://www.iso.org/obp

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

3.1
accessibility
extent to which products, *systems* (3.5), services, environments and facilities can be used by people from a population with the widest range of user needs, characteristics and capabilities to achieve identified goals in identified contexts of use

Note 1 to entry: Context of use includes direct use or use supported by assistive technologies.

[SOURCE: ISO 9241-112:2017, 3.15]

3.2
cognition
mental actions or processes of acquiring knowledge and understanding through thought, experience, and the senses

Note 1 to entry: Specific cognitive functions include; perception, attention, memory, linguistic functions (verbal, non-verbal), reasoning, planning, problem solving, decision making, reading and calculating. Cognition interacts with global mental functions (e.g. consciousness, energy, motivation) and affective functions (e.g. emotion, mood and self-regulation).

3.3
cognitive accessibility
extent to which *systems* (3.5) can be used by people from a population with the widest range of user needs, cognitive characteristics and capabilities to achieve identified goals in identified contexts of use

3.4
haptic
relating to the sense of touch, in particular relating to the perception and manipulation of objects using the senses of touch and proprioception

Note 1 to entry: While there is no difference between haptic and tactile in most dictionary definitions, in the area of haptics, researchers and developers use haptic to include all haptic sensations, while tactile is limited to mechanical stimulation of the skin.

3.5
system
product, service, or built environment or any combination of them with which the *user* (3.7) interacts

[SOURCE: ISO/IEC Guide 71:2014, 2.1]

3.6
time management
mental functions of ordering events in chronological sequence, allocating amounts of time to events and activities

Note 1 to entry: This definition is taken from Reference [9].

3.7
user
individual who accesses or interacts with a *system* (3.5)

[SOURCE: ISO/IEC Guide 71:2014, 2.2]

3.8
user profile
set of user requirements stored in a way that it can be re-used by a *system* (3.5)

4 Implementing the recommendations

In order to implement the recommendations in this document,

a) the ability to follow each recommendation in the document shall be determined;

b) any recommendation determined not being able to be followed shall be justified;

c) any recommendation being able to be followed but that is not followed shall be justified.

This implementation can be evaluated by self-assessment, or by an assessment carried out by another party.

Annex A provides assistance in documenting the implementation of the recommendations in this document.

5 Motivation and focus

5.1 General

People differ markedly in their means of engagement or motivation to learn or to perform a task. There are a variety of factors that can influence individuals including neurology, culture, personal relevance, subjectivity, and background knowledge. Some people are highly engaged by spontaneity and novelty while others might feel disengaged or even frightened by those aspects, preferring a strict routine. There is no single means of engagement that will be optimal for everyone, so providing multiple options for engagement is essential.

5.2 Means of motivation

5.2.1 Recruiting interest

The system should provide options for recruiting interest. People differ significantly in what interests them and this changes over time. A person's interests might shift with age, the gaining of new insights or activities, or changes in the environment.

NOTE 1 A way of recruiting interest and engagement is to highlight the usefulness and to demonstrate the relevance of the system.

NOTE 2 It might be useful to find alternative ways of recruiting interest, since recruiting interest leads to attention and attention leads to engagement.

NOTE 3 If the system does not interest people, it might not be used.

5.2.2 Individual options

The system should optimize individual options. Once a goal for a system has been determined, options can be given on how to access and how to use the system. Options can be related to context, use, support, or means of achieving the overall objective of the system.

NOTE 1 Optimizing options is not about presenting as many options as possible, it is about presenting a set of meaningful and appropriate options.

NOTE 2 Options are a way of maximizing the chances of success. People are more likely to succeed in using the system when there are meaningful options.

NOTE 3 See also ISO/IEC Guide 71:2014, 8.2.5.

5.2.3 Autonomous use

The system should support autonomous use. In situations of individual use or in cooperation between individuals, means to provide autonomy for each individual is important.

NOTE 1 Some people might always need support from either humans or assistive technology to achieve the desired outcome.

NOTE 2 If the use of the system is likely to involve cooperation, means for cooperation might be useful.

5.2.4 Usefulness and relevance

The system should optimize usefulness and relevance. People find different qualities useful and relevant. Usefulness draws on how relevant and valuable the system is for people.

NOTE Usefulness and relevance can be dependent on personal preferences, lifestyles, contexts, socio-cultural aspects, age and ability.

5.2.5 Level of abstraction

The system should provide options for the level of abstraction. Any design uses some level of abstraction. People might have difficulty with both high and low levels of abstraction.

EXAMPLE 1 People using digital maps and support for wayfinding can switch between satellite (real world) presentations, map view and text view. The detail shown in both satellite and map view can be increased or decreased by zooming in and out.

EXAMPLE 2 Orientation with the help of arrows pointing the direction at intervals is more abstract compared with following a continuous painted line on the floor.

5.2.6 Focus on the desired outcome

The system should support sustained focus on the desired outcome. Over the course of any sustained usage, there are many sources of interest and engagement that compete for attention and effort.

NOTE 1 Some people depend on support to remember their initial goal or to maintain a consistent vision of the rewards of achieving that goal. For these people, it is useful to build in periodic or persistent reminders or prompts of both the goal and its value, in order to sustain effort and concentration in the face of distraction.

NOTE 2 The goal can be displayed in multiple ways and at different stages. Long-term goals can be divided into short-term objectives or tasks.

