35

Applying International Usability Standards

35.1 Introduction

Usability has become recognized as a major factor in determining the acceptance of information systems. Poor usability has been identified as a significant cause of system failure—from large-scale government systems to small bespoke developments. The expanding use of information technology in all types of consumer products from music players and mobile phones to websites and washing machines has brought usability into even sharper focus.

In the past, poor usability was either ignored or blamed on lack of user training. The video cassette recorder (VCR) was one of the most recognizable unusable consumer products employing information technology (albeit relative simple timer technology). The number of such products with clocks “flashing 1200” after a power failure was testament to the difficulty of making a simple change to the clock setting. This in itself did not, however, appear to reduce VCR sales or adoption significantly, and customers only discovered the problems when they had already bought the machines. So, few manufacturers bothered to invest in usability.

The growth of the World Wide Web changed the information technology scene dramatically. Generally, users are offered so much choice (too much to understand properly, some might argue) that they no longer tolerate poor usability. For online retailers, their competitors are “simply a click away,” and few would now launch a website without some user testing. Similarly, the mobile phone industry has recognized that the wide availability of competing products means that good usability design pays dividends. Many with a technical background find Apple products frustrating because they build a
layer between the user and technology. The limitations are not technical but commercial. This so-called walled garden approach means that Apple can control almost all aspects of the user interface and the experience of the user. For many users, this seamless (albeit restricted) interaction not only satisfies but also apparently justifies a significant premium on price.

Apple has long made strong claims about the “intuitiveness” of its user interfaces. Watching young children quickly use pinch and swipe on an iPad, it is hard to argue. However, the computer operating system (OS) is a different matter. Some of the ideas of point and click and direct manipulation are indeed relatively natural to many people, but such concepts as dragging a floppy disk icon to the “trash can” to eject it are far from natural. Where Apple has been successful with its limited and close system is policing a consistent look and feel on its interfaces (even as these have developed).

As an organization, they have been able to retain the control over their part of the industry which no one else has achieved. However, they are not alone in trying to ensure that users can actually use their systems and can achieve results effectively, efficiently, and even find the process satisfying. There are international usability standards that any developer or user organization can use to make their systems usable. By usable, we mean effective, efficient, and satisfying (the definition of usability in one of the international standards ISO 9241-11: 1998 Guidance on usability). ISO/TC159/SC4 is the subcommittee (SC) that deals with human–system interaction.

These standards have been developed over nearly 30 years with new and updated standards being published continuously. The purpose of this chapter is to describe how to apply international usability standards to improve the design of user interfaces and the experience of the users of information systems and technology.

Before describing the standards in detail and their impact on practice, it is important to understand the underlying principles of standardization, especially international standardization.

### 35.2 Underlying Principles

International standards (ISs) are powerful tools for improving the quality, effectiveness, and safety of goods and services; they are also the facilitators of world trade. International usability standards play an important role in information systems and information technology as they encompass widely accepted best practices. However, one of the most common problems people experience when trying to use these standards (and usability standards in particular) is that they do not understand the limitations and constraints that apply to the standards development (Smith 1986; Potonak 1988; Stewart 2000). This section describes the principles underlying ISs in general and international usability standards in particular.

#### 35.2.1 Purpose of Standards

There are two main purposes for standards. First, an important purpose in some areas is to ensure what is called interoperability. For example, there are standards which define screw threads, the prime purpose of which is to ensure that nuts fit bolts. In the information and communications technology arena, there are many standards concerned with interoperability, such as standards for encoding images JPEG, which allow pictures to be shared easily.

Second, there are standards that enshrine best practice and aim to ensure that products, systems, or services meeting these standards perform at some specified level. For example, there are standards for life jackets that aim to ensure that they provide an appropriate level of buoyancy that ensures that people who have to abandon vessels can be kept in a position that allows them to breathe (i.e., face up out of the water) even if they were unconscious. In the usability standards area, there are hardware standards which aim to ensure that computer displays meeting them provide an appropriate level of visibility that ensures that people who use them will be able to read them in typical office environments. There are software usability standards which aim to ensure that dialog screens are designed to match the users and the tasks they are performing and take account of relevant user psychology and cognitive processes.
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35.2.1.1 Best Practice

International usability standards are primarily concerned with providing definitive statements of good practice. The growing field of usability and more recently user experience (UX) is filled with experts offering their own, often conflicting, views of good practice. There are those who argue that user interface design should be regarded as a science and that systematic user research and usability testing techniques are essential in order to design a usable interface. There are others, the most notable example being the late Steve Jobs who famously said in a magazine interview that “You can’t just ask the customers what they want and then try to give that to them. By the time you get it built, they’ll want something new.”

The truth probably lies somewhere between these two extremes. Simply relying on user research will not result in the kind of highly innovative interfaces for which Apple has been famous. However, simply relying on creatively guessing user needs is not enough, and even Apple has conducted extensive testing of its ideas and prototypes with many not making it to market.

In this volatile arena, international usability standards can provide independent and authoritative guidance. International standards are developed slowly, by consensus, using extensive consultation and development processes. This has its disadvantages in such a fast-moving field as user interface design, and some have criticized any attempts at standardization as premature. However, there are areas where a great deal is known about good design practices which can be made accessible to designers through appropriate standards (Dzida et al. 1978; Shneiderman 1987; Sperandio 1987; Newman and Lamming 1995). There are approaches to user interface standardization, based on human characteristics, which are relatively independent of specific design solutions or technologies (e.g., display technology).

The practical discipline of having to achieve international consensus helps moderate some of the wilder claims of user interface enthusiasts and helps ensure that the resulting standards do indeed represent good practice. Although the slow development process means that usability standards can seldom represent the leading edge of design, nonetheless, when properly written, they need not inhibit creativity. Indeed, as discussed later, the development of process standards avoids the trap of limiting standards to current technology. Another approach—which not only does not inhibit creativity but actually enhances it—involves the development of user-based test methods (as exemplified in ISO 9241-304:2008). In this standard, the check for conformance involves comparing the performance of a user executing a standard task on a reference display (which meets the standard) and the new display. If the performance on the new display is as good as or better than the reference display, the new display passes. Since the task involves reading and recognizing characters on the display, it does not matter what technology is used. The test simply checks the performance of the user viewing the display. Similar tests have also been agreed for keyboards and other input devices. Far from limiting creativity, these test standards encourage designers to develop even more innovative technical solutions that work well for their users.

