Bluffers' Guide to ISO 9241

David Travis, Userfocus ltd.

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About Userfocus

Userfocus is a consultancy and training company that helps organisations reduce costs and increase profits by making stuff easier to use. Our clients are typically blue-chip organisations like eBay, RBS and Hewlett Packard who want help improving the usability of their web site, intranet or handheld gadget. Unlike competitor companies, our consultants are experimental psychologists, which means we provide rigorous insights into audience expectations and behaviour.

Preface

What is ISO 9241?

In the dusty institutions where usability standards gather to party with each other, ISO 9241 is a bit of a celebrity. It is widely cited by people who would be hard pushed to name any other standard, and parts of it are virtually enshrined in law in some European countries (such as the UK). But as is the fate of many celebrities, all most usability professionals know about the standard is its name: "Ergonomic requirements for office work with visual display terminals (VDTs)". Ah, VDTs: as evocative of the eighties as yuppies and punk rock music. This makes the standard seem out of date, but don't be fooled. ISO have renamed it: as the parts are re-issued they will adopt the much more modern title, "The Ergonomics of Human System Interaction".

It is a shame that ISO 9241 is more widely cited than read because it includes a wealth of information that covers every aspect of usability, including hardware, software and usability processes. You could use the standard to design a workstation, evaluate a display, set usability metrics, evaluate a graphical user interface, test out a new keyboard, assess a novel interaction device such as a joystick, check that the working environment is up to scratch, measure reflections and colour on flat panel displays and assess your new touch sensitive device. It contains checklists to help structure a usability evaluation, examples of how to operationalise and measure usability, and extensive bibliographies. It even has the courage to define usability!

There are a few reasons why it is not widely read.

- Standards are not easy to get hold of. You can't get them in bookshops or find them on the high street (although you can order them online through ISO).
- ISO 9241 is expensive. If you purchase all of the parts from ISO's website (www.iso.org) it will literally cost you £1000s.

- The use of the phrase "office work" in the title of the older parts of ISO 9241 makes it sound like the standard is relevant only for, well, office work. In practice, many of the parts are relevant to a wide range of applications.
- Standards have a reputation for being inaccessible, either because the language is legalistic or because they are written in a peculiar dialect of English that is favoured by people for whom English is not their first language.
- ISO 9241 is big. If you pile all the parts on top of each other it measures nearly half a foot in thickness (that's 15cm to my European colleagues). This is about as thick as the hardback versions of Nielsen's *Usability Engineering*, Shneiderman's *Designing the User Interface* and Helander's *Handbook of Human-Computer Interaction* combined (let alone Travis's *E-Commerce Usability*).

The truth is that few people would be interested in all of the parts of ISO 9241, which is why indeed it has been published as separate documents. But it is hard to work out which particular part you are interested in just from the title, and that is about all the information that is publicly available (for example, the ISO web site doesn't give you the table of contents or even tell you how many pages are in the standard). Also, although you may be interested only in a few of the parts, it's always nice to get an overview and see what you are missing in the other parts. You might choose the standard credit card over the platinum version, but you still like to know about the extras you have forfeited.

I hope this document comes to your rescue. View it as your Michelin travel guide to the various destinations of ISO 9241. If nothing else, it may help you bluff your way through a meeting.

Who is ISO?

ISO stands for the International Organisation for Standardisation and is a network of national standards institutes from 147 countries. Because

technology is an international business, manufacturers pay attention to international standards. Many countries (especially those in Europe) also adopt ISO standards as national standards, and so you may find parts of ISO 9241 cited as the route to compliance with health and safety legislation.

Other usability standards

ISO 9241 is just one of many standards that apply to usability and ergonomics. Other relevant ISO usability standards include:

- IEC 62366:2008 Medical devices -- Application of usability engineering to medical devices
- ISO 10075:1991 Ergonomic principles related to mental work-load -- General terms and definitions
- ISO 11064-1:2000 Ergonomic design of control centres -- Part 1: Principles for the design of control centres
- ISO 14915-1:2002 Software ergonomics for multimedia user interfaces -- Part 1: Design principles and framework
- ISO 17287:2003 Road vehicles -- Ergonomic aspects of transport information and control systems -- Procedure for assessing suitability for use while driving
- ISO 20282-1:2006 Ease of operation of everyday products -- Part 1: Design requirements for context of use and user characteristics
- ISO 6385:2004 Ergonomic principles in the design of work systems
- ISO 9355-2:1999 Ergonomic requirements for the design of displays and control actuators -- Part 2: Displays
- ISO/IEC 25051:2006 Software engineering -- Software product Quality Requirements and Evaluation (SQuaRE) -- Requirements for quality of Commercial Off-The-Shelf (COTS) software product and instructions for testing

- ISO/IEC 25062:2006 Software engineering -- Software product Quality Requirements and Evaluation (SQuaRE) -- Common Industry Format (CIF) for usability test reports
- ISO/TR 16982:2002 Ergonomics of human-system interaction -- Usability methods supporting human-centred design

Some of these standards are currently being re-written and will appear in the ISO 9241 stable.

Just as each of the parts of ISO 9241 need to be seen in the context of the whole standard, ISO 9241 needs to be seen in the context of national and International standardisation efforts.

A note on the renumbering of ISO 9241

The interest in ISO 9241 encouraged the standards sub-committees to create new usability standards. However, people soon realised that just listing the standards sequentially would make it hard for people to work out which standard to read. ISO therefore decided to embark on a program of renumbering the parts of the standard to make its overall structure a little clearer. This means all of the standards will be renumbered once they have been revised and re-issued.

Three part numbers will be retained from the original ISO 9241 structure, as these address issues that apply across all parts of ISO 9241:

- Part 1 Introduction.
- Part 2 Job design.
- Part 11 Hardware and software usability.

An additional part that also applies across all of ISO 9241 is "Accessibility and human-system interaction", so this is given part 20.

The rest of the parts are structured in 'hundreds' as follows:

- 100 series Software ergonomics
- 200 series Human system interaction processes

- 300 series Displays and display related hardware
- 400 series Physical input devices - ergonomics principles
- 500 series Workplace ergonomics
- 600 series Environment ergonomics
- 700 series Application domains - Control rooms
- 900 series Tactile and haptic interactions

The new structure reflects the numbering of the original ISO 9241 standard: for example keyboards was originally part 4, so now the 400 series is devoted to physical input devices. In each section, the 'hundred' is an introduction to the section, for example, part 400 gives an introduction to physical input devices. The number of parts in each section varies depending on the complexity of the area and the need for specific standards.

Part 1: General introduction

How do I cite it?

ISO 9241-1:1997 Ergonomic requirements for office work with visual display terminals (VDTs) -- Part 1: General introduction.

What do I need to know about it?

This part of ISO 9241 serves as an introduction to all of the parts in the ISO 9241 series.

It describes the purpose of the 9241 standard and discusses the user performance philosophy. This philosophy is the bedrock of the ISO 9241 series. Standards making is a slow process, partly because of the need for consensus and partly because it takes some time for stability to emerge in any new technology. This means that ergonomics standards may not be available to support the procurement of newer interface devices (such as a novel keyboard or a new type of visual display). In such cases, requiring manufacturers to demonstrate evidence of the usability of their products provides the most effective route for ensuring good ergonomics quality. So a number of the parts in the ISO 9241 series contain user performance tests, to help manufacturers do just that.

The standard also includes a bibliography and an informative annex that describes how to apply the software parts of ISO 9241 (parts 10-17).

Under ISO's plans to renumber ISO 9241, this part will be replaced by ISO/TR9241-1 and ISO 9241-130.

Who is it written for?

Anyone interested in any part of ISO 9241.

How many pages does it have?

16

What are the main sections in this standard?

- Scope
- Normative reference
- Definitions
- General introduction to ISO 9241
- Purpose and intended users
- Product specification, technological change and the user-performance approach
- Structure of ISO 9241
- Guidance on use of ISO 9241
- Reporting conformance to parts of ISO 9241
- Annex A: Description and application of software parts (in ISO 9241-10 to ISO 9241-17)
- Bibliography
- Annex ZA: Normative references to international publications with their relevant European publications

Part 2: Guidance on task requirements

How do I cite it?

ISO 9241-2:1992 Ergonomic requirements for office work with visual display terminals (VDTs) -- Part 2: Guidance on task requirements.

What do I need to know about it?

This part of ISO 9241 provides guidance on the design of tasks and jobs that involve work with visual display terminals.