NOTE 3 The desired outcome can be visualized and supported in different ways

5.2.7 Challenge by varying demands and resources

The system should optimize challenge by varying demands and resources. People vary in what motivates them to do things. They respond to different challenges and they respond to challenges differently.

NOTE 1 The right level of challenge is useful for maintaining interest. Engagement and motivation can be maintained by providing a balanced and varied range of challenges and resources.

NOTE 2 Differentiation in degrees of complexity or difficulty, availability of alternatives, degrees of freedom in performance, and access to appropriate resources can be tools for optimizing challenge.

5.2.8 Self-regulation, self-assessment and coping

The system should provide options for self-regulation, self-assessment and coping. People might have difficulty regulating their own emotions and motivations. Careful assessment of the design solutions' impact on an individual's emotions and affect can assist with self-regulation, self-assessment and coping.

NOTE Self-regulation of emotions can be affected by the design of the system.

EXAMPLE 1 An option to undo a previous action or a previous decision is self-regulatory support.

EXAMPLE 2 An overview before accepting a purchase, or a warning before a known risk factor might support self-assessment.

EXAMPLE 3 Features and functions that help people monitor and reflect on their usage and levels of success in use will help them to recognize both difficulties and progress. Access to statistics and results, or other kinds of positive or negative feedback, and reports on changes can be helpful.

5.2.9 Unintentional triggers of inappropriate reactions

The system should avoid unintentional triggers of inappropriate reactions.

NOTE Design that intentionally interferes with self-regulatory processes, or that attempts to coerce people to make decisions or take actions that are inappropriate for or detrimental to them is unethical. However not all intentional interference with self-regulatory processes is unethical.

5.2.10 Differences in coping abilities

The system should provide means to meet individual differences in coping abilities. People have different coping abilities and strategies. They also have different abilities in adopting strategies that will enhance their coping skills.

NOTE 1 Coping skills and strategies might include reminders, models, checklists, examples as well as adjustable settings, personal profiles, support or guidance, etc.

NOTE 2 See also ISO/IEC Guide 71:2014, 8.2.5.

5.2.11 Self-determination and confidence

The system should optimize for self-determination and confidence. Success in usage and autonomous usage in particular, builds self-determination, pride, trust and confidence in the system.

5.2.12 Threats and trust

The system should minimize threats and maximize trust. Psychological barriers in a system can exist in the form of threats that inhibit or prevent people from usage, or decrease self-determination, independence and satisfaction.

NOTE 1 These barriers can exist as intrinsic feelings even when no physical threat exists. Some design patterns and shapes can be regarded as threatening by some people. It is beneficial if design, concepts and content are used to build trust.

NOTE 2 Design that contributes to the reduction of potential threats creates trustworthy systems.

EXAMPLE Examples of known features that, in some situations, can be regarded as threatening include

— haptic: sharp angles, uncomfortable textures, hot or cold surfaces,

— audio: continuous noises or beeps; buzzing from machinery,

— visual: excessive information displayed with poor typography, shapes with sharp angles.

5.2.13 Accessibility and safety

The system should avoid enhanced accessibility compromising safety. It is important that solutions designed to increase accessibility do not result in loss of privacy, increased risks to personal safety or security, or the stigmatization of individuals.

5.3 Focus, attention and feedback

5.3.1 Object in focus

The system should clarify the object in focus. It is important for the user to understand which object or feature is intended to be in focus. Different means of drawing attention to the intended focus can be used and preferably consistently.

NOTE 1 Focus is often drawn by visual cues, but visualization is often not enough to ensure perception of focus for all people in all situations. Other means such as sound or haptic cues might be needed.

NOTE 2 Focus is useful in processes where a logical order of interaction or presentation is present.

EXAMPLE 1 Insufficient colour contrast can cause difficulties perceiving what is in focus.

EXAMPLE 2 A visually and haptically highlighted button can provide clues as to what might be in focus.

EXAMPLE 3 Calling the user's name might help that person to focus on a relevant object.

5.3.2 Shifts in focus

When a new object is supposed to be in the user's focus, support should be provided for the user to shift focus from one object to the next. The system should support/facilitate shifts in focus

NOTE Information about present location is often useful to assist users to change focus from one object in order to focus on the next. This can be supported by design that emphasizes both the previous and the new focus.

5.3.3 Inadvertent changes of focus or division of attention

The system should avoid features that inadvertently change focus or divide attention. Distractions might prevent people from fulfilling a desired task. Design strategies aimed at avoiding inappropriate changes in focus and attention are important.

NOTE 1 Environmental conditions can result in people losing attention.

NOTE 2 Losing focus is related to losing interest and some users have significant difficulty maintaining focus on the intended target.

NOTE 3 Known features that might divide attention could include

— flickering objects,

— moving objects or movement in an interface,

— sounds,

— irrelevant or illogical content,

— automated actions outside the user's control,

— complex or unclear demand, and

— long processes that cannot be paused.

5.3.4 Feedback

The system should provide relevant feedback. Feedback should be provided at all stages, with not providing feedback being the exception. Providing people with relevant feedback is often a matter of balance and timing. People need feedback to know the outcome of a task, when something has happened, or just to be reassured that they are progressing as expected.

NOTE Determining what type of feedback is appropriate is a useful design consideration.

EXAMPLE Feedback can be:

— Positive: Aiming to engage and motivate. Providing reassurance to the user.

— Neutral: Displaying what has happened. Summarizing activity or presenting current status and values, e.g. sound feedback/rewarding click. Presenting options.

— Negative: Alerting the user to possible errors.