35.2.1.2 Common Understanding

Another problem in the field of usability and user experience is that there are many views not only about the potential interface solutions but also about the terminology involved at all stages. Even what the main players involved in designing systems for people should be called can become a point of argument—are they UX designers? Information designers or architects? Interaction or interface designers? What happened to system designers, developers, software designers, and so on. Apart from potentially overlapping or conflicting roles, good usability design involves a number of different perspectives and viewpoints. One of the benefits of international usability standards is to provide a framework for different parties to share a common understanding when specifying interface quality in design, procurement, and use. International usability standards allow:

- Users to set appropriate procurement requirements and to evaluate competing suppliers’ offerings
- Suppliers to check their products during design and manufacturing and provide a basis for making claims about the quality of their products
- Regulators to assess quality and provide a basis for testing products against national and international requirements
35.2.1.3 Consistency

Anyone who uses computers knows only too well the problems of inconsistency between applications and often even within the same application. Inconsistency, even at the simplest level, can cause problems. On the World Wide Web, inconsistency is very common. Even something as straightforward as a hypertext link may be denoted by underlining on one site, by a mouseover on a second site, and by nothing at all on a third site.

Usability standards can help organizations develop their own internal user interface standards and style guides to address this problem. Such documents can provide a consistent reference across design teams or across time to help avoid time-consuming and error-inducing inconsistency in the user interface.

35.2.1.4 Raising the Profile of User Interface Issues

One of the most significant benefits of international usability standardization is that it places user interface issues squarely on the agenda. Standards are serious business, and whereas many organizations may choose to pay little regard to research findings, few organizations can afford to ignore standards. Indeed in Europe, and increasingly in other parts of the world, compliance with relevant standards is a mandatory requirement in major contracts (Earthly et al. 2001).

35.2.2 Use of Language

It is important to understand that although ISs are written in English, French, or Russian (the three official languages of ISO, the International Organization for Standardization), there are extensive drafting rules, which mean that certain terms have quite specific meanings. For example, in the English versions of the standards, the use of the word “shall” means that something is necessary in order to meet the requirements in the standard. Meeting all the “shall}s” in the standard is necessary in order to be able to claim that something “conforms” to the standard.

In the field of usability, there are few circumstances where there is only one solution and therefore where a “shall” is required. One of the frustrations that information systems designers experience is that when they ask a usability expert for advice, the answer usually start with “it depends … .” The reason for this is not that usability people share with politicians an unwillingness to give straight answers but rather a recognition that the “correct answer” depends on the context. So, for example, an apparently simple question such as “what is the maximum number of items that can be presented as a menu?” does not have a simple answer. If the menu is a simple drop-down list which the user will scroll down using a mouse or arrow key, then according to ISO 9241-14:2000 Menu Dialogues, that number is generally 7 ± 2 corresponding to short-term memory. However, if the menu is an alphabetic listing of every song on an iPod which will be accessed by the user touching a list which allows scrolling to be sped up or slowed down, then the answer is as many songs as the user possesses.

In practice, therefore, usability standards generally provide “guidance” and use the word “should” (in English versions) to reflect that this is a “recommendation” rather than a “requirement.”

35.2.3 Conformance

International standards are generally voluntary, that is, it is up to the user of the standard to decide whether to follow a standard or not. In practice, however, especially in procurement conformance with standards may be required in order to satisfy the procuring organization. Conformance means complying with the mandatory requirements set out in the specific standard, usually indicated by the word “shall” in the text and a description on how to assess compliance in an annex (a test method).

As discussed earlier, many international usability standards do not contain many requirements and instead provide guidance, that is, “shoulds,” which depend on the context. However, it is still
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possible to claim conformance to such standards. One way is simply to declare that “all relevant recommendations in standard x have been followed.” It is then up to the party to whom such a claim is made to assess whatever evidence is provided and determine whether they agree that the recommendations have been followed. Many user experience consultancies offer such evaluation services to their clients—both to suppliers wishing to make such claims about their products and to user organizations wishing to have suppliers’ offerings assessed.

In some cases, the usability standards contain what is known as conditional compliance clauses. These standards do contain a “shall,” that is, a mandatory requirement. That requirement typically stipulates that users of the standard shall determine which clauses and recommendations apply to their product, system, or service, and then detail how they determined that they met that requirement. For example, clause 4.3 in ISO 9241-14:1997 Menu Dialogues states, “If a product is claimed to have met the applicable recommendations in this part of ISO 9241, the procedure used in establishing requirements for, developing, and/or evaluating the menus shall be specified. The level of specification of the procedure is a matter of negotiation between the involved parties. Users of this part of ISO 9241 can either utilize the procedures provided in Annex A, or develop another procedure tailored to their particular development and/or evaluation environment.”

35.2.4 How ISO Develops International Standards

The ISO is the world’s largest developer and publisher of ISs. Its members are the National Standards Bodies (NSBs) of 162 countries. It is supported by a Central Secretariat based in Geneva, Switzerland. The principal deliverable of ISO is the IS.

Standards development work is conducted by technical committees (TCs) and subcommittees (SCs) which meet every year or so and are attended by formal delegations from participating members of that committee. In practice, the technical work takes place in working groups (WGs) of experts, nominated by national standards committees but expected to act as independent experts. Most NSBs set up “mirror committees” to coordinate their input to the international work.

- The work starts when a new work item (NWI) is proposed identifying a suitable topic for standardization. This proposal document is circulated for vote to the appropriate TC or SC.
- If approved, it is passed to a WG to be developed into a working draft (WD), which is a partial or complete first draft of the text of the proposed standard. The work is usually done by a project editor with members of the WG.
- The first formal stage is to produce and circulate a committee draft (CD) and circulate it for comment and approval within the committee and the national mirror committees. It is not unusual for a second CD to be required if there is significant disagreement over the first CD.
- The first public stage is a draft international standard (DIS), which is circulated widely for public comment via the NSBs.
- Once this is approved and any relevant comments addressed, it is issued as final DIS. At this stage, no further substantive comments are permitted, except a final go/no go vote.
- Eventually (under ISO rules, each stage takes a minimum of 3–6 months to allow for full review in each country), a final IS is published.

35.3 Impact on Practice

ISO usability standards have become increasingly important in the design of information systems and technology. They are specified in many procurement contracts, and most major software developers rely on them to demonstrate the quality of their products. Their history stretches back over more than 30 years.
35.3.1 Early History of ISO Usability Standards

Usability standards have been under development by ISO since 1983 when a NWI with the title “Visual Information Processing” was approved. This work item became the responsibility of ISO TC159 SC4 Ergonomics of human–system interaction, and after several years work resulted in a 17-part standard ISO 9241 entitled “Ergonomic requirements for office work with visual display terminals.” The focus on office work reflected concerns at the time about the impact of VDU use on people’s health, but many of the parts of ISO 9241 dealt with broader usability and software interface issues. It has been an influential standard across the world and is referenced in many countries’ regulations, including the United Kingdom’s Health and Safety (display screen equipment) Regulations 1992 (Stewart 1992). Thirty five countries take part in the standards work and many go on to adopt the ISs as national standards.

When it came to revising this standard, the committee wanted both to retain the ISO 9241 “brand” which had become a recognized benchmark and also to broaden its scope. A new title “The Ergonomics of Human–System Interaction” reflected this ambition, and the multipart structure allowed the committee to integrate other usability standards.