It provides guidance on the characteristics of well-designed tasks (for example, you should "recognise the experience and capabilities of the user population") and describes how to go about specifying design requirements (for example, by observational studies, questionnaires and interviews). It then describes how to develop an effective implementation plan. Finally, it points out that you need to continuously monitor the system after implementation because user needs will change over time.

Who is it written for?

Managers and designers responsible for organising work practices.

How many pages does it have?

7

What are the main sections in this standard?

- Scope
- Normative reference
- Definitions
- Task design

- Evaluation and maintenance of the system

Part 3: Visual display requirements

What do I need to know about it?

This part has been withdrawn. It's been replaced by Part 303.

Part 4: Keyboard requirements

What do I need to know about it?

This part has been withdrawn. It's been replaced by the part 400 sub-series.

Part 5: Workstation layout and postural requirements

How do I cite it?

ISO 9241-5:1998 Ergonomic requirements for office work with visual display terminals (VDTs) -- Part 5: Workstation layout and postural requirements.

What do I need to know about it?

This part of ISO 9241 specifies ergonomic guiding principles that apply to the design of workstation equipment used for display screen work.

The standard emphasises that the design of the workplace needs to be preceded by an analysis of the tasks that it is intended to support. This information will help identify the different tasks that are carried out and the relative contributions of the different components that support the tasks, which in turn will help users adopt a comfortable and healthy working posture.

The specifications are derived from five guiding principles:

- versatility-flexibility
- fit
- postural change
- user information
- maintainability-adaptability

The specifications themselves cover:

- posture
- ease of adjustment
- support surfaces

- seating
- additional support elements (such as document holders and footrests)
- layout of the workstation in the workspace

An informative annex provides anthropometric data needed for workstation design and selection.

Under ISO's plans to renumber ISO 9241, this part will be replaced by the ISO 9241-500 subseries.

Who is it written for?

Manufacturers of office workstation products and people that need to design and implement office workstations.

How many pages does it have?

26

What are the main sections in this standard?

- Scope
- Normative references
- Definitions
- Guiding principles
- Design requirements and recommendations
- Conformance
- Measurement
- Annex A: Anthropometric data needed for workstation design and selection
- Bibliography

Part 6: Guidance on the work environment

How do I cite it?

ISO 9241-6:1999 Ergonomic requirements for office work with visual display terminals (VDTs) -- Part 6: Guidance on the work environment.

What do I need to know about it?

This part of ISO 9241 provides guidance on basic properties of the working environment to support display screen work.

The characteristics of the work environment are considered under six headings:

- natural and artificial lighting (including glare control)
- sound and noise (including the reduction of noise effects)
- mechanical vibrations (for example, from air conditioning systems or nearby industrial activities)
- electromagnetic fields and static electricity (and its effects on the image quality of visual displays)
- thermal environment (including thermal comfort and humidity)
- space organisation and workplace layout

The standard includes four annexes that cover

- lighting
- methods for measuring and evaluating sound
- measurement, evaluation and assessment of whole-body vibrations;
- thermal environment (this includes recommended values for thermal comfort)

Under ISO's plans to renumber ISO 9241, this part will be replaced by the ISO 9241-600 subseries.

Who is it written for?

People that need to design and implement office layouts.

How many pages does it have?

32

What are the main sections in this standard?

- Scope
- Normative references
- Terms and definitions
- General guiding principles
- Guidance on natural and artificial lighting
- Guidance on sound and noise
- Guidance on mechanical vibrations
- Guidance on electromagnetic fields and static electricity
- Guidance on thermal environment
- Guidance on space organisation and workplace layout
- Annex A: Lighting
- Annex B: Methods for measuring and evaluating sound
- Annex C: Measurements, evaluation and assessment of whole-body vibrations
- Annex D: Thermal environment

Part 7: Requirements for display with reflections

What do I need to know about it?

This part has been withdrawn. It's been replaced by the Part 300 subseries.

Part 8: Requirements for displayed colours

What do I need to know about it?

This part has been withdrawn. It's been replaced by the Part 300 subseries.

Part 9: Requirements for non-keyboard input devices

How do I cite it?

ISO 9241-9:2000 Ergonomic requirements for office work with visual display terminals (VDTs) -- Part 9: Requirements for non-keyboard input devices.

What do I need to know about it?

This part of ISO 9241 applies to several types of non-keyboard input devices including mice, pucks, joysticks, trackballs, tablets and overlays, touch-sensitive screens, styli and light pens.

The standard specifies the quality of the input device in terms of a performance criterion: "it is considered useable [sic] if users can achieve a satisfactory level of performance on a given task and maintain an acceptable level of effort and satisfaction".

The standard also includes a set of design requirements that first covers general requirements and recommendations (such as resolution, button design and upper extremity and head posture), and then addresses specific input device requirements and recommendations (such as mice, pucks and joysticks). Compliance with the standard can be achieved only by carrying out a usability test.

The standard has four annexes: input device selection, usability testing and analysis; testing of efficiency and effectiveness; assessment of comfort; and additional evaluation methods. The standard also includes a bibliography with over 100 references. Note that this standard does not cover voice input.

Under ISO's plans to renumber ISO 9241, this part will be replaced by the ISO 9241-400 subseries.

Who is it written for?

Audience

How many pages does it have?

48

What are the main sections in this standard?

- Scope
- Normative references
- Terms and definitions
- Guiding principles
- Performance criterion
- Design requirements and recommendations
- Measurement conditions and conventions
- Conformance
- Annex A: Input device selection, usability testing and analysis
- Annex B: Testing of efficiency and effectiveness
- Annex C: Assessment of comfort
- Annex D: Additional evaluation methods

Part 10: Dialogue principles

What do I need to know about it?

This part has been withdrawn. It's been replaced by Part 110.

Part 11: Guidance on usability

How do I cite it?

ISO 9241-11:1998 Ergonomic requirements for office work with visual display terminals (VDTs) -- Part 11: Guidance on usability.

What do I need to know about it?

This part of ISO 9241 introduces the concept of usability but does not make specific recommendations in terms of product attributes. Instead it defines usability as the "extent to which a product can be used by specified users to achieve specified goals with effectiveness, efficiency and satisfaction in a specified context of use".

One of the benefits of this approach is that it helps design teams plan for usability as part of the development lifecycle, by setting and measuring usability goals for the product. The standard describes how it can be applied to: specify and measure the usability of products; specify and evaluate usability during design; and specify and measure a work system in use. The standard includes five annexes: an example of how to specify the context of use; examples of usability measures; an example of a usability requirements specification; relationship to other international standards; and a bibliography.

The term "satisfaction" in the definition of usability has been criticised as sounding weak: it sounds like "adequate" or "just good enough", which is hardly a design goal worthy of aspiration. However, this is more an artefact of current usage: the dictionary defines satisfaction as "the feeling of pleasure that comes when a need or desire is fulfilled".

Who is it written for?

Anyone that needs to set or measure usability goals for a system.

How many pages does it have?

19

What are the main sections in this standard?

- Scope
- Normative references
- Definitions
- Rationale and benefits
- Specifying and measuring the usability of products
- Specifications and evaluation of usability during design
- Specifying and measuring a work system in use
- Annex A: Example of how to specify the context of use
- Annex B: Examples of usability measures
- Annex C: Example of a usability requirements specification
- Annex D: Relationship to other International Standards
- Annex E: Bibliography

Part 12: Presentation of information

How do I cite it?

ISO 9241-12:1998 Ergonomic requirements for office work with visual display terminals (VDTs) -- Part 12: Presentation of information.

What do I need to know about it?

This part of ISO 9241 contains recommendations on how to present visual information on screens so that users can easily perform "perceptual tasks" (such as searching for information on the screen).

The recommendations are based on seven guiding principles

- clarity (information should be conveyed quickly and accurately);
- discriminabilty (information should be able to be distinguished accurately)
- conciseness (provide only the information necessary to complete the task)
- consistency (present the same information in the same way throughout the application)
- detectability (direct the user's attention to the information required)
- legibility (information should be easy to read)
- comprehensibility (the meaning should be clearly understandable)

The recommendations are provided in three main areas

- organisation of information
- graphical objects
- coding techniques

There is no discussion of icon design in this standard.

The standard has two annexes. The first is a sample procedure for assessing applicability and adherence and includes a detailed design checklist spanning 13 pages. This compliance procedure is based on the notion of "conditional compliance": the assessor first determines which recommendations are relevant and then determines whether or not they have been adhered to. The reason for this approach is that users, tasks and technological solutions vary and it is therefore not possible to give blanket recommendations that apply to all systems that present visual information. The conditional compliance route is ISO's acknowledgement of this variability and complexity. The second annex is a bibliography.

