

Chapter 17 ISO standards for user centered design and the specification of usability

Abstract: This chapter will be of interest to people wishing to find out more about usability and how to achieve it, and to those responsible for delivering and sustaining usable systems. It introduces the international standards for usability and their use in government system acquisition, and details their requirements for ergonomics and human-centered design (HCD). It describes the ISO process models, HCD processes, and design guidance. It describes the application of the ISO HCD process to government systems from the perspectives of requiring HCD in government system contracts as a means of reducing the risk from poor usability, inclusion in process improvement, product specification, and validation. It also discusses the effect of project scale and provides the details of relevant standards.

Key words: Human-centred, human centered, user centered, design process, ergonomics standards, ISO TC159, usability, conformance

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“I’m not sure why standards get such short shrift. After all, they are a distillation of the best practice prepared by the peers of those who should be glad of their support”.

– Danny Dresner (UK National Computing Centre)

Introduction

This chapter is about the standards for usable systems from the International Organization for Standardization (ISO). It explains how to conform to the ISO standards for user centered design and the specification of usability. To emphasize the impact on stakeholders who might not typically be considered as users, ISO uses the term “human-centred” rather than “user centered”. To avoid misunderstanding when referring to or describing the content of the ISO standards, this chapter uses the term “human centered design” (abbreviated to HCD).

If your job is related to the acquisition of systems, these standards are a convenient way to specify the way that you want suppliers to develop and test a usable system, and your own

organization to support it. (See Chapter 16 for more information on getting UX into the project.) If you are supplying a system, the standards can be used to justify the work you need to do to incorporate user centered design, and to define and demonstrate the usability of the system. They also describe how to develop a usable system.

The chapter introduces the main standards related to the ISO HCD process, then describes the application of this family of standards through examples of the application of ISO usability standards to government systems, and concludes with success factors for applying these standards.

International Standards for Usability

International standards represent the agreement of the world's experts on a topic. Tom Stewart (1991) explains that standards play an important role in improving the usability of systems:

- They offer the possibility of consistency, even at the international level.
- They provide a disciplined framework for human factors recommendations and making them accessible to non-specialists.
- They represent consensus about good practice.

He goes on to explain that ISO has four aims for standards: mutual understanding; health, safety, and the protection of the environment; facilitating compatibility; and fitness for purpose. All of these contribute to usability. Standards allow acquirers to set appropriate procurement requirements and provide a basis for evaluation of suppliers' offerings. They allow suppliers to check their products during design and manufacture and provide a basis for making claims about the quality of products. They allow regulators to assess quality and provide a basis for testing of products.

The early standards for information technology (IT) ergonomics specified design features (such as character height on a display). Although this encourages consistency and achievement of basic ergonomic properties, it does not take account of the interactions that occur in use. The next generation of standards defined measures based on use, initially for physical devices (such as displays) and eventually for system usability — measured as a user's effectiveness, efficiency, and satisfaction in the performance of a task. The latest standards set requirements for the management, performance, and documentation of HCD.

For a subject that is relatively new – and that has a background of diverse, individual practice and several definitions for its core concepts – international standards represent a significant maturing of the discipline. They give a defensible framework for addressing usability in a project or contract (Earthy, Sherwood Jones, & Bevan, 2001). Used together the standards related to usability provide a framework that can be used for developing (by good practice), specifying (by mandates), and ensuring (by conformance) usability in government system acquisition.

ISO 9241-11:1998 introduced a broad definition of usability, closely aligned with business objectives. The most recent definition of usability, in ISO 9241-210:2009, is "the extent to which a system, product or service can be used by specified users to achieve specified goals with effectiveness, efficiency and satisfaction in a specified context of use". The software quality model ISO/IEC 25010:2011 describes this as "quality in use", to distinguish it from narrower interpretations of usability as just the ease of use of an interface. The broader interpretation (sometimes referred to as "big usability") is the user's experience of the quality of the product,

system or service and thus a critical goal for systems design — i.e., the extent to which users can successfully achieve their goals in an acceptable amount of time, and are satisfied with the experience.

ISO requirements for ergonomics and user centered design

ISO has recently published standards for ergonomics principles and HCD activities. These place requirements on the practice and process of user centered design. They provide a context for the detailed recommendations and guidance in standards that address the application of ergonomics. This application framework and the setting of requirements are useful in the promotion of usability in the government sector.