The structure reflected the numbering of the original ISO 9241 standard; for example, displays were originally Part 3, and became the 300 series. In each section, the “hundred” is an introduction to the section, for example, Part 100 gives an introduction to the software ergonomics parts. The number of parts that will be developed in each section varies depending on the complexity of the area and the need for specific standards. Only three part numbers have been retained (following revision) from the original ISO 9241 structure, as these address issues that apply across all other 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
  - Part 20 Accessibility and human–system interaction

The remaining 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

35.3.2 How Do You Apply Usability Standards in Practice?

During the development of ISO 9241, it became clear that user interface technology was developing so quickly that the traditional approach to standards could not keep up in all areas. Two solutions were adopted for this problem.

First, standards concerned with hardware including displays and input devices contained what were known as “user performance test methods” as well as conventional hardware test methods. These user performance test methods allowed a new device to be used under controlled conditions by a defined group of participants performing specific tasks. The performance of the participants was then compared with their performance on a test device, which met the standard. If the participants’ performance was as good or better on the test device, then this device was deemed to pass. This approach means that any
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Technology can be tested if it is designed to allow users to perform suitable tasks, for example, read text on a screen, or enter characters into a system.

Second, it was realized that in many cases the best way to ensure that a design was usable was to follow a human-centered design process. Human-centered design is an approach to developing and acquiring software that improves system effectiveness and the efficiency and satisfaction of users (usability). Following this systematic framework helps reduce the risk that new software is unusable or fails to work properly for its intended users. Across all industries and governments, major software development projects are notorious for being delivered late and overbudget. Worse still, they often fail to deliver the service promised (Clegg et al. 1997). In hindsight, the problems are often due to a failure to engage fully with all stakeholders, especially those intended to operate and use the systems. Furthermore, excessive ambition which overlooks the reality of existing working practices, and design and development methods which are rigid, inflexible, and unable to adapt to emerging business needs and changes in the environment are also reasons for failure. In 1999, ISO TC159 SC4 published a new standard ISO 13407 on Human-Centered Design for Interactive Systems. The standard provides a systematic framework, which directly addresses these and other problems in delivering usable software, products, and services. It is aimed at Project Managers and describes how they can apply human-centered design processes to procure or develop technical software that will deliver value to the users and the business. This standard presents four principles of human-centered design, including the iteration of design solutions and the active involvement of users. It also describes key activities including the need to understand and specify the context of use, produce designs and prototypes of potential solutions, and evaluate these solutions against the human-centered criteria. The term human-centered design was used in preference to user-centered design, because the process includes all stakeholders, not just those usually considered as users.

Both approaches have been adopted widely, and the new parts of ISO 9241 that deal with displays and input devices both contain user performance test methods. Human-centered design has been recognized as the best way to develop usable systems, and the standard has been endorsed by such bodies as the Usability Professionals Association and the International Ergonomics Association.

The human-centered design approach is complementary to existing design methodologies—it does not describe all the processes that are necessary to design and develop a system. It is characterized by the following:

- Systems are designed to take account of all the people who will use them and other stakeholder groups, including those who might be affected (directly or indirectly) by their use. Constructing systems based on an inappropriate or incomplete understanding of user needs is one of the major sources of systems failure.
- Users are involved throughout design and development. This provides knowledge about the context of use, the tasks, and how users are likely to work with the future system. User involvement should be active, whether by participating in design, acting as a source of relevant data, or by evaluating solutions.
- The design is driven and refined by user-centered evaluation. Early and continuous feedback from users minimizes the risk that the system does not meet user and organizational needs (including those requirements that are hidden or difficult to specify explicitly). Such evaluation ensures preliminary design solutions are tested against “real world” scenarios, with the results being fed back into progressively refined solutions. User-centered evaluation should also take place as part of final acceptance of the product to confirm that requirements have been met. Feedback from users during operational use identifies long-term issues and provides input to future design.
- The process is iterative. For complex systems, it is impossible to specify completely and accurately every aspect of the interaction at the beginning of development. Initial design solutions rarely satisfy all the user needs. Many users and stakeholders need only emerge during development, as the designers refine their understanding of the users and their tasks, and as users provide feedback on potential solutions.
• The design addresses the whole user experience. This involves considering, where appropriate, organizational impacts, user documentation, on-line help, support and maintenance (including help desks and customer contact points), training, and long-term use.
• The design team reflects a range of skills and perspectives. The team does not have to be large, but should be sufficiently diverse to understand the constraints and realities of the various disciplines involved. This can have other benefits too. For example, technical experts can become more sensitized to user issues, and the users themselves can become more aware of technical constraints.

35.3.3 Using Standards to Support Human-Centered Design

Although, as explained earlier, the human-centered design standard ISO 13407 was developed in parallel with ISO 9241, many parts of ISO 9241 were developed with an implicit human-centered design process in mind. These parts can also be used to support specific design activities whether or not a full human-centered design process is being followed. Therefore, the next section describes the human-centered design process, originally specified in ISO 13407, and explains how the various parts of ISO 9241 can be used to support this process.

As part of the overall restructuring of ISO 9241 mentioned earlier, the opportunity was taken when ISO 13407 was undergoing its systematic review (a key part of the ISO process to ensure continued relevance) to incorporate it within the new ISO 9241 structure as ISO 9241-210:2010 Human-centered design for interactive systems. The revised standard remained largely unchanged, with one major exception. The four key human-centered design activities were no longer just recommendations; they became “requirements.” This meant that people could now claim conformance, that is, that they followed and adhered to the ISO 9241-210 human-centered design process. To do so, they have to ensure that they

• Understand and specify the context of use (including users, tasks, environments)
• Specify the user requirements in sufficient detail to drive the design
• Produce design solutions which meet these requirements
• Conduct user-centered evaluations of these design solutions and modify the design taking account of the results

Note that the requirement is to provide evidence to show that they have done these successfully. There is no requirement to produce lots of documents to conform to the standard. The onus is on the organization claiming conformance to provide whatever level of detailed evidence the recipient requires.

In addition to these four activities, the standard provides guidance and recommendations on how to plan the human-centered design process and how to follow-up to ensure that the system is implemented properly. These six main steps are described in the following sections, and the other parts of ISO 9241, which support these steps, are explained and described briefly.

Standards development is an ongoing process, and standards can change radically during the various stages. The tables therefore only reference ISO standards that have been published up to February 2012.

35.3.3.1 Planning When and How the Human-Centered Design Activities Fit in the Program

The Project Manager should prepare the plan, which shows how the human-centered activities integrate into the overall project plan. Where the software is being developed in-house within the organization, the Project Manager creates the plan directly ensuring due time and resources are scheduled to allow the human-centered activities to be undertaken properly and any results fed back into the overall development process.
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Where software is being purchased from an external supplier, there are two options:

1. The software is already available “off the shelf.”
2. Significant customizing and development are required.

In option 1, the Project Manager only has to plan any organization-specific activities involved in selecting, evaluating, or implementing the software.