Under ISO's plans to renumber ISO 9241, this part will be replaced by replaced by ISO 9241-111 and ISO 9241-141.

Who is it written for?

User interface designers and evaluators.

How many pages does it have?

47

What are the main sections in this standard?

- Scope
- Normative references
- Definitions
- Application of this part of ISO 9241
- Organization of information
- Graphical objects
- Coding techniques

Part 13: User guidance

How do I cite it?

ISO 9241-13:1998 Ergonomic requirements for office work with visual display terminals (VDTs) -- Part 13: User guidance.

What do I need to know about it?

This part of ISO 9241 contains recommendations on user guidance.

The recommendations cover:

- general advice (for example, "User guidance should not disrupt the user's task and the continuation of the dialogue")
- prompts (for example, "Prompts for data/command entry should be displayed in a standard location next to the entry field")
- feedback (for example, "The system should clearly indicate its state whenever the state (or mode) changes")
- status information (for example, "A consistent display location should be used for each type of status information")
- error management (for example, "Users should be able to modify or cancel input prior to executing an action")
- on-line help (for example, "The content of system-initiated on-line help information should be specific to the task context")

This standard does not cover documentation (either on-line or paper) or on-line tutorials.

The standard contains two annexes. The first is a sample procedure for assessing applicability and adherence and includes a six-page checklist (using a conditional compliance route, see the description of ISO 9241-12). The second annex is a bibliography.

Under ISO's plans to renumber ISO 9241, this part will be replaced by ISO 9241-124.

Who is it written for?

User interface designers, user interface evaluators and documentation experts.

How many pages does it have?

33

What are the main sections in this standard?

- Scope
- Normative references
- Definitions
- Application of this part of ISO 9241
- Common guidance recommendations
- Prompts
- Feedback
- Status information
- Error management
- On-line help
- Annex A: Sample procedure for assessing applicability and adherence
- Annex B: Bibliography

Part 14: Menu dialogues

How do I cite it?

ISO 9241-14:1997 Ergonomic requirements for office work with visual display terminals (VDTs) -- Part 14: Menu dialogues.

What do I need to know about it?

This part of ISO 9241 provides recommendations for the design of systems that use menus (such as pop-up, pull-down and text-based menus).

The standard begins by reviewing the application areas where menus are most useful (for example, when use of the system is infrequent and the user does not know what options are available). The recommendations cover

- menu structure (such as logical categories, grouping options and ordering items)
- menu navigation (including titles and access time)
- option selection and execution (including selection methods, use of the keyboard and voice activation)
- menu presentation (including placement and use of icons)

The standard contains three annexes. The first is a sample procedure for assessing applicability and adherence and includes a ten-page checklist (using a conditional compliance route, see the description of ISO 9241-12). The second annex provides three scenarios of how to apply the standard (from the perspective of the user interface designer, the procurer and the evaluator). The third annex is a detailed bibliography.

Under ISO's plans to renumber ISO 9241, this part will be replaced by ISO 9241-131.

Who is it written for?

User interface designers and evaluators.

How many pages does it have?

57

What are the main sections in this standard?

- Scope
- Normative references
- Definitions
- Application of ISO 9241-14
- Menu structure
- Menu navigation
- Option selection and execution
- Menu presentation
- Annex A: Sample procedure for assessing applicability and adherence
- Annex B: Examples of applying ISO 9241-14
- Annex C: Bibliography

Part 15: Command dialogues

How do I cite it?

ISO 9241-15:1997 Ergonomic requirements for office work with visual display terminals (VDTs) -- Part 15: Command dialogues.

What do I need to know about it?

This part of ISO 9241 provides recommendations for systems that use command line interfaces (such as DOS and UNIX).

With a command line interface, the user works with the system by typing in commands that meet certain syntactic rules. The standard begins by describing the appropriate application areas for these interfaces (for example, applications that people use frequently, and that require speed and flexibility). The recommendations cover:

- structure and syntax (for example, macros and command arguments)
- command representation (for example, command names and abbreviations)
- input and output considerations (for example, command reuse and editing)
- feedback and help (for example, command processing and error feedback)

The standard contains two annexes. The first is a sample procedure for assessing applicability and adherence and includes a five-page checklist (using a conditional compliance route, see the description of ISO 9241-12). The second annex is a bibliography.

Under ISO's plans to renumber ISO 9241, this part will be replaced by ISO 9241-132.

Who is it written for?

User interface designers and evaluators.

How many pages does it have?

29

What are the main sections in this standard?

- Scope
- Definitions
- Application of ISO 9241-15
- Structure and syntax
- Command representation
- Input and output considerations
- Feedback and help
- Annex A: Sample procedure for assessing applicability and adherence
- Annex B: Bibliography

Part 16: Direct manipulation dialogues

How do I cite it?

ISO 9241-16:1999 Ergonomic requirements for office work with visual display terminals (VDTs) -- Part 16: Direct manipulation dialogues.

What do I need to know about it?

This part of ISO 9241 provides recommendations for systems that use direct manipulation (basically this means virtually all mouse-driven user interfaces).

With direct manipulation, the user acts directly on the objects on the screen (for example by dragging a document icon and dropping it on an application to open it). The standard points out that this is not the same as a graphical user interface, which may or may not implement direct manipulation.

The standard begins by describing the appropriate application areas for these interfaces (for example, the system can simulate real-world task objects, their properties and operations). The recommendations cover:

- general information (metaphors; the appearance of objects used in direct manipulation; feedback; and input devices)
- manipulation of objects (general considerations; pointing and selecting; dragging; sizing of objects; and rotating)
- direct manipulation of text objects (pointing and selecting; and sizing of text)
- direct manipulation of windows (general considerations; pointing and selecting; and sizing of windows)
- direct manipulation of control icons (pointing and selecting)

The standard contains one annex and a bibliography. The annex is a sample procedure for assessing applicability and adherence and includes

a three-page checklist (using a conditional compliance route, see the description of ISO 9241-12).

Under ISO's plans to renumber ISO 9241, this part will be replaced by ISO 9241-133.

Who is it written for?

User interface designers and evaluators.

How many pages does it have?

31

What are the main sections in this standard?

- Scope
- Normative references
- Terms and definitions
- Application of this part of ISO 9241
- General information
- Manipulation of objects
- Additional recommendations for direct manipulation of text objects
- Additional recommendations for direct manipulation of windows
- Additional recommendations for direct manipulation of control icons
- Annex A: Sample procedure for assessing applicability and adherence
- Bibliography

Part 17: Form filling dialogues

What do I need to know about it?

This part has been withdrawn. It's been replaced by Part 143.

Part 20: Accessibility guidelines for ICT equipment and services

How do I cite it?

ISO 9241-20:2009 Ergonomics of human-system interaction -- Part 20: Accessibility guidelines for information/communication technology (ICT) equipment and services.

What do I need to know about it?

This part of ISO 9241 contains general recommendations to improve the accessibility of ICT equipment. The definition of "ICT equipment" is left deliberately vague, but includes mobile devices, computers and software.

The standard promotes a framework for accessibility that has four steps:

- Understand and specify context of use paying particular attention to the variation of user characteristics, and the impact of task, equipment and environmental characteristics that affect accessibility.
- Specify the user requirements for accessibility.
- Produce design solutions paying particular attention to accessibility considerations.
- Evaluate accessibility design solutions of ICT equipment and services with the targeted user group.

The standard makes several general recommendations for achieving these goals, such as designing for a range of user characteristics, supporting multiple interaction mechanisms and supporting "individualization" (ISO jargon for personalisation).

The standard covers various disabilities, including blindness, deafness, speech, motor and cognitive disabilities.

Who is it written for?

People responsible for planning, designing, developing, evaluating or purchasing ICT equipment.

How many pages does it have?

42

What are the main sections in this standard?

- Scope
- Normative references
- Terms and definitions
- Application
- Accessibility
- Recommendations related to managing development
- Recommendations related to user characteristics
- Recommendations related to task characteristics
- Recommendations related to equipment and service characteristics
- Recommendations related to environmental characteristics
- Annex A: Overview of the ISO 9241 series
- Annex B: Sample checklist for assessing applicability and conformance of ICT
- equipment and services
- Annex C: User needs
- Bibliography

Part 100: Introduction to standards related to software ergonomics

How do I cite it?

ISO/TR 9241-100:2011 Ergonomics of human-system interaction -- Part 100: Introduction to standards related to software ergonomics.

What do I need to know about it?

This part of ISO 9241 is designed to help you work out which software ergonomics standards are relevant to your needs. It's a kind of ISO-sanctioned Bluffers' Guide to software standards (not just the 9241 parts).