ISO 26800:2011 brings together in one document the basic principles and concepts of ergonomics. ISO 9241-210:2009 provides requirements and recommendations for HCD principles and activities throughout the life cycle of interactive systems; it is for use by those responsible for planning and managing projects that develop interactive systems. It addresses technical human factors and ergonomics issues to the extent necessary to enable understanding of their relevance and importance in the design process as a whole.

The following lists (derived from Earthy & Sherwood Jones, 2010) summarize the collated requirements of these two standards. They characterize HCD and how it is achieved as a series of objectives. As you can see, these requirements do not constrain the methods used or the solutions provided: they delineate what HCD is and how to recognize that it is being done.

Fundamental principles of ergonomics and HCD:

1. Ensure the project understands what the users want or need to achieve and the environment in which they work or live.
2. Ensure the designers know who the users are and how the system should fit into their lives or their work.
3. Make the demonstration of usability (in the broad sense of quality in use) the objective of the design team.
4. Have a flexible team that can understand and address all aspects of the users' experience with the system.

Required project activities:

5. Facilitate a focus on usability from the very beginning of the project.
6. Help the users to develop a clear understanding of their actual requirements.
7. Set targets for user interaction and performance with the system.
8. Ensure that the team takes account of relevant ergonomics knowledge and the users' requirements.
9. Ensure that quality in use is an early and continued target for the designers.
10. Select and provide methods and tools suitable for doing HCD work on the project.
11. Make sure HCD work is done and that the results are used.
12. Make sure the findings from HCD work, and their impact, is communicated to all the right people.

Required organizational management activities:

13. Include and integrate HCD into the overall project plan and all phases of the product life cycle.
14. Integrate milestones for human centered activities into the overall design and development process.
15. Allocate time for iteration and the incorporation of user feedback, and for evaluating whether the design solution satisfies the users' requirements
16. Involve workers or users (or potential workers or users) in the process.
17. Identify the range of skills and viewpoints required in the team in addition to the staff, public, and other users
18. Define the responsibility for achieving each of the above objectives and allocate sufficient authority to fulfill these responsibilities.

The traditional (slow and expensive) defense system acquisition process produced a number of standards for Human Engineering Program Plans (HEPPs), which have also been used for non-defense government acquisition. These standards fall short of the above objectives for HCD and do not satisfy fully the needs of modern defense acquisition. With support from the US Army, the US National Academy of Sciences (NAS) has supported the development of the Incremental Risk Model (Pew & Mavor, 2007), which is of potentially wider application.

ISO process models

Early attempts to manage IT resulted in the definition of detailed and prescriptive development methodologies. These were found to be too constraining, and the Software Engineering Institute (SEI) at Carnegie-Mellon University applied the concepts of maturity and business process reengineering to the problem of identifying a lead indicator of IT project success (Paulk, Weber, Curtis, & Chrissis, 1993). This resulted in the Software Capability Maturity Model (CMM) and then the superseding Capability Maturity Model Integration (CMMI). Equivalent standards have been produced by ISO/IEC JTC1/SC7, including ISO/IEC 15504, which provides a framework for assessing an organization's capability in performing processes.

Processes are related collections of responsibilities described in terms of ongoing sets of activities, characterized by an outcome and an owner (James Moore, personal communication. 26th June 2003). A process has a purpose and fulfills a business requirement. Activities often include the creation of a work product.

Process models are structured collections of processes that describe an aspect of business from a defined perspective. A disciplined evaluation of an organization's processes against a model is called process assessment. Process assessment seeks to establish first whether or not processes are performed successfully and then the degree to which processes are under control.

Process modeling and assessment provide the following three benefits:

- a means to analyze the ability of an organization to implement good practice
- a description of the factors that hinder this ability
- the means of addressing such shortcomings and mitigating risk

The activities described in ISO 9241-210 have been formalized in two ISO HCD process models: ISO TR 18529:2000 and, for larger or more complex projects, ISO TS 18152:2010. These are the repository of industrial, academic, and government knowledge on how to achieve usability. As such, these process models provide a valuable means of achieving usable systems for government applications. These standards are cited as a means of assuring usability in the ISO/IEC 15288 process model for systems, and the ISO/IEC 12207 process model for software.