In option 2, the Project Manager requires the supplier to provide the plan, taking full account of the time and resources, which may be required from the organization, to participate in user research, requirements gathering, user testing, and any other user-based activities.

Underestimating the extent of user interaction required is a common feature of projects that do not plan human-centered design appropriately. For example, a system may be initially intended to be fully automated but ends up requiring significant user interaction, which then has to be designed in a rush without a sound understanding of the context of use.

The level of detail in the plan will vary depending on the scale of the project, the degree of user interaction expected, and the risks associated with poor usability or user rejection of the system.

The plan

- Identifies appropriate methods and resources for the human-centered activities
- Defines how these and their outputs fit with other system development activities
- Identifies the individuals and the organization(s) responsible for the human-centered design activities and the range of skills and viewpoints they provide
- Describes how user feedback and communication are collected and communicated
- Sets appropriate milestones and timescales for human-centered activities within the overall plan (allowing time for user feedback, and possible design changes, to be incorporated into the project schedule)

The plan for human-centered design is subject to the same project disciplines (e.g., responsibilities, change in control) as other key activities.

Time should also be allocated within the plan for communication among design team participants. Time spent resolving usability issues early in the project will deliver significant savings at later stages (when changes are, inevitably, more costly).

Human-centered design activities should start early in the project (e.g., at the initial concept stage) and continue throughout the life of the project (Table 35.1).

35.3.3.2 Understand and Specify the Context of Use (Including Users, Tasks, Environments)

The characteristics of the users, their tasks, and the organizational, technical and physical environment define the context in which the system is used (the context of use).

<table>
<thead>
<tr>
<th>TABLE 35.1</th>
<th>Parts of ISO 9241 and Associated Standards Relevant to Planning</th>
</tr>
</thead>
<tbody>
<tr>
<td>Relevant parts of ISO 9241</td>
<td>Brief Description</td>
</tr>
<tr>
<td>ISO 9241-210:2010 Human-centered design for interactive systems (supersedes ISO 13407 1999)</td>
<td>This part provides guidance on and requirements for the human-centered design process and is aimed at those responsible for managing the design of interactive systems.</td>
</tr>
<tr>
<td>ISO/TR 18529:2000 Human-centered life cycle process descriptions</td>
<td>Uses the ISO standard format for process models to describe the processes necessary for ensuring human-centered design content in systems strategy.</td>
</tr>
</tbody>
</table>

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The context of use description includes details of the following:

- The users and other stakeholder groups.
- The user profile in terms of relevant knowledge, skill, experience, training, physical attributes (e.g., any disabilities), preferences, and capabilities of the users.
- The environment profile in which the system will operate the technical environment, including the hardware, software, and materials; the relevant characteristics of the physical environment, including thermal conditions, lighting, spatial layout, and furniture.
- The user task profile, including the frequency and duration of tasks and interdependencies (Table 35.2).

The user, environment, and task profiles should be described in sufficient detail to support the requirements, design, and evaluation activities. They are working documents that start as outlines, and are reviewed, maintained, extended, and updated during the design and development process.

The next step is to turn the profiles into concrete, detailed usage “scenarios” and “personnas” (Dzida 1998). Scenarios are realistic stories that describe the use of the software from the user’s perspective and are combinations of individual tasks in the right sequence to achieve an overall goal. Personnas are rich descriptions of target users.

The scenarios and personnas provide a high-level summary of the key goals, which the software is intended to support, in user-centered language.

Where the software is being custom-developed (whether in-house or by an external supplier), the scenarios and personnas help communicate how the users will expect to use the software and what they will want to achieve from it. Designers find these kinds of descriptions useful in maintaining a focus on the user when designing specific functionality.

Where software is being purchased “off the shelf” from an external supplier, the scenarios help the software selectors understand the user’s context and communicate this to potential suppliers.

In both situations, the scenarios provide a consistent framework for the subsequent evaluation of emerging or proposed designs.

35.3.3.3 Specify the User Requirements in Sufficient Detail to Drive the Design

Identifying user needs and specifying the functional and other requirements for the system are major software development activities. When following the human-centered design approach, these activities are extended to create an explicit specification of user requirements in relation to the context of use and the objectives of the system (Table 35.3).

The user requirements specification should be

- Stated in terms that permit subsequent testing
- Verified by the relevant stakeholders
- Internally consistent
- Updated as necessary, during the life of the project

This specification is then used to drive the design and provide agreed quality measures used to evaluate the software.
These quality measures should

- Capture the key success factors for the product and what value it will deliver for users.
- Summarize who will be doing what and under what circumstances.
- Identify the type of measures to be used (e.g., performance data, user preference data, or conformance to standards).
- Specify the level that the software must achieve to be released to users. Scores below that level mean that the products must be improved. Scores above that level may mean that resources have been wasted.

35.3.3.4 Produce Design Solutions That Meet These Requirements

There are several chapters in this handbook that provide guidance for the design of usable software. Within the ISO 9241 series of standards, there are several standards that provide detailed guidance, but the overall process involves six main steps in designing usable software.

1. Structure solutions around key tasks and workflows based on the context of use and user requirements specification. A key issue concerns establishing an appropriate “allocation of function”—deciding which system tasks are to be automated and which should be under user control. Table 35.4 lists standards relevant to designing jobs and tasks.

2. Design the interaction, interface, and navigation from the user’s perspective and keep them consistent. Be aware of other software that the user is likely to be using, and be cautious about introducing different styles of interface. Table 35.5 lists standards relevant to designing dialogs and navigation.

3. Define the navigation and keep it consistent. If different teams are developing separate parts of the software, maintain consistency by establishing an agreed style guide at the beginning of the development.

4. Follow interface design best practice. Various parts of ISO 9241 offer guidance and are based on internationally agreed best practice for achieving usable hardware and software (see Tables 35.6 through 35.8). The HCI Bibliography website lists more than 53 journals, many peer-reviewed, relevant to usability and human–computer interaction (HCI Bibliography 2012).