The standard describes the overall structure of the software parts of ISO 9241, including a review of general standards on software ergonomics (parts 110-119), standards on input, output and interaction (parts 120-129), standards on performance support (parts 130-139), standards on interaction techniques (parts 140-149), topic-specific standards (parts 15-159), standards on user interface components (parts 160-169) and standards on accessibility (parts 170-179). In a wonderful bit of recursiveness, it even reviews itself (part 100).

Next, it describes standards on human-centred design processes and methods relevant to software ergonomics, including Human-centred design process for interactive systems (ISO 9241-210), Human-centred lifecycle process descriptions (ISO/TR 16982), Common Industry Format (CIF) for usability — General framework for for usability related information (ISO/IEC TR 25060) and the Common Industry Format (CIF) for usability test reports (ISO/IEC 25062).

Next it describes general standards relevant to software ergonomics, including Ergonomic principles in the design of work systems (ISO

6385), Guidance on usability (ISO 9241-11) and Accessibility guidelines for ICT equipment and services (ISO 9241-20).

Finally, it reviews other standards that include specific software-ergonomics guidance, including Guidance on tactile and haptic interactions (ISO 9241-920), Information technology — Accessibility considerations for people with disabilities — User needs summary (ISO/IEC TR 29138-1) and Ergonomics data and guidelines for the application of ISO/IEC Guide 71 to products and services to address the needs of older persons and persons with disabilities (ISO/TR 22411).

Who is it written for?

Anyone with an interest in software ergonomics standards.

How many pages does it have?

19

What are the main sections in this standard?

- Scope
- Terms and definitions
- International Standards and software ergonomics
- Software-ergonomics standards
- Standards on human-centred design processes and methods relevant to software ergonomics
- General standards relevant to software ergonomics
- Other standards that include specific software-ergonomics guidance
- Annex A: Overview of the ISO 9241 series
- Bibliography

Part 110: Dialogue principles

How do I cite it?

ISO 9241-110:2006 Ergonomics of human-system interaction -- Part 110: Dialogue principles.

What do I need to know about it?

This part of ISO 9241 presents a set of usability heuristics that applies to the interaction of people and information systems (the heuristics are based on an earlier German standard).

The standard refers to this interaction as a "dialogue" and describes seven "dialogue principles". These general principles span the specific dialogue techniques that are discussed in parts 13-17 of ISO 9241. The seven principles are:

- suitability for the task (the dialogue should be suitable for the user's task and skill level)
- self-descriptiveness (the dialogue should make it clear what the user should do next)
- controllability (the user should be able to control the pace and sequence of the interaction)
- conformity with user expectations (it should be consistent); error tolerance (the dialogue should be forgiving)
- suitability for individualisation (the dialogue should be able to be customised to suit the user)
- suitability for learning (the dialogue should support learning)

The standard describes applications and examples of the dialogue principles. It has one annex (a short bibliography).

This part of ISO 9241 used to be known as ISO 9241-10, but has now been renumbered under ISO's revision and restructuring programme.

Who is it written for?

User interface designers and evaluators.

How many pages does it have?

22

What are the main sections in this standard?

- Scope
- Normative references
- Terms and definitions
- Dialogue principles and recommendations
- Framework for using the dialogue principles and recommendations
- Relationship between this part of ISO 9241 and ISO 9241-11 and ISO 9241-12
- Annex A: Overview of the ISO 9241 series
- Bibliography

Part 129: Guidance on software individualization

How do I cite it?

ISO 9241-129:2010 Ergonomics of human-system interaction -- Part 129: Guidance on software individualization.

What do I need to know about it?

ISO 9241-110 contains a dialogue principle titled "suitability for individualisation": this means people should be able to customise the user interfaces that they use. This part of ISO 9241 elaborates on that principle by providing guidance on how to personalise or tailor software for different users (ISO uses the word "individualization").

It provides some general guidance on customising interfaces and then describes ways of going about it (distinguishing between user-initiated and computer-initiated customisation — for example, the software can monitor user behaviour and automatically customise the interface). Next the standard discusses configuration settings and how to make them usable, before turning to the use of user profiles to support individual users.

Subsequent sections present guidance for personalising interface components (such as different styles or 'skins'), guidance for personalising interaction activities (essentially, macros or sets of actions that the user can save and apply later) and guidance for personalising content (such as searching, annotating and filtering).

The standard includes a useful annex with a checklist for assessing the quality of the personalisation of a user interface.

Who is it written for?

User interface designers and developers and people who evaluate software.

How many pages does it have?

51

What are the main sections in this standard?

- Scope
- Normative references
- Terms and definitions
- Conformance
- Framework for applying this part of ISO 9241
- Introduction to individualization
- General guidance on individualization
- Stages of individualization
- Configuration, settings and defaults
- Supporting individual users
- Individualizing interface components
- Individualizing interaction activities
- Individualizing content
- Annex A: Overview of the ISO 9241 series
- Annex B: Factors to consider when designing individualizations
- Annex C: Sample procedure for assessing applicability and conformance
- Bibliography

Part 143: Forms

How do I cite it?

ISO 9241-143:2012 Ergonomics of human system interaction -- Part 143: Forms.

What do I need to know about it?

This part of ISO 9241 provides recommendations for systems that use forms. ISO define a form as something 'in which the user fills-in, selects entries for, or modifies labelled fields on, a "form" or dialogue box presented by the system'.

The recommendations cover information presentation, interaction, validation, choice of form elements, and form element design.

Information presentation covers:

- layout
- names and labels
- visual cues in fields and form elements

Interaction covers:

- Navigation
- Navigation by tab keys and scrolling
- Input focus and cursors
- Input
- User control
- Feedback
- Access to forms and dialogue boxes
- Default values
- Default actions for forms elements

Validation covers:

- Single-field validation
- Multiple-field validation

Choice of form elements covers:

- Accessibility of form elements
- Choice considerations
- Push buttons
- Toggle buttons
- Text entry fields
- Radio buttons
- Check boxes
- Stepper buttons
- Single-selection list boxes
- Multiple-selection list boxes
- Pop-up/drop-down list
- Combination boxes
- Single-selection hierarchical lists
- Multiple-selection hierarchical lists
- Analogue form elements (slider, rotary dials and equivalents)
- Tabbed form elements

Form element design covers:

- Alphanumeric text entry
- Choice
- List-based elements for choice
- Tabs
- Scroll bars

- Push buttons and tool palettes

The standard contains an extensive, 36-page "applicability and compliance checklist" to assess conformance. This checklist is useful as a review tool for a system that uses forms.

Who is it written for?

User interface designers and evaluators

How many pages does it have?

95

What are the main sections in this standard?

- Scope
- Normative references
- Terms and definitions
- Forms
- Information presentation
- Interaction
- Validation
- Choice of form elements
- Form element design
- Conformance
- Annex A: Overview of the ISO 9241 series
- Annex B: Checklist for applying this part of ISO 9241
- Bibliograpy

Part 151: Guidance on World Wide Web user interfaces

How do I cite it?

ISO 9241-151:2008 Ergonomics of human-system interaction -- Part 151: Guidance on World Wide Web user interfaces.

What do I need to know about it?

This part of ISO 9241 presents detailed design principles for designing usable web sites.

The standard covers five areas:

- High-level design decisions and design strategy: What is the purpose of the site and how is this made clear to its users? Who are the users and what are their goals?
- Content design: What is the site's conceptual model? How is content organised and how should the site deal with issues such as privacy and personalisation?
- Navigation and search: How should the content be organised so that users can navigate the site easily? How will users search the content of the site?
- Content presentation: How should individual pages be designed so that people can make use of the information? How should links be designed?
- General design aspects: how should you design for an international audience? How should you provide help? What download times are acceptable?

This is a nuts-and-bolts standard packed with sound design advice. Here is just one example from the section on search: "On the results page, the query entered should be shown. This allows users to check

their query against the results obtained and to detect errors or problems in the query formulated."

Who is it written for?

Developers and designers of web user interfaces, content authors and usability evaluators.

How many pages does it have?

49

What are the main sections in this standard?

- Scope
- Normative references
- Terms and definitions
- Application
- A reference model for human-centred design of World Wide Web user interfaces
- High-level design decisions and design strategy
- Content design
- Navigation and search
- Content presentation
- General design aspects
- Annex A: Overview of the ISO 9241 series
- Annex B: Sample procedure for assessing applicability and conformance
- Bibliography

Part 154: Interactive voice response (IVR) applications

How do I cite it?

ISO 9241-154:2013 Ergonomics of human-system interaction -- Part 154: Interactive voice response (IVR) applications.