The processes to address HCD within a project or organization, and to fulfill the objectives enumerated above, fall into four categories:

- **Focusing the enterprise on usability:** Establishes and maintains awareness and sensitivity for risks arising from stakeholder and user needs across the organization, and keeps usability and user experience an inherent element in an organization's business strategy.
- **Enabling HCD across and within projects:** Ensures that HCD activities are resourced, conducted and matched to the whole system lifecycle process and the enterprise.
- **Executing HCD within a project:** Carries out HCD activities as appropriate, to ensure that the system is safe, accessible, and usable.
- **Introducing and operating a system:** Identifies unsatisfied needs and unsatisfactory system attributes during introduction, support, and maintenance of the system, to meet stakeholder and user requirements continuously.

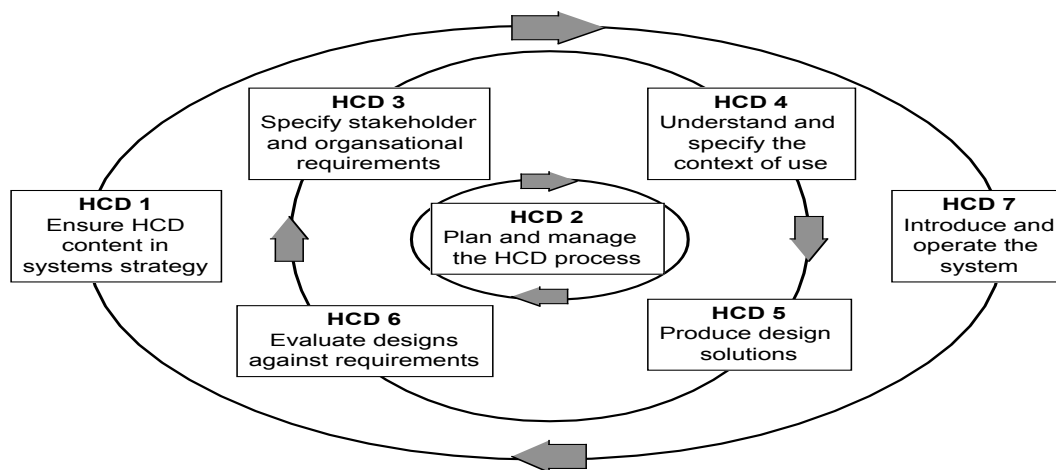
As shown in Table 17.1, the performance of these categories of process is the responsibility of particular organizational roles. Each category addresses certain types of risk and facilitates particular types of decision. International standards that are relevant to each category are listed. These standards are described at the end of this chapter.

Table 17.1 Responsibilities for categories of HCD process and the relevant standards

Process category	Responsible	Type of risks addressed	Type of decisions made	Relevant standards
Focusing the enterprise on usability	C-Level Executives Usability Management in terms of “facilitating usability across the organization”	Image/society Business survival Human-system issues in governance Human-system issues in services	Approach to policy Investment Strategy/ic Development	38500, 18152
Enabling HCD across and within projects	“The group that makes things happen (or not)” Program managers Project managers Product manager Usability managers Process owners Technical specialists with cross-project / organizational responsibilities	Resource Functional Human-system issues in program Human-system issues in project Quality of product	Governance Program Lifecycle Standards Project Process improvement	15288, 20000, 25000, 9241-210, 18529, 18152, 25060, 25062, 26800, 9241-11, 9241-110
Executing HCD within a project	Usability Professionals Practitioners	Technical Human-system issues in products	Technique and design Process implementation	26800, 9241-210, 18529, 62508, 9241-110, 9241-100 series
Introducing and operating the system	Service managers Support managers Usability Professionals Practitioners	Operational Human-system issues in services Quality of service	Support Contextual Investment	20000, 6385, 18529, 18152

User centered design process issues for government projects

Figure 17.1 shows the simple process model in ISO 18529:2000. This sets out seven HCD processes (referenced as HCD 1-7) for focusing, enabling, executing, and introducing and operating systems and services. (Large, complex projects require the use of the more sophisticated ISO TS 18152 model.) This section highlights the systems life cycle issues for government projects for these processes, followed by illustrations from the introduction of e-government in the UK, which remain equally relevant to current e-government systems.