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**TABLE 35.3** Parts of ISO 9241 Relevant to Specifying the User Requirements

<table>
<thead>
<tr>
<th>Relevant Parts of ISO 9241</th>
<th>Brief Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>ISO 9241-11:1998 Guidance on usability</td>
<td>Defines usability as “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,” and provides guidance on how to address usability in design projects.</td>
</tr>
<tr>
<td>ISO 9241-20:2009 Accessibility guidelines for information/communication technology equipment and services</td>
<td>A high-level overview standard covering both hardware and software. It covers the design and selection of equipment and services for people with a wide range of sensory, physical, and cognitive abilities, including those who are temporarily disabled, and the elderly.</td>
</tr>
</tbody>
</table>

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**TABLE 35.4** Parts of ISO 9241 Relevant to Designing Jobs and Tasks

<table>
<thead>
<tr>
<th>Relevant Part of ISO 9241</th>
<th>Brief Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>ISO 9241-2:1992 Guidance on task requirements deals with the design of tasks and jobs involving work with visual display terminals</td>
<td>Provides guidance on how task requirements may be identified and specified within individual organizations and how task requirements can be incorporated into the system design and implementation process.</td>
</tr>
<tr>
<td>Relevant Parts of ISO 9241</td>
<td>Brief Description</td>
</tr>
<tr>
<td>---------------------------</td>
<td>------------------</td>
</tr>
<tr>
<td>ISO/TR 9241-100:2010 Introduction to standards related to software ergonomics</td>
<td>Provides an introduction to the &quot;100 series&quot; of ISO 9241 software parts. Published as a TR, which has a shorter development time than a full IS. This will allow it to be updated regularly to reflect the current content and structure of ISO 9241.</td>
</tr>
<tr>
<td>ISO 9241-110:2006 Dialog principles (supersedes ISO 9241 10:1996)</td>
<td>Sets out seven dialog principles and gives examples. The dialog should be suitable for the task (including the user's task and skill level); self-descriptive (it should be obvious what to do next); controllable (especially in pace and sequence); conform to user expectations (i.e., consistent); error-tolerant and forgiving; suitable for individualization and customizable; and should support learning.</td>
</tr>
<tr>
<td>ISO 9241-129:2010 Guidance on software individualization</td>
<td>This part provides ergonomics guidance on individualization within interactive systems, including recommendations on where individualization might be appropriate or inappropriate and how to apply individualization. The standard provides general guidance on individualization rather than specific implementations of individualization mechanisms. It is intended to be used along with other parts of ISO 9241—not in isolation.</td>
</tr>
<tr>
<td>ISO 9241-14:2000 Menu dialogues</td>
<td>Recommends best practice for designing menus (pop-up, pull-down, and text-based menus). Topics include menu structure, navigation, option selection, and menu presentation (including placement and use of icons). One of the annexes contains a 10-page checklist for determining compliance with the standard.</td>
</tr>
<tr>
<td>ISO 9241-15:1998 Command dialogues</td>
<td>This part provides recommendations for the ergonomic design of command languages used in user–computer dialogs. The recommendations cover command language structure and syntax, command representations, input and output considerations, and feedback and help. Part 15 is intended to be used by both designers and evaluators of command dialogs, but the focus is primarily toward the designer.</td>
</tr>
<tr>
<td>ISO 9241-16:1999 Direct manipulation dialogues</td>
<td>This part provides recommendations for the ergonomic design of direct manipulation dialogs, and includes the manipulation of objects, and the design of metaphors, objects, and attributes. It covers those aspects of &quot;Graphical User Interfaces,&quot; which are directly manipulated, and not covered by other parts of ISO 9241. Part 16 is intended to be used by both designers and evaluators of command dialogues, but the focus is primarily toward the designer.</td>
</tr>
<tr>
<td>ISO 9241-143:2012 Forms</td>
<td>ISO 9241-143:2012 provides requirements and recommendations for the design and evaluation of forms, in which the user fills in, selects entries for, or modifies labeled fields on a &quot;form&quot; or dialog box presented by the system. It contains guidance on the selection and design of interface elements relevant to forms. The requirements and recommendations can be used during design, as a basis for heuristic evaluation, as guidance for usability testing, and in the procurement process. It replaces ISO 9241-17:1998 Form-filling dialogs.</td>
</tr>
<tr>
<td>ISO 9241-151:2008 Guidance on World Wide Web user interfaces</td>
<td>Sets out detailed design principles for designing usable websites—these cover high-level design decisions and design strategy; content design; navigation; and content presentation.</td>
</tr>
<tr>
<td>ISO 9241-171:2008 Guidance on software accessibility</td>
<td>Aimed at software designers and provides guidance on the design of software to achieve as high a level of accessibility as possible. Replaces the earlier Technical Specification ISO TS 16071:2003 and follows the same definition of accessibility—&quot;usability of a product, service, environment, or facility by people with the widest range of capabilities.&quot; Applies to all software, not just web interfaces.</td>
</tr>
</tbody>
</table>
5. Produce sketches and mock-ups early to test assumptions. Using scenarios and simple sketches or mock-ups enables the designers to communicate the proposed design to users and other stakeholders to obtain feedback before design decisions are finalized.

6. Keep testing emerging solutions with users until the quality criteria are met. Human-centered evaluation can take place throughout the design process from initial concepts to final (signed-off) designs.

One example of the kind of high-level guidelines in ISO 9241 is reproduced in simplified form in Table 35.9, which is based on ISO 9241-110:2006 Dialogue Principles. See Table 35.10 for standards relevant to selecting usability methods for design and evaluation.
### TABLE 35.7 Parts of ISO 9241 Relevant to Designing or Selecting Keyboards and Other Input Devices

<table>
<thead>
<tr>
<th>Relevant Parts of ISO 9241</th>
<th>Brief Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>ISO 9241-4:1998 Keyboard requirements (some clauses in this standard have been superseded by ISO 9241-400 and ISO 9241-410)</td>
<td>This part specifies the ergonomics design characteristics of an alphanumeric keyboard, which may be used comfortably, safely, and efficiently to perform office tasks.</td>
</tr>
<tr>
<td>ISO 9241-400:2007 Principles and requirements for physical input devices</td>
<td>Sets out the general ergonomics principles and requirements, which should be taken into account when designing or selecting physical input devices.</td>
</tr>
<tr>
<td>ISO 9241-410:2008 Design criteria for physical input devices (supersedes ISO 9241-9: 1998)</td>
<td>Describes ergonomics characteristics for input devices, including keyboards, mice, pucks, joysticks, trackballs, touchpads, tablets, styli, and touch-sensitive screens. The standard is aimed at those who design such devices and is very detailed.</td>
</tr>
<tr>
<td>ISO 9241-420:2011 Selection of physical input device</td>
<td>Provides ergonomics guidance for selecting input devices for interactive systems. It describes methods for evaluating a wide range of devices from keyboards and mice to pucks, joysticks, trackballs, trackpads, tablets and overlays, touch-sensitive screens, styli, and light pens. It encourages user organizations and systems integrators to consider the limitations and capabilities of users and the specific tasks and context of use when selecting input devices.</td>
</tr>
<tr>
<td>ISO 9241-910:2011 Framework for tactile and haptic interaction</td>
<td>Provides a framework for understanding and communicating various aspects of tactile/haptic interaction. It defines terms, describes structures and models, and also serves as an introduction to the other parts of the ISO 9241 “900” subseries. It provides guidance on how tactile/haptic interaction can be applied to a variety of user tasks. It does not specifically cover gesture-based interfaces, although it does offer some relevant guidance for understanding such interactions.</td>
</tr>
<tr>
<td>ISO 9241-920:2009 Guidance on tactile and haptic interactions</td>
<td>Gives recommendations for tactile and haptic hardware and software interactions. It provides guidance on the design and evaluation of hardware, software, and combinations of hardware and software interactions. It does not provide recommendations specific to Braille, but can apply to interactions that make use of Braille.</td>
</tr>
</tbody>
</table>