What do I need to know about it?

This part of ISO 9241 contains guidance on the design of interactive voice response (IVR) systems — telephone-based interfaces that we use to check movie times and train schedules or simply to get routed to the right department in an organisation. So this standard is about the design of auditory interfaces where the main input device is either a telephone keypad or your voice. Although the standard covers speech as an input mechanism, it specifically excludes guidance on automatic speech recognition.

The standard serves as an excellent description of best practice in IVR design. For example, it requires that people should need to enter information (like your postcode) only once, even if the call gets transferred. Similarly, it points out that "Yes" and "No" should be assigned to the number keys 1 and 2 respectively on the keypad. It also points out that your input prompts should be phrased with the goal first then the action (e.g. "To tell us about a change of address, press 1", rather than, "Press 1 to tell us about a change of address").

Who is it written for?

The standard is aimed at user interface designers and developers who create IVR systems.

How many pages does it have?

35

What are the main sections in this standard?

- Scope
- Normative references
- Terms and definitions
- Conformance
- Voice messaging systems
- Information input
- Speech input
- Touchtone input
- Information output
- Navigation
- Help
- Access to human representatives
- Feedback
- Errors
- Annex A: Overview of the ISO 9241 series
- Annex B: The role of speech recognition errors in IVR design
- Bibliography

Part 171: Guidance on software accessibility

How do I cite it?

ISO 9241-171:2008 Ergonomics of human-system interaction -- Part 171: Guidance on software accessibility.

What do I need to know about it?

This part of ISO 9241 provides guidance on how to design software so that disabled people can use it.

The scope is extremely broad. Unlike the W3C's Web Content Accessibility Guidelines, this standard covers all software (not just the web) and as well as the obvious home and work domains it also explicitly includes public systems, such as kiosks. Moreover, the standard uses the term "accessibility" in a very broad context, encompassing elderly users as well as users with a temporary disability (such as someone with a broken arm).

The standard begins with some general guidance that states the most important ways to increase accessibility. These are:

- adopting a human centred approach to design
- following a context-based design process
- providing the capacity for individualisation
- offering individualised user instruction and training

It then describes three principles of accessibility:

- equitable use (solutions that provide the same means of use for all users)
- suitability for the widest range of use (designing solutions that will be useful, acceptable and available to the widest range of users)

- robustness (to allow it to work with current and future assistive technologies)

The bulk of the standard (39 pages) provides detailed design guidance on issues such as names and labels, keyboard and mouse use, fonts and colours and audio and video. One example of a guideline in the "Pointing devices" section is: "Platform software shall provide a mechanism to enable users to locate the pointer". The standard includes examples for nearly all these recommendations to help the reader understand the requirement (for example, "A user with low vision loses track of the mouse pointer. When the Control key is pressed animated concentric circles are presented around the location of the mouse pointer.")

Who is it written for?

Those responsible for the specification, design, development, evaluation and procurement of software platforms and software applications.

How many pages does it have?

88

What are the main sections in this standard?

- Scope
- Normative references
- Terms and definitions
- Rationale and benefits of implementing accessibility
- Principles for designing accessible software.
- Sources of variation in user characteristics
- How to use this part of ISO 9241
- General guidelines and requirements

- Inputs
- Outputs
- On-line documentation, "Help" and support services
- Annex A: Overview of the ISO 9241 series
- Annex B: List of requirements
- Annex C: Sample procedure for assessing applicability and conformance
- Annex D: Activity limitation issues
- Annex E: Access features
- Annex F: Accessibility and usability
- Bibliography

Part 210: Human-centred design for interactive systems

How do I cite it?

ISO 9241-210:2010 Ergonomics of human-system interaction -- Part 210: Human-centred design for interactive systems.

What do I need to know about it?

This part is a process standard aimed at people responsible for managing design processes. It presents a high level overview of the activities that are recommended for human centred design.

The standard used to be known as ISO 13407. But in 2010 it was updated and re-issued as ISO 9241-210 to bring it into line with other ISO usability standards. (So if you hear anyone talking about ISO 13407, they are out of date. They should be talking about ISO 9241-210).

The standard describes 6 key principles that will ensure your design is user centred:

- The design is based upon an explicit understanding of users, tasks and environments.
- Users are involved throughout design and development.
- The design is driven and refined by user-centred evaluation.
- The process is iterative.
- The design addresses the whole user experience.
- The design team includes multidisciplinary skills and perspectives.

This is such an important standard, it's worth exploring each of these principles in depth.

The design is based upon an explicit understanding of users, tasks and environments

This principle is about understanding your users' 'context of use': you need to understand your users, understand what they want to do with the system and understand the environment in which the system is used. As an example, the standard contrasts an interface aimed at a teenager downloading music on a mobile phone with a business user accessing corporate information on a handheld device. What makes a great experience for one may not be an acceptable experience for the other.

Users are involved throughout design and development

The purpose of this principle is to ensure design teams involve users in all design phases: not just by running a focus group at the start of design or by administering a survey at the end of design. Moreover, the standard emphasises that user involvement needs to be 'active': in other words, you don't simply demonstrate your design to users, you engage them in the design. You can achieve this through field studies early in design and usability testing once you have an artefact that people can use.

The design is driven and refined by user-centred evaluation

As well as being the canonical method that almost defines the field, usability testing truly helps design teams improve upon their products, software and services. But one mistake that's often made is to run just one test, usually at the end of development. The standard points out that usability testing should be carried out throughout the design process. So you should also use it to test preliminary designs, such as paper prototypes and electronic mock-ups.

The process is iterative

The standard describes this principle unambiguously: 'The most appropriate design for an interactive system cannot typically be achieved without iteration.' The idea behind this principle is that it's extremely difficult, if not impossible, for users to explain what they want from a system. So to find out what people want, you have to show them something that they probably don't want (your first design) and then

discover how to improve it. This means that if you're using a waterfall methodology where you have to nail down requirements before starting on design, your design process will struggle to be user centred. The standard doesn't proscribe any particular development methodology, but if you're using Agile then it's much more likely you'll be following this principle.

The design addresses the whole user experience

This principle wasn't mentioned in the standard's previous incarnation as ISO 13407. It's probably been included in this new version to make sure people realise that usability isn't just about the hygiene factor of making things easy (or at least, not making things difficult). 'Easy' is a good place to start, but usability (and a good user experience) is about a lot more than making things simple. The standard makes this explicit by writing, 'the concept of usability used in ISO 9241 is broader and… can include the kind of perceptual and emotional aspects typically associated with user experience.'

The design team includes multidisciplinary skills and perspectives

With this principle, the standard is pointing out that a siloed design team is the wrong way to approach user centred design. You need to include a range of views, including the voices of accessibility experts, end users, domain experts, marketing, tech support, technical writers and business analysts, as well as the roles just mentioned.

Who is it written for?

Anyone that works in the field of user experience.

How many pages does it have?

32

What are the main sections in this standard?

- Scope
- Terms and definitions
- Rationale for adopting human-centred design
- Principles of human-centred design
- Planning human-centred design
- Human-centred design activities
- Sustainability and human-centred design
- Conformance
- Annex A: Overview of the ISO 9241 series
- Annex B: Sample procedure for assessing applicability and conformance
- Bibliography

Part 300: Introduction to electronic visual display requirements

How do I cite it?

ISO 9241-300:2008 Ergonomics of human-system interaction -- Part 300: Introduction to electronic visual display requirements.

What do I need to know about it?

The "300" series replaces ISO 9241-3, ISO 9241-7, ISO 9241-8, ISO 13406-1 and ISO 13406-2. ISO 9241 was written with Cathode Ray Tubes (CRT) in mind and ISO 13406 with Liquid Crystal Displays (LCD) displays in mind and the standards were restricted to office tasks and office-like environments. The standards in this subseries cover a large range of technologies, tasks and environments. The areas that were covered already in ISO 9241 and ISO 13406 are essentially unchanged, but test methods and requirements have been updated to account for advancement in technology and science.

This part of ISO 9241 is an introduction to the "300" subseries, like a foreword to a book. It is very short: the main content occupies just 4 pages. The standard makes the point that displays cannot always be tested simply using optical and electrical measurements because the image quality can depend on other factors, such as the software used to present information on the display (for example, number of display colours), the user (for example, the viewing distance) and the user's task (for example, the number of display characters on the screen). The standard also includes a useful table listing various work environments that can affect the usability of a display.

Who is it written for?

This standard is aimed at people interested in any of the "300" parts, which is primarily people who design or evaluate display technologies.

How many pages does it have?

9

What are the main sections in this standard?