[Caption]

Figure 17.1 HCD processes in ISO 18529 and their linking

HCD 1 is a focusing process, whose purpose is to establish and maintain a focus on stakeholder and user issues in each part of the organization that deal with system markets, concept, development, and support. Citizen-centered Electronic Service Delivery (ESD) has been seen as essential to modernizing government. To make this effective, policy has to reflect the centrality of users and a user centered approach:

"The delivery of public services that are focused on the needs of customers and citizens is one of the central aims of the Scottish Executive's strategic vision for the modernization of government. Developing a customer/citizen focused approach to the delivery of public services is an integral element of key cross cutting initiatives such as Best Value, Community Planning, and 21st Century Government. It is also a central feature of a range of other initiatives in key policy areas such as health, education, housing, planning, and social justice." (Stevenson & Gibson, 2002, p. 3)

HCD 2 is the key enabling process, whose purpose is to specify how the human-centered activities fit into the whole system lifecycle process and the enterprise. In the context of citizen-facing government systems, planning the HCD process may be a demanding activity in itself. Maintaining the focus on the user through the development and implementation process can also be a demanding management task:

"...initiatives that span multiple agencies require a disproportionate amount of political backing and funding. The result is that over 60% of e-government projects are doomed to failure." (Gartner Inc., 2002).

HCD 3 is an executing process, whose purpose is to establish the requirements of the organization and other interested parties for the system. This process takes full account of the needs, competencies, and working environment of each relevant stakeholder in the system. User requirements form a vital link between policy aspiration and technical implementation. Usability metrics based on achieving requirements can form a central role in assessing the value of the system. Failure to establish user requirements can lead to the failure of systems to deliver usability:

"...the public may see no advantage in accessing services electronically and take-up may be low. To overcome this departments need to set take-up targets and provide incentives such as cost savings to users" (National Audit Office, 2002 p4) "Individual members of the public interact with and have an interest in the work of public service providers in a number of different capacities and "wearing a number of different hats" — as customers, citizens and members of communities of place and interest. This is an important factor that needs to be taken into account in developing effective mechanisms for seeking feedback from and consulting with members of the public." (Stevenson & Gibson, 2002, p. 1)

HCD 4 is an execution process, whose purpose is to identify, clarify, and record the context of use: the characteristics of the stakeholders, their tasks, and the organizational and physical environment in which the system will be used. This process complements a transactional view of the system functionality:

“People have different needs. Departments, therefore, need to have a good understanding of the needs and preferences of the users of their services. The elderly for example, have a range of requirements depending on their income, health, general well-being, and where they live. Other groups such as students, children, parents, the unemployed, and businesses will have different requirements. There is, however, considerable variation in the quality of information which departments have on their key users and client groups for example on the frequency and ways in which citizens access government services.” (National Audit Office, 2002, p. 4)

HCD 5 is an execution process, whose purpose is to create potential design solutions by drawing on established state-of-the-art practice, the experience and knowledge of the participants, and the results of the context-of-use analysis. The development of multiple design prototypes is a change from traditional requirements-driven procurement. The timing and management of this process is critical in relation to software development commitments:

“This document therefore seeks to provide Government web managers with specific guidance around usability issues relevant to public sector websites and in particular awareness of issues that need to be addressed under the relevant human centered design standards”. (UK Cabinet Office, 2003. p. 2)

HCD 6 is an execution process, whose purpose is to collect feedback on the developing design. This feedback will be collected from end users and other evaluation activities.

Evaluation may need to inform both design and policy. Metrics need to be at a task level, rather than a transaction level. Design reviews need to be against use scenarios rather than reviews of

screens. The selection of users to target for surveys etc. needs to reflect the system personas and their usage patterns.

"Public sector organizations are less likely to analyze feedback from customers to monitor trends or identify potential service improvements than to respond to individual cases." (Stevenson & Gibson, 2002, p. 1)

HCD 7 is an introducing and operating process, whose purpose is to establish the human-system aspects of the support and implementation of the system. The rollout and deployment of a new government service may require new partnerships to work, the readiness of permanent and temporary support facilities, awareness material, in-service monitoring, and feedback resources etc.