### TABLE 35.8 Parts of ISO 9241 Relevant to Designing or Workplaces for Display Screen Users

<table>
<thead>
<tr>
<th>Relevant Parts of ISO 9241</th>
<th>Brief Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>ISO 9241-5:1999 Workstation layout and postural requirements</td>
<td>This part specifies the ergonomics requirements for a visual display terminal workplace, which will allow the user to adopt a comfortable and efficient posture.</td>
</tr>
<tr>
<td>ISO 9241-6:2000 Guidance on the work environment</td>
<td>This part specifies the ergonomics requirements for the visual display terminal working environment, which will provide the user with comfortable, safe, and productive working conditions.</td>
</tr>
</tbody>
</table>
TABLE 35.9  Usability Principles (Based on ISO 9241-110)

1. **Fit with user's task**
   The interface should match the way users perform their tasks
   1.1 Are screens designed to provide users with the relevant information they need to complete tasks?
   1.2 Is only necessary information displayed?
   1.3 Does the system accept input and produce output in useful and appropriate formats?
   1.4 Do input fields contain useful default values?
   1.5 Is the sequence of actions required optimum? (i.e., all that is needed, but no more)
   1.6 If paper documents are needed for the task, do the screens match their format?

2. **Sign posting**
   The users should be able to tell from the screens, where they are in the task and what they can do next
   2.1 Do the screens guide the user what to do next?
   2.2 Can most users work without needing to refer to manuals?
   2.3 Is it obvious when input is required or about to be required?
   2.4 Is it clear what input is required?
   2.5 Is it clear how to interact with the different system components?
   2.6 Do input fields indicate what format and units are required (for example, dd/mm/yyyy)?

3. **Intuitiveness**
   The system should respond to the task context and follow accepted conventions for the target users
   3.1 Is the terminology appropriate to the target users?
   3.2 Is there timely feedback on users' actions?
   3.3 Are users given useful feedback on response times?
   3.4 Do the data structures correspond to users' expectations?
   3.5 Is there sufficient and useful feedback to users?
   3.6 Are the behavior and appearance of the system consistent throughout?
   3.7 Does the input focus default appropriately?
   3.8 Are system messages useful and constructive?
   3.9 Is the interface suitable for users who do not have English as their first language?

4. **Learnability**
   The system should support learning
   4.1 Does the system provide explanations which help users learn?
   4.2 Are there prompts and reminders to help users learn?
   4.3 Is sufficient support available to help infrequent users?
   4.4 Does the system help users build a mental model of what is going on?
   4.5 Can users see the steps needed to complete a task?
   4.6 Does the system minimize the amount of input required (e.g., using autocomplete)?
   4.7 Does the system encourage users to explore (if appropriate) without negative consequences?

5. **User control**
   The user should be able to control the interaction
   5.1 Can the user control the pace of the interaction?
   5.2 Can the user control the sequence of steps?
   5.3 Does the system allow the user to restart their task if necessary?
   5.4 Does the system offer an "undo" where possible?
   5.5 Can the user control the amount of data displayed at a time?
   5.6 Does the system support alternative input/output devices?
   5.7 Can users set appropriate default values?
   5.8 If appropriate, can users "track changes" and view original data after a modification?

(continued)
35.3.3.5 Conduct User-Centered Evaluations of These Design Solutions and Modify the Design, Taking Account of the Results

User-centered evaluation (evaluation based on the users’ perspective) is at the heart of human-centered design. It occurs throughout the design life cycle from initial testing of concepts to final testing to confirm that the software meets the quality criteria.

There are two main approaches:

- Inspection-based evaluation
- User-based testing

35.3.3.5.1 Inspection-Based Evaluation

Inspection-based evaluation helps eliminate major issues before user testing (and hence makes the user testing more cost-effective). It is ideally performed by usability experts, with broad experience of problems encountered by users, working with domain experts who understand the software and the problem

<table>
<thead>
<tr>
<th>TABLE 35.9 (continued) Usability Principles (Based on ISO 9241-110)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>6. Error tolerance</strong></td>
</tr>
<tr>
<td><strong>The system should minimize the likelihood and severity of errors</strong></td>
</tr>
<tr>
<td>6.1 Does the system help minimize input errors?</td>
</tr>
<tr>
<td>6.2 Is the system robust?</td>
</tr>
<tr>
<td>6.3 Are error messages helpful for correcting the error?</td>
</tr>
<tr>
<td>6.4 Does the system actively support error recovery?</td>
</tr>
<tr>
<td>6.5 If automatic error correction is provided, can users override this functionality?</td>
</tr>
<tr>
<td>6.6 Can users continue (where appropriate) and defer correcting an error until a more suitable time?</td>
</tr>
<tr>
<td>6.7 Can users get additional help for errors?</td>
</tr>
<tr>
<td>6.8 Does the system validate input data before processing?</td>
</tr>
<tr>
<td>6.9 Has the number of steps for error correction been minimized?</td>
</tr>
<tr>
<td>6.10 Does the system require confirmation for potentially critical actions?</td>
</tr>
</tbody>
</table>

**7. Customizing**

Users should be able to customize the system to suit their skills and preferences

7.1 Can the system be tailored to suit different user profiles?  
7.2 Can the user customize how data is displayed?  
7.3 Can the help information be tailored for users with different skills?  
7.4 Can users customize system speed and sensitivity?  
7.5 Can users choose different interaction styles, for example, command line versus GUI?  
7.6 Can users choose from a variety of interaction methods (e.g., keyboard vs. mouse)?  
7.7 Can users customize how input/output data is displayed, to a degree that meets their needs?  
7.8 Can users customize the interface or functionality to suit their task requirements and preferences?  
7.9 Can users modify names of objects and actions to suit their requirements?  
7.10 Can default settings be restored?

<table>
<thead>
<tr>
<th>TABLE 35.10 Standards Relevant to Selecting Usability Methods for Design and Evaluation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Relevant Standard</td>
</tr>
<tr>
<td>ISO/TR 16982:2002 Usability methods supporting human-centered design</td>
</tr>
</tbody>
</table>
Applying International Usability Standards

domain. Inspection can be based on task scenarios or on guidelines and standards, for example, the Web Content Accessibility Guidelines (WCAG).