- Scope
- Normative references
- Terms and definitions
- Conformance
- Overview of the ISO 9241 "300" subseries
- Integrated vs. modular products
- Work environments
- Annex A: Overview of the ISO 9241 series
- Bibliography

Part 302: Terminology for electronic visual displays

How do I cite it?

ISO 9241-302:2008 Ergonomics of human-system interaction -- Part 302: Terminology for electronic visual displays.

What do I need to know about it?

This part of ISO 9241 simply contains a list of definitions, terms and equations that are used by the other parts in the "300" subseries. It's no more (and no less) than a display technologist's dictionary. Some of these definitions are taken from elsewhere (for example, the definition of "luminous flux" is taken from the CIE). If you want to know the difference between chroma, chromaticity and chromaticity coordinates, this is the standard for you.

Who is it written for?

People who design or evaluate display technologies.

How many pages does it have?

80

What are the main sections in this standard?

- Scope
- Normative references
- Terms and definitions
- Annex A: Overview of the ISO 9241 series
- Bibliography
- Alphabetical index

- French alphabetical index

Part 303: Requirements for electronic visual displays

How do I cite it?

ISO 9241-303:2011 Ergonomics of human-system interaction -- Part 303: Requirements for electronic visual displays.

What do I need to know about it?

This part of ISO 9241 establishes image quality requirements for electronic visual displays. The requirements are deliberately generic, so they apply to any kind of display, regardless of the technology used, and they cover all users and tasks. The requirements are stated as performance specifications to ensure effective and comfortable viewing conditions for users with normal or adjusted to normal eyesight.

The standard contains requirements in eight separate areas:

- viewing conditions (such as viewing distance)
- luminance (to ensure sufficient contrast)
- special physical environments (such as very high or low temperatures)
- visual artefacts (such as colour non-uniformity)
- legibility and readability (such as character height)
- legibility of information coding (such as colour coding)
- legibility of graphics (such as the minimum colour difference needed to distinguish different colours)
- fidelity (such as spatial resolution)

Who is it written for?

People who design or evaluate display technologies.

How many pages does it have?

43

What are the main sections in this standard?

- Scope
- Normative references
- Terms and definitions
- Guiding principles
- Ergonomic requirements and recommendations
- Conformance
- Annex A: Overview of the ISO 9241 series
- Annex B: Attractivity, or subject visual quality
- Annex C: Usability aspects of installation
- Annex D: Basic concepts of visual perception for contrast and luminance of electronic displays
- Annex E: Virtual display — Performance objectives
- Annex F: Electronic visual display accessibility — Selected bibliography
- Bibliography

Part 304: User performance test methods for electronic visual displays

How do I cite it?

ISO 9241-304:2008 Ergonomics of human-system interaction -- Part 304: User performance test methods for electronic visual displays.

What do I need to know about it?

This part of the ISO 9241 "300" subseries is quite different from the others. Although it covers visual displays, it takes a very different approach from the other parts in the subseries. The other parts focus on optical and electronic measurements of displays, whereas this part focuses on measuring how people perform when using the display: in other words, you run a (summative) usability test.

The standard describes how to develop a suitable test method and provides a specific example of a test method you could use to evaluate the quality of text presented on a visual display. With this test method, you compare user performance on the display under test with a "benchmark display", a display that you know already meets the requirements of ISO 9241-303.

The test method also describes how to collect and analyse the results using a statistical procedure known as "sequential testing". With this procedure, the number of test participants is not defined in advance: you calculate the statistic after each participant and make a "pass / fail" decision. Since no statistical tests can prove that two products are the same, this test is used to decide if performance for the test product is significantly worse than the benchmark. If the test product is not significantly worse than the benchmark, the test product is considered to conform to the standard.

Who is it written for?

People who design or evaluate display technologies and people that run usability tests of displays.

How many pages does it have?

21

What are the main sections in this standard?

- Scope
- Normative references
- Terms and definitions
- Guiding principles
- Conformance
- Specifying the visual ergonomics test objectives
- Defining the test procedure
- Visual performance and comfort test — Carrying out the test and analysing the data
- Annex A: Overview of the ISO 9241 series
- Bibliography

Part 305: Optical laboratory test methods for electronic visual displays

How do I cite it?

ISO 9241-305:2008 Ergonomics of human-system interaction -- Part 305: Optical laboratory test methods for electronic visual displays.

What do I need to know about it?

This part of ISO 9241 describes optical test methods and expert observation techniques to evaluate a visual display against the requirements in ISO 9241-303. Weighing in at around 180 pages, this is a substantial text that contains very detailed instructions on taking display measurements. It describes two types of measurement: basic optical lab measurements and compound measurements (compound measurements are essentially the analytical techniques or equations that you use to make sense of the basic measurements).

This part needs to be read in conjunction with ISO 9241-307 so that you can decide if your display meets the standard.

Who is it written for?

Display technologists with experience in the optical measurement of visual displays.

How many pages does it have?

183

What are the main sections in this standard?

- Scope
- Normative references

- Terms and definitions
- General
- Measurement conditions
- Measurement methods
- Conformance
- Annex A: Overview of the ISO 9241 series
- Annex B: Guidelines for measurement method types
- Annex C: Matrix of measurement procedures and their sources
- Annex D: Bidirectional reflectance distribution function (BRDF)
- Annex E: Uncertainty analysis guidelines
- Annex F: Reconstruction of luminance distribution by microstepping
- Bibliography

Part 306: Field assessment methods for electronic visual displays

How do I cite it?

ISO 9241-306:2008 Ergonomics of human-system interaction -- Part 306: Field assessment methods for electronic visual displays.

What do I need to know about it?

This part of ISO 9241 will help you evaluate visual displays in the wild — for example, in offices. The purpose of this is to ensure that displays are not evaluated only in isolation (such as in an optical laboratory) but that the evaluation takes into account the context of use: for example, the software used on the display and reflections in the environment.

The reason these evaluations need to be carried out in context is because of issues like glare from windows: visual displays have much more "positional sensitivity" than old technologies like paper. This standard is therefore a guide to ergonomic workplace assessment for visual displays.

As with ISO 9241-305, this is a technical standard and assumes that the reader is comfortable with taking display measurements. But the measurements are not as complex as with ISO 9241-305 — for example, you can measure blink coding frequency with a stop watch — and the majority of the "measurements" are really visual judgements.

Who is it written for?

Ergonomists and people who carry out workstation assessments.

How many pages does it have?

45

What are the main sections in this standard?

- Scope
- Normative references
- Terms and definitions
- Preparation for assessment
- Assessment methods
- Other considerations
- Annex A: Overview of the ISO 9241 series
- Annex B: Influences on ergonomics parameters of visual displays
- Annex C: Unwanted reflections
- Annex D: Display output linearization and evaluation of achromatic ISO/IEC test chart output for eight different ambient light reflections at office work places
- Bibliography

Part 307: Analysis and compliance test methods for electronic visual displays

How do I cite it?

ISO 9241-307:2008 Ergonomics of human-system interaction -- Part 307: Analysis and compliance test methods for electronic visual displays.

What do I need to know about it?

This part of ISO 9241 is a companion part for ISO 9241-305. It runs to around 220 pages and its purpose is to help you decide if your display meets the requirements. For each of the attributes (such as luminance balance), the standard provides a pass/fail criterion and a measurement method.

Who is it written for?

Display technologists with experience in the optical measurement of visual displays.

How many pages does it have?

217

What are the main sections in this standard?

- Scope
- Normative references
- Terms and definitions
- Guiding principles
- Compliance routes
- Conformance

- Annex A: Overview of the ISO 9241 series
- Annex B: Boundaries for reproduction of natural colours
- Annex C: Compliance routes
- Bibliography

Part 308: Surface-conduction electron-emitter displays (SED)

How do I cite it?

ISO/TR 9241-308: Ergonomics of human-system interaction -- Part 308: 2008 Surface-conduction electron-emitter displays (SED).

What do I need to know about it?

This part of ISO 9241 is a technical report on a new kind of display technology called "Surface-Conduction Electron-Emitter Displays" or SED for short.

SEDs have some advantages (such as fast response times and uniform focus) and some disadvantages (such as being suitable only for large displays) compared with other display technologies and this document describes the strengths and weaknesses from an ergonomic perspective.

The document describes the technology behind SEDs, provides some typical physical and design data, provides the intended context of use and contains guidelines for assessment.

Who is it written for?

Display technologists and people interested in exploiting novel display technologies.

How many pages does it have?

13

What are the main sections in this standard?