"Perhaps the greatest challenge the government faces in delivering services electronically is in developing the organizational capability to do so." (Performance and Innovation Unit, 2000, p. 69)

Design guidance

The defense sector has developed a number of standards for product characteristics, such as MIL-STD-1472F (DOD, 1999). Since these are aimed at a military population, they are not appropriate for the design of public-facing government systems, but of course are required for defense systems.

There have been a number of attempts at writing guidelines for government websites. An example of this is the U.S. Department of Health and Human Services' (HHS's) "Research-Based Web Design and Usability Guidelines" (www.usability.gov) (HHS, 2011) — which has a number of sections of design guidance.

Such guidance has the challenge of being maintained in the face of rapid technological change, including the use of mobile technology and tablets. The guidance available is best seen as a resource for the development of project style guides. At the time of writing, sources of government guidelines for websites are available from (HHS, 2011), (Central office of information, 2011), (Kranz, 2011).

ISO 9241 provides extensive design support in the 9241-100 series of standards, including 9241-171:2008, guidance on software accessibility, and ISO 9241-151:2008 on web design. The design standards in the ISO 9241 series provide recommendations for ergonomic systems that can be customized to a particular context. The result of this customization is a binding and verifiable style guide for developers.

The scale of the challenge in maintaining any attempt at comprehensive guidance is evident. As a consequence of these difficulties, ISO has increased its emphasis on process, including the definition of an appropriate baseline for a project.

Application of ISO usability standards to government systems

Applying ISO standards provides a credible, industrial strength, internationally recognizable way of ensuring that usability is addressed in government projects. The easiest way to ensure that a standard is used is to have the contract require conformance to that standard in the contract. Each

international standard contains a section that describes how conformance is to be demonstrated. The rest of this chapter explains how the ISO standards introduced above can be applied to government projects and what conformance to these standards gives you in terms of control over the usability of a system. The order of the sections is broadly the order in which decisions are made about how to address issues related to achieving a usable system.

HCD as a means of reducing risk in contracts

The contractual and commercial constraints on government systems are different from those in the private sector, and are subject to political influences. It is not appropriate for a government department to specify or adopt a proprietary method that is subject to intellectual property rights restrictions. An international standard provides a defensible framework for a project or contract. Insofar as 'big' usability is indisputable as an objective for government public-facing systems, standards for HCD are default requirements for the development process.

Government IT failures are well publicized (e.g., UK Rural Payments Agency and National Health Service IT). Lack of user input at an early stage appears frequently. Adopting an HCD process can provide mitigation against major well known risks.

The practicalities of system acquisition, particularly for large systems, are that contracts (at various levels of the supply chain) may be placed with less than total assurance of receiving a usable system. This may be because the user requirements have not been fully defined (or cascaded), or may be recognized as subject to change. The nature of the design solution(s) may still be unclear, either in the delivery medium (cellphone texts vs. computer web browser vs. call center, etc.), or in the arrangements for back-office functions. In such situations, assessing the HCD capability of candidate suppliers before contracts are placed is the most promising resource available to the customer organization.

Government systems have attempted to transfer risk to other parties, not always successfully. Risks to the usability of a service (possibly aggregated from different systems) are likely to remain with the government department. Subsidiary to this may be the risks associated with the usability of an online system that meets part of the government service obligation, perhaps held by an agency. A lower-level risk, such as ease of interaction on a display, may be held by a supplier. Clear assignment of risk ownership and hence conformance is necessary in all contractual arrangements. This means that, in addition to clear ownership of risk, arrangements for risk identification and mitigation across boundaries need to be in place. For example, usability trials should be holistic and their scope not be constrained by contractual boundaries.

Adoption of ISO 9241-210 as a standard for projects introduces a set of requirements to deliver usable systems through HCD. Inclusion and enforcement of a clause such as the following in contracts would require a supplier to produce evidence that the project needs for user centered design are assessed, and that internal and external project activity is monitored against a benchmark of good practice.

“The contractor shall adopt iterative human-centered design in accordance with ISO 9241-210:2009 *Human-centred design for interactive systems*. The conformance procedure described in Clause 8 and Annex B of ISO 9241-210 standard shall be applied. The client reserves the right to conduct an assessment of the usability of the developing or finished service or system. The client reserves the right to conduct an assessment of potential contractors' capability to conduct user centered design.