During the development process, or where there are no users already familiar with the software, inspection-using scenarios can be used. This involves the assessor putting themselves in the position of the user working through the scenarios agreed in the requirements stage. This can be done with working prototypes or with partial prototypes or even nonfunctioning mock-ups of the software. At the very early stages in design, these mock-ups can be simple sketches on paper, or at a slightly later stage, PowerPoint screenshots with hotspots to simulate functionality. The assessor works through the tasks in the scenario and notes any issues, for example, points in the sequence where it is not clear what to do next or where the result is unexpected. The objective is to identify breaks in flow and incomplete or unclear screens and dialogs at an early enough stage for them to be changed quickly and cheaply. Delaying assessing early designs is not only wasteful, but also tends to inhibit assessors who may be reluctant to recommend changes, which they think may be time-consuming or expensive. Starting assessment early also provides a useful benchmark, which shows how the design has improved, as it is modified, based on user-centered feedback.

Inspection-based evaluation can also be conducted using guidelines and standards. Software accessibility, the degree to which software can be used by people with disabilities, is one area where it can be necessary to check compliance with published external standards. In particular, the WCAG, published by the World Wide Web Consortium (W3C), are the widely accepted accessibility standards for web-based applications. More information on available standards to support inspection is shown in Tables 35.5 through 35.10.

35.3.3.5.2 User Testing

User testing can be undertaken at any stage of the design and development cycle. At an early stage, users can be presented with sketches or mock-ups of design concepts and asked to evaluate them by working through how they would carry out key tasks. This provides much more information than simply showing or demonstrating them to users. For instance, scenarios could be used to provide a useful framework for structuring this walkthrough of the software. Later in development, user testing is used to confirm that the software meets the agreed quality criteria established earlier.

User testing is best conducted in a usability laboratory, which allows user behavior including detailed mouse and keyboard use to be observed and recorded for subsequent analysis. This can be supplemented with eye-tracking technology, which shows exactly where on the screen the users have been looking during the tasks. It can also be conducted more simply at the user’s normal workstation by observing and video recording their behavior as they work through the tasks.

In addition to direct observations or measurements of user behavior (e.g., task completion times), user testing can involve users vocalizing their thought process while they perform the tasks. Further feedback can be obtained through questionnaires or interviews and checklists (before, during, or after the tasks).

The procedure for conducting user-based testing involves the following:

- Writing a test plan, which uses the scenarios to test the software against the release criteria, collects the relevant user behavior information, and identifies appropriate test participant profiles, for example, experienced user of competing product
- Ensuring that all stakeholders review and agree the plan in advance
- Recruiting the participants to the agreed profile
- Preparing the software, computer hardware, usability lab or other equipment, and questionnaires and checklists
- Conducting a pilot study to ensure that the testing is likely to produce the appropriate data for establishing whether the release criteria have been met
Conducting the formal test with the requisite number of participants (typically a minimum of three to four per unique user group) ensuring that the test conditions are randomized or balanced to avoid confounding learning effects or bias

Analyzing and reporting the results in an agreed format with usability issues prioritized in terms of severity (see following paragraphs)

Working with the design team to review the usability defects and decide on the basis of their severity, number of users affected, cost to fix, and how and when to fix them

The severity of usability defect is often classified as follows:

- Critical—the user is unable to use the software
- High—the user is severely restricted in using the software
- Medium—the user can circumvent the problem and use the software with only moderate inconvenience
- Low—the user can use the software with limitations, but these do not restrict its use

The Project Manager should ensure that the test plan is designed to allow the agreed quality criteria to be tested. Testers should be competent in conducting usability tests and follow the Usability Professionals Association or equivalent code of conduct. Where the user testing is being conducted by a third party, for example, independent usability specialists or usability teams within the software supplier, then the Project Manager may require the test reporting to follow ISO/IEC 25062:2006 software engineering—software products quality and requirements evaluation (SQuaRE)—common industry format (CIF) for usability tests.

When the testing is conducted internally, the worksheet presented in Table 35.11 (which is based on the full standard) may be used for reporting usability test results.

### 35.3.3.6 Implement the System with Appropriate Training and Support

The final stage in deploying a new software, whether it is developed in-house or purchased “off the shelf,” is implementation.

Implementation involves a large number of technical processes to ensure that the new software (and/or hardware) operates properly in its environment. This includes tasks such as installation, configuration, testing, and making necessary changes before the software is finally deployed.

Human-centered design is complementary to and does not replace existing standards or processes for implementing the software.

Following a human-centered design process means that users are already prepared for the new software through their earlier involvement in requirements gathering and user testing. The scenarios identified earlier provide a useful basis for structuring any training required and also for other training and support materials, such as on-screen help and user manuals. Any usability issues that could not be fixed on time can be addressed through work-arounds and specific “frequently asked questions” (FAQs). While users find it convenient to ask more knowledgeable colleagues or dedicated support staff for help, one of the benefits of following a human-centered design process is that users require less support, even at implementation. This reduces the burden on colleagues and the dependence on costly on-site support.

Once the software is fully deployed, the final human-centered design activity is to track real world usage, not only to ensure that the original objectives were achieved but also to provide input to further development. Help desk data, log files, defect reports, user satisfaction surveys, and requests for changes, all provide valuable data. Formal follow-up evaluation can be carried out within a specific period, for example, 6 months to 1 year after system installation to test system performance and collect data on whether the user requirements were met.

Table 35.12 identifies standards relevant to reporting usability test results.
TABLE 35.11 Worksheet for Reporting Usability Test Results

<table>
<thead>
<tr>
<th>Report title page</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Name of the product and version that was tested</td>
<td></td>
</tr>
<tr>
<td>When the test was conducted?</td>
<td></td>
</tr>
<tr>
<td>Date the report was prepared</td>
<td></td>
</tr>
<tr>
<td>Contact name(s) for questions and/or clarifications</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Background</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Product name, purpose, and version</td>
<td></td>
</tr>
<tr>
<td>What parts of the product were evaluated?</td>
<td></td>
</tr>
<tr>
<td>The user population for which the product is intended</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Test objectives</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Description of context of use (note any difference between test context and real context)</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Methods</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Experimental design</td>
<td></td>
</tr>
<tr>
<td>Participant characteristics</td>
<td></td>
</tr>
<tr>
<td>Tasks and scenarios used</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Test facilities</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Computer configuration, including model, OS version, required libraries, or settings</td>
<td></td>
</tr>
<tr>
<td>Display devices, including screen size, resolution</td>
<td></td>
</tr>
<tr>
<td>Input devices, including make and model</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Measures</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Checklists, scoring sheets or questionnaires used—attach copies in the Appendix</td>
<td></td>
</tr>
<tr>
<td>Procedure including time limits on tasks and whether participants “thought aloud”</td>
<td></td>
</tr>
<tr>
<td>Participant instructions including task instructions—attach in Appendix</td>
<td></td>
</tr>
<tr>
<td>Metrics for effectiveness, completion rates, errors, and assists</td>
<td></td>
</tr>
<tr>
<td>Metrics for efficiency, completions rates/time on task</td>
<td></td>
</tr>
<tr>
<td>Metrics for satisfaction</td>
<td></td>
</tr>
<tr>
<td>Data analysis including any statistical analysis</td>
<td></td>
</tr>
<tr>
<td>Performance results</td>
<td></td>
</tr>
<tr>
<td>Satisfaction results</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Appendices</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Checklists, scoring sheets, and questionnaires used</td>
<td></td>
</tr>
<tr>
<td>Participant task instructions</td>
<td></td>
</tr>
</tbody>
</table>


Check that the user test report contains at least the listed information to a sufficient level of detail to allow the validity and reliability of the findings to be assessed (✓ to confirm).