- Scope
- Terms, definitions, symbols and abbreviated terms

- SED technology
- SED product information
- Intended context of use
- Guidelines for assessment
- Conclusion
- Annex A: Overview of the ISO 9241 series
- Bibliography

Part 309: Organic light-emitting diode (OLED) displays

How do I cite it?

ISO/TR 9241-309:2008 Ergonomics of human-system interaction -- Part 309: Organic light-emitting diode (OLED) displays.

What do I need to know about it?

This part of ISO 9241 is a technical report on a new kind of display technology called "Organic Light Emitting Diode Displays" or OLED for short.

The document describes the technology behind OLEDs, provides some typical physical and design data, provides the intended context of use and contains guidelines for assessment.

Who is it written for?

Display technologists and people interested in exploiting novel display technologies.

How many pages does it have?

13

What are the main sections in this standard?

- Scope
- OLED technology
- Information about OLED displays
- Intended contexts of use
- Guidelines for assessment

- Conclusion
- Annex A: Overview of the ISO 9241 series
- Bibliography

Part 310: Visibility, aesthetics and ergonomics of pixel defects

How do I cite it?

ISO/TR 9241-310:2010 Ergonomics of human-system interaction -- Part 310: Visibility, aesthetics and ergonomics of pixel defects.

What do I need to know about it?

This part of ISO 9241 is a literature review of the ergonomic requirements for pixel defects in electronic displays. Because of the lag between writing and publication, this technical report covers only those papers that were published prior to 2005.

A pixel defect can take many forms but a common one is a pixel that is 'stuck on' or 'stuck off' (a bright pixel on a black background and vice versa). Most displays have some pixel defects but they are often too small to notice. But when they occur in clusters,these defects can interfere with reading information from the display. This report also gives guidance on the specification of pixel defects, visibility thresholds and aesthetic requirements for pixel defects.

Who is it written for?

Display technologists with experience in the optical measurement of visual displays. You will also need some knowledge of human colour vision to understand parts of this standard.

How many pages does it have?

50

What are the main sections in this standard?

- Scope

- Terms and definitions
- Review of research
- Review of standards
- Review of industry practice
- Illustrations and descriptions of pixel defects
- Annex A: Overview of the ISO 9241 series
- Annex B: Pixel defect industry and market status 2005
- Annex C: A draft of a model for acceptable pixel level
- Annex D: Draft recommendations

Part 331: Optical characteristics of autostereoscopic displays

How do I cite it?

ISO/TR 9241-331:2013 Ergonomics of human-system interaction -- Part 331: Optical characteristics of autostereoscopic displays.

What do I need to know about it?

This is a technical report that describes optical measurement methods for a particular kind of 3D display known as "autostereoscopic". With autostereoscopic displays, you can view 3D images without wearing special glasses. However, the region where you can position yourself and still see a 3D image is often limited and can result in what the technical report describes as "visual stress". So the aim of this standard is to help designers create displays that minimise visual fatigue.

Section 3 contains a primer into 3D display technologies, describing the cues we use to perceive depth and then moving on to provide a taxonomy of different 3D display types. The report then goes into some depth describing autostereoscopic technologies in particular.

Section 4 describes the causes of visual stress in 3D displays, such as binocular rivalry (caused, for example, when the image sent to one eye is brighter than the image sent to the other eye).

Section 5 describes optical measurement methods that the display engineer can use to evaluate the display. This section is highly technical.

Section 6 describes the concept of a "Qualified Viewing Space": the angle/volume of view in which a 3D image can be viewed while at the same time creating an acceptable level of visual fatigue. In layman's terms, this is the range over which you can move your head and still get a 3D effect without simultaneously getting a headache.

Who is it written for?

Display technologists with experience in the optical measurement of visual displays. You do not need a knowledge of human vision to understand this technical report as it describes stereopsis in sufficient depth for the reader to follow along.

How many pages does it have?

83

What are the main sections in this standard?

- Scope
- Terms and definitions
- Autostereoscopic display technologies
- Performance characteristics
- Optical measurement methods
- Viewing spaces and their analysis
- Further work
- Annex A: Overview of the ISO 9241 series
- Annex B: Head tracking technology
- Bibliography

Part 400: Principles and requirements for physical input devices

How do I cite it?

ISO 9241-400:2007 Ergonomics of human-system interaction -- Part 400: Principles and requirements for physical input devices.

What do I need to know about it?

This part of ISO 9241 describes generic ergonomic principles for the design and use of input devices, such as keyboards, mice and joysticks. It does not provide specific design guidance for these devices, but instead provides a background in the important ergonomic requirements that designers need to consider. The whole of the "400 series" will be devoted to input devices and this part is really the introduction to the series (the other parts in the series are listed in the future parts of ISO 9241). There are three key sections:

- Terms and definitions
- Guiding principles
- Properties of input devices relevant for usability

The bulk of the standard (around half of the pages) is devoted to various definitions, from "click" through to "ulnar deviation". (In case you were wondering, a "click" is the "depression and release of a button or actuation point on an input device").

The design guidelines are:

- "Appropriateness" (the input device should match the user, the user's tasks and the user's work environment)
- "Operability" (its intended use should be obvious, predictable and consistent)

- "User compatibility" (the design should match the anthropometric and biomechanical capabilities of users)
- "Feedback" (the device should let the user know when it is responding to the user's actions)
- "Controllability" (the device should be responsive)
- "Biomechanical load" (which should be minimised)

The properties of input devices relevant for usability include functional properties (such as keyboard slope); electrical properties (such as the thickness of cabling for a mouse); mechanical properties (such as the weight of a hand-held device); and interdependency with software.

Who is it written for?

Manufacturers of input devices and people that need to evaluate the quality of input devices. It is unlikely that anyone would read this part in isolation: it makes sense only as an introduction to the other parts in the "400 series".

How many pages does it have?

35

What are the main sections in this standard?

- Scope
- Normative references
- Terms and definitions
- Guiding principles
- Performance criterion
- Properties of input devices relevant for usability
- Annex A: Overview of the ISO 9241 series

- Bibliography
- Index

Part 410: Design criteria for physical input devices

How do I cite it?

ISO 9241-410:2008 Ergonomics of human-system interaction -- Part 410: Design criteria for physical input devices.

What do I need to know about it?

This part of ISO 9241 describes the critical design characteristics for input devices, namely keyboards, mice, pucks, joysticks, trackballs, touchpads, tablets, styli and touch sensitive screens. It's aimed at people who are actually designing these devices so that they take into account all the relevant ergonomic factors for their device.

The standard covers a range of devices, so it's not surprising that this standard runs to 100 pages. The standard says it should be applied by following four steps:

- Identify the properties of the device that are relevant for usability (for example, key legends on a keyboard)
- Apply generic design requirements (these may be different depending on the context of use)
- Apply device specific design requirements (the standard provides extensive annexes with this information for a range of devices)
- Evaluate the performance criterion (in other words, ensure the device fulfils requirements)

The bulk of the standard is the annexes: one annex for each type of input device. These annexes are extremely detailed. For example, the annex on keyboards includes a graph showing the relationship between key displacement and key force. The annex on mice includes diagrams of appropriately and inappropriate mouse shapes (the inappropriate one looks similar to the notorious Apple Puck mouse, one of PC World's "25

Worst Tech Products of All Time"). And the annex on tablets shows how to map a tablet for either left- or right-handed use.

Who is it written for?

The manufacturers of physical input devices, product designers and organisations that assess the usability of input devices.

How many pages does it have?

100

What are the main sections in this standard?

- Scope
- Normative references
- Terms and definitions
- Procedure for applying this part of ISO 9241
- Performance criterion
- Properties of physical input devices relevant for usability
- Generic design requirements for physical input devices
- Device-specific design requirements
- Documentation
- Annex A: Overview of the ISO 9241 series
- Annex B: Keyboards
- Annex C: Computer mice
- Annex D: Pucks
- Annex E: Joysticks
- Annex F: Trackballs
- Annex G: Touchpads

- Annex H: Tablets and overlays
- Annex I: Styli and light-pens
- Annex J: Touch-sensitive screens
- Annex K: Designing input devices to accommodate diverse users
- Bibliography

Part 411: Evaluation methods for the design of physical input devices

How do I cite it?

ISO 9241-411:2014 Ergonomics of human-system interaction -- Part 411: Evaluation methods for the design of physical input devices.

What do I need to know about it?

This part of ISO 9241 describes methods for the laboratory analysis of input devices (such as keyboards, mice, pucks, joysticks, trackballs, touch pads, tablets/overlays, touch-sensitive screens, and styli/light pens). It does not contain requirements for input devices: it explains how to assess conformance with the requirements of ISO 9241-410.