For the purposes of this contract, ISO 9241-210 Clause 5, *Planning human-centred design*, extends to an iterative program of evaluation and improvement for the human-centered design process. Process improvement shall be based on a validated assessment scheme such as that described in ISO/IEC 15504-2:2003 *Process assessment*, ISO 9004:2009 *Managing for the sustained success of an organization*, or the SEI CMM and may be integrated with process improvement based on models that conform with these schemes. Process assessment shall be based on ISO TR 18529:2000 *Human-centred lifecycle process descriptions*. The improvement program and its findings shall be reported to the client.”

Process improvement using capability assessment is described in the next section.

Conformance to the requirements and recommendation of 9241-210 is managed conveniently using Annex B of ISO 9241-210 (ISO, 2010). Editable versions of the checklist are provided on the ISO TC internet site in a subfolder to the TC159/SC4 public information folder called "ISO-9241-210-tables" (ISO, 2010). This annex contains a checklist of all requirements and recommendations from the standard. This checklist is used to present three pieces of information:

- evidence of which recommendation are applicable
- how compliance with requirements and applicable recommendations is going to be demonstrated
- whether or not this has been achieved

The checklist is used to manage agreements on exactly how HCD is to be done on a project, with the understanding that you are following (or agreeing to not follow) the international standard approach to HCD. Alternatively, a supplier can unilaterally use a completed table as evidence that they have followed the internationally-agreed approach to HCD.

Usability may be a key discriminator in international acquisition. Systems from suppliers in other nations may have been developed to meet similar legislation, provide similar software functions, and operate in a similar technical environment, but the context of use and user requirements may be very different. It may be possible to use usability test results to evaluate proposals for products or systems based on commercial, off-the-shelf (COTS) packages, but it may also be necessary to draw on resources such as early user centered design activity by the acquiring department, or to assess the candidate suppliers. Where organizations from other nations are bidding to develop government systems, pre-contract award capability evaluation becomes a powerful form of risk mitigation. The existence of international standards enables such evaluation to be justified in a government system context. (For further details on usability evaluation in different countries, see Chapter 21.)

Improving user centered design processes

Many organizations lack the skills and processes needed to implement even the simplest user centered design activities. Despite good intentions, the organization may be unable to produce products with acceptable usability. A traditional approach to improving usability has been to start by introducing usability testing at the end of the development process to highlight shortcomings in usability, in the hope that this will motivate the more important activities that are needed earlier in the lifecycle. However, this has the disadvantage that it is often too late to make any significant improvements, and these types of bottom-up initiatives are often conducted at the

whim of the individual project manager. They are therefore not adequate as a basis for award of contract.

Lasting improvements can come only from a top-down policy for improvement of usability. ISO TR 18529 and ISO TS 18152 are comprehensive models of good practice in HCD. These provide the basis for the pre-contract assessment of the usability maturity/capability of an organization. Process assessment is essentially a series of guided, in-depth, structured interviews with relevant project stakeholders in an organization and a selection of representative projects. The results provide a profile of technical and managerial capability. This profile is analyzed to identify strengths and weaknesses. Demonstration of timely improvement in the areas of weakness is included in the conditions of contract. If necessary, regular third part audits can also be stipulated.

The cultural milieu for the development and operation of government systems differs from that around commercial systems. Pre-contract award capability evaluation can be used to counter political pressure to award contracts to suppliers without user centered design capability. The issue of government department or agency capability is more sensitive but can be addressed using capability assessment.

The ISO standards for HCD are ‘quality manager friendly’ and acknowledged best practice. Process improvement using standards derived from ISO/IEC 15504 is likely to be accepted in government system acquisition, and is compatible with overarching frameworks such as Control Objectives for Information and Related Technologies (COBIT) V (Information Systems Audit and Control Association, 2011). Less formal assessments may be of benefit to both government departments and their supply chain. Bevan, Bogomolni, & Ryan (2001) describe the use of process improvement internal to a government organization.

Because risks associated with usability are likely to be held by the government department or agency, a process capability evaluation is of value at all stages in the supply chain, not just external suppliers. Capability assessment should therefore include the HCD processes performed by the acquiring department and operating agency.