TABLE 35.12 Standards Relevant to Reporting Usability Test Results

<table>
<thead>
<tr>
<th>Relevant Standard</th>
<th>Brief Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>ISO/IEC 25062:2006 Software product Quality Requirements and Evaluation (SQuaRE)—Common Industry Format (CIF) for usability test reports</td>
<td>Provides a standard method for reporting usability test findings. The format is designed for reporting results of formal usability tests in which quantitative measurements were collected, and is particularly appropriate for summative/comparative testing.</td>
</tr>
</tbody>
</table>
35.4 Research Issues

The relationship between international usability standards and research confuses some people. There are two major issues. First, although standards should be based on research evidence, research results themselves are not usually sufficient to determine what the standard should recommend or require. So, for example, in the standards concerned with identifying a suitable level of office illumination for work with visual display screens, research can show how individual sensitivity and acuity are affected by overall illumination level, image contrast, and so on. What such data show is that people vary in their sensitivity, and while some may be able to tolerate high ambient illumination, others will complain that their visual performance is significantly impaired. What the data itself cannot determine is where to set limits in the standard. The decision on where to set such limits involves a judgment on the part of the standards maker. Perhaps, this is more obvious in the area of workplace design. Human dimensions vary enormously, and so it is not realistic to design a single item of equipment to take account of the full range of human variability. In practice, many standards aim to address the middle 90% of the population and accept that the lower 5th percentile and the higher 95th percentile may not be accommodated. Such practicalities may be difficult for purist researchers to accept.

Second, much usability practice is closer to a craft than to a science. Usability practitioners regularly test systems with very small samples of participants, often as few as five. Anyone skilled in psychophysics knows that such small numbers make it almost impossible to draw reliable conclusions about the user population. However, even such small-scale testing can reveal useful and valuable data about some of the problems that real users may experience with the final product. And, there is a substantial body of practical data that can be used to guide user interface designers to improve the usability of their systems. But, the uncertainties associated with this body of practical experience mean that usability standards, especially international usability standards, can seldom be as prescriptive as traditional industry standards. Subtle differences in context can completely change the user experience, and emerging technology develops faster than the standards.

Both of these issues pose major problems for researchers wishing to support international usability standards. However, there is a need both for sound human-centered design and evaluation methods and for empirical data on new and emerging technologies. Therefore, data from well-constructed research studies will always be welcomed by the relevant standards committees.

In terms of future developments in usability standards, the path is not entirely clear. Some of the standards discussed here are based on human characteristics, and these are unlikely to change much. Although ISO standards go through a formal review process every 5 years, there seems little point in making major updates to standards which deal with human basics, such as visual perception. However, even if the principles are the same, there is evidence that readers and users of such standards are unlikely to trust them if the examples are out of date. There is, therefore, a need to continue to “refresh” such standards to ensure that they not only remain relevant but also appear to be most up-to-date.

In terms of future standardization efforts, new technological developments are likely to continue to generate new requirements. As discussed earlier, some usability standards are better written as process standards rather than product standards. However, experience shows that designers much prefer specific product standards, provided that they remain relevant. So, for example, work is currently underway in ISO TC159 SC4 WG2 to develop a technical report (TR) dealing with autostereoscopic displays, which can appear three-dimensional without the need for the viewer to wear glasses. Specific technical guidance in this chapter will help display designers avoid the many pitfalls in this emerging technology.

Ever more innovative interfaces are likely to emerge, requiring standard makers to remain agile and innovative in their efforts to ensure that all users can benefit from such developments in technology.
35.5 Summary

This chapter introduced the reader to international usability standards from the Human–System Interaction Committee of the ISO. It explained how standards are developed and the implications for how they can be used. It then went on to describe the human-centered design process as contained in ISO 9241, part 210 and explained how different standards can be used to support these human-centered design activities.

Further Information

Any readers who wish to get involved in the international usability standardization processes described in this chapter should contact their national standards body, which belongs to ISO and ask if it participates in ISO TC159 SC4. If it does, it will usually be able to put the reader in touch with a National Mirror Committee. If it does not, then it may be willing to become involved if there is sufficient support in that country.

References

International Standards

All parts of ISO 9241 have a series title “Ergonomics of Human System Interaction” as well as a part title as shown below.

ISO 9241-2:1992 Guidance on task requirements
ISO 9241-4:1998 Keyboard requirements (some clauses in this standard have been superseded by ISO 9241-400 and ISO 9241-410)
ISO 9241-5:1999 Workstation layout and postural requirements
ISO 9241-6:2000 Guidance on the work environment
ISO 9241-12:1999 Presentation of information
ISO 9241-13:1999 User guidance
ISO 9241-14:2000 Menu dialogues
ISO 9241-15:1998 Command dialogues
ISO 9241-16:1999 Direct manipulation dialogues
ISO 9241-20:2009 Accessibility guidelines for information/communication technology (ICT) equipment and services
ISO/TR 9241-100:2010 Introduction to standards related to software ergonomics
ISO 9241-129:2010 Guidance on software individualization
ISO 9241-143:2012 Forms
ISO 9241-171:2008 Guidance on software accessibility
ISO 9241-210:2010 Human-centered design for interactive systems (supersedes ISO 13407 1999)
ISO 9241-300:2008 Introduction to electronic visual display requirements
(The ISO 9241-300 series supersedes ISO 9241, parts 3, 7, and 8)
ISO 9241-302:2008 Terminology for electronic visual displays
ISO 9241-303:2011 Requirements for electronic visual displays
ISO 9241-305:2008 Optical laboratory test methods for electronic visual displays

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ISO/TR 9241-308:2008 Surface-conduction electron-emitter displays (SED)
ISO/TR 9241-309:2008 Organic light-emitting diode (OLED) displays
ISO/TR 9241-310:2010 Visibility, aesthetics, and ergonomics of pixel defects
ISO 9241-400:2007 Principles and requirements for physical input devices
ISO 9241-420:2011 Selection of physical input device
ISO 9241-910:2011 Framework for tactile and haptic interactions
ISO 9241-920:2009 Guidance on tactile and haptic interactions
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Other References


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Web Link