The standard comprises a series of tables (there are about 20 tables in total). Each table has three columns. The first column is an attribute from ISO 9241-410; the second column contains a pass/fail criterion based on requirements and intended context of use; and the third column describes the measuring method. For example, in the 'Mice' section, one of the 14 attributes is 'Button displacement'. The pass/fail criterion is 'The maximum button displacement on a mouse shall be ≤ 6 mm.' The measurement method is, 'Verify that the maximum button displacement is ≤ 6 mm.'

The standard includes some annexes that include user performance test methods for input devices.

Who is it written for?

Manufacturers, product designers and test organisations who evaluate commercial input devices such as keyboards, mice, pucks, joysticks, trackballs, touch pads, tablets/overlays, touch-sensitive screens, and styli/light pens.

How many pages does it have?

62

What are the main sections in this standard?

- Scope
- Normative references
- Terms and definitions
- Guiding principles
- Evaluation methods
  - Physical input devices in general
  - Keyboards
  - Mice
  - Pucks
  - Joysticks
  - Trackballs
  - Touchpads
  - Tablets and overlays
  - Styli and light-pens
  - Touch-sensitive screens
- Conformance
- Annex A Overview of the ISO 9241 series
- Annex B Testing of efficiency and effectiveness
- Annex C Assessment of comfort
- Annex D Usability test for keyboards
- Bibliography

Part 420: Selection procedures for physical input devices

How do I cite it?

ISO 9241-420:2011 Ergonomics of human-system interaction -- Part 420: Selection of physical input devices.

What do I need to know about it?

The aim of this standard is to help designers choose the most appropriate input device for their system (input devices include keyboards, mice, pucks, joysticks, trackballs, trackpads, tablets and overlays, touch-sensitive screens, styli and light pens).

The standard recommends you begin by carrying out an analysis of the overall task that the user carries out with the system. Then, to select the most appropriate input device, it recommends you either review the ergonomic pros and cons of each device as described in ISO 9241-410, or you carry out a user test.

To help you assess the pros and cons, the standard includes useful tables showing what each different type of input device is good for (for example, a tablet with stylus is much better for a 'tracing' task than a mouse).

To help you carry out a usability test, the standard provides a methodology for running a series of simple tests. These include:

- Tracing test
- Dragging test
- Assessment of comfort
- One-direction tapping test
- Multi-directional tapping test
- Test for mobile text entry (hand-held keyboards)

- Tables for selecting devices in consideration of product description
- Usability test for keyboards

The standard includes a number of annexes that describe each of these tests in detail.

Who is it written for?

The manufacturers of physical input devices, product designers and organisations that assess the usability of input devices.

How many pages does it have?

94

What are the main sections in this standard?

- Scope
- Normative references
- Terms and definitions
- Procedures for selecting equipment — General considerations
- Performance criterion
- Methods and aids for selection of devices
- Field assessment of input devices
- Annex A: Overview of the ISO 9241 series
- Annex B: Tracing test
- Annex C: Dragging test
- Annex D: Assessment of comfort
- Annex E: One-direction tapping test
- Annex F: Multi-directional tapping test
- Annex G: Test for mobile text entry (hand-held keyboards)

- Annex H: Tables for selecting devices in consideration of product description
- Annex I: Usability test for keyboards
- Bibliography

Part 910: Framework for tactile and haptic interaction

How do I cite it?

ISO 9241-910:2011 Ergonomics of human-system interaction -- Part 910: Framework for tactile and haptic interaction.

What do I need to know about it?

This part of ISO 9241 provides a common set of terms, definitions and descriptions for people who design tactile and haptic interactions. "Tactile and haptic interactions" includes touch-based interfaces (such as touchscreens) as well as kinaesthetic interfaces (such as a remote control that uses force-feedback to give you information about terrain). With iPhones and iPads, touch-based interfaces are now quite common but kinaesthetic interfaces are still relatively rare (except in the gaming industry).

The standard includes a basic introduction to the field as well as basic guidance of when to use tactile/haptic interactions. Recommended application areas include:

- Accessibility
- Desktop interactions
- Mobile interactions
- Robotics
- Medical
- Gaming
- Art and creativity
- Multimodal applications and simulators

The standard also provides design guidance.

Note that this standard does not really discuss or standardise gestures, such as the 'pinch and zoom' gesture familiar to all touch screen users although it does review what it calls 'user-initiated interactive task primitives', such as searching, navigating, targeting, selecting and manipulating.

Who is it written for?

Designers of tactile / haptic interfaces.

How many pages does it have?

55

What are the main sections in this standard?

- Scope
- Terms and definitions
- Introduction to haptics
- Human haptic exploration
- When to use tactile/haptic interactions
- Designing tactile/haptic interactions
- User-initiated interactive task primitives
- Tactile/haptic interaction elements
- The range of tactile/haptic interface devices
- Annex A: Tactile devices
- Annex B: Tactile/haptic devices that provide force feedback
- Annex C: Physiology of haptics
- Bibliography

Part 920: Guidance on tactile and haptic interactions

How do I cite it?

ISO 9241-920:2009 Ergonomics of human-system interaction -- Part 920: Guidance on tactile and haptic interactions.

What do I need to know about it?

This part of ISO 9241 gives recommendations for tactile and haptic interfaces. You can think of these as "feel" screens rather than touch screens. The promise of this technology is that it could allow users to locate features and functions by touch and then the user could get tactile feedback (such as a finger buzz) based on their choice.

This kind of technology is obviously very new, so the standard serves as a useful primer for what can be achieved with it.

Section 3 describes some general ergonomic principles (such as minimising fatigue and allowing users to personalise the interface).

Section 4 provides guidance on how to encode tactile/haptic information, such as encoding by frequency, temperature and location (on the body).

Sections 5 and 6 describe ways to encode specific information, such as using landmarks in tactile maps, and the design of tactile/haptic objects. Finally, section 7 describes interaction techniques for navigating tactile/haptic space.

Who is it written for?

People creating and evaluating special-purpose computing environments (such as virtual reality or simulation systems). It will also be of interest to people creating assistive technologies.

How many pages does it have?

25

What are the main sections in this standard?

- Scope
- Applying ISO 9241-920
- Tactile/haptic inputs, outputs, and/or combinations
- Attributes of tactile and haptic encoding of information
- Content-specific encoding
- Design of tactile/haptic objects and space
- Interaction
- Annex A: Overveiew of the ISO 9241 series
- Bibliography

The future parts of ISO 9241

Visit the ISO web site for the up-to-date status of the other parts of ISO 9241.

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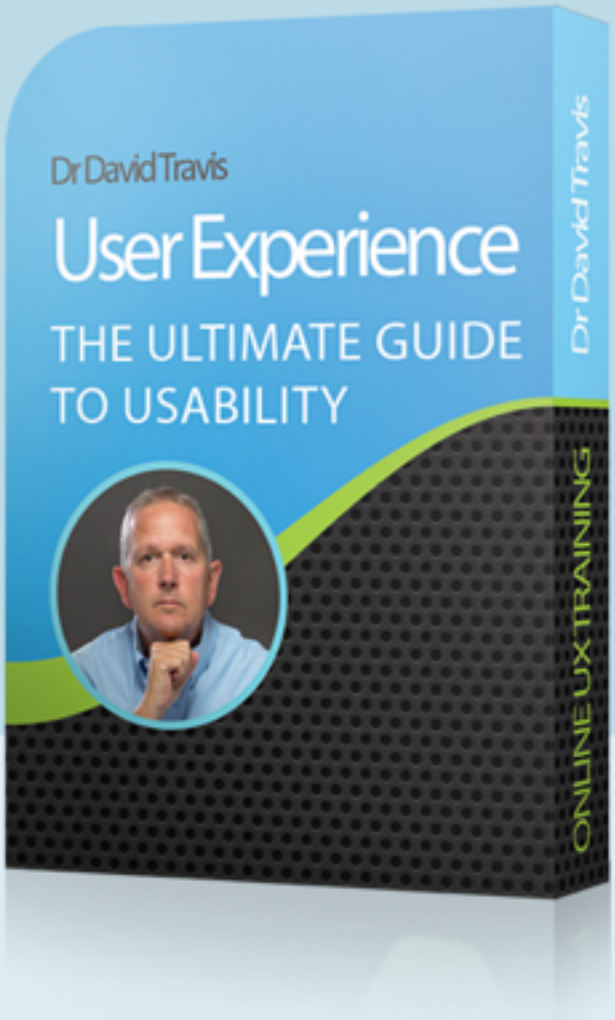

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