Managing user centered design in large-scale systems

The ISO HCD standards provide the resources necessary to plan and manage usability-related activities for large complex systems. Large systems are disproportionately more difficult to manage than smaller systems. In terms of contracts there is the added difficulty of passing usability requirements down supply chains. In terms of the definition of system requirements, problems can arise from conflicting service delivery goals between departments. At a working level it is no longer possible for a UX team to keep informal track of what implementers are doing. The scale of use cases, user requirements, personas, etc. requires formal management. Risk and issue management becomes formalized. Project planning and management reporting become more demanding and more important. The challenge for the UX team is to retain the agility and economy of UX methods, while operating in a large project context. HCD process models, particularly the Human-Systems model in ISO TS 18152, have been developed to address these problems. Large system integration, undertaken using the Systems Engineering processes described in ISO/IEC 15288, offers particular benefits because the Human-Systems model has been designed to integrate with this standard.

The increase in management effort for large projects is illustrated by the differences between ISO TR 18529, with its one process for the planning and management of HCD, and the thirteen lifecycle and integration processes in ISO TS 18152.

Several types of government systems have consequences of failure that are substantial. For such high integrity systems the consideration of usability extends the existing approach to mechanical and logical dependability, as described in standards such as IEC 62508:2010. IEC 62508 categorizes the ISO TS 18152 activities by project stages and gives guidance on how they are applied to achieve whole system integrity.

Including usability in product specification

To ensure that a product meets user needs, the requirements specification should include all the aspects of quality that are important for that product to be successful. ISO/IEC 25010:2011 provides a comprehensive checklist of quality characteristics. From a user-centered perspective, the most important characteristics are likely to be functional suitability, usability, and freedom from risk. It is essential that user and other stakeholder needs be identified (ISO/IEC DIS 25064:2011), taking account of the context of use (ISO/IEC DIS 25063:2011). These needs should be translated into a set of functional requirements that support the user needs, and into requirements for usability in terms of effectiveness, efficiency, and satisfaction in typical and critical contexts of use. ISO 9241-11 provides guidance on these measurements. The product should be designed so that it is usable in all the intended contexts of use: for all intended types of users, tasks, and physical, technical, and organizational environments. Those usability requirements that are essential for the success of the product should be given priority if there is any need to trade off these requirements against other requirements.

As mentioned above in the section on Design Guidance, the ISO 9241-100 series provides recommendations on interaction and interface design. Each standard includes an annexed checklist for use in assessing the relevance of each recommendation and demonstration of compliance to that recommendation. This checklist can be made part of a contract and used as the basis of both a style guide and the requirements for the product test program.

Validating usability

The only way to ensure that a product will meet user needs is to carry out usability testing in representative scenarios of use (ISO 9241-11). This type of testing is important to manage the risks to project success that could arise from poor usability. Usability testing should be a routine activity for any major system. Even for a smaller project, where usability testing cannot be justified, it is important to establish the usability requirements, as considering these during development can have a major influence on the design. ISO TR 16982:2002 provides guidance on methods for evaluation of usability. ISO/IEC 25060:2010 provides a means to report usability testing. Further details on validating usability can be found in the Chapters 20 and 21.

Guidelines for Making Use of HCD Standards

The ISO standards for HCD offer a range of benefits in the acquisition and supply of government systems. Here are some guidelines on how to achieve these benefits:

- **Use the framework and status that the standards provide.** Proprietary methods are all very well and good, but you can't stick them into a government contract. ISO provides an

integrated set of standards with a common philosophy that avoid the risk of using specifications that are inflexible or incorrectly prescriptive. They provide a means of requiring and assessing conformance, and matching what is done to the capability of the client organization.

- **Integrate conformance to standards with contract and quality.** Conformance makes things happen. Ensuring that processes and products conform to standards may be the first time that usability people are useful to a project manager. Up until now, they have probably been seen as a cost and a risk. However, usability professionals don't normally encounter standards and should watch and learn from those who do. In particular understand conformance and how it integrates with contract and quality. For usability people unfamiliar with using standards to advantage, a good primer is Dresner (2003).
- **Use standards to provide a common language and concepts.** Internationally agreed terms, concepts and principles remove arguments over terminology and the best way to do things. Of course they need to be interpreted for particular situations, but this is a valuable part of the planning process. Having a standard to argue from places user centered design on a level playing field with other engineering disciplines, and can also be used to counter noncommercial barriers in government acquisition.
- **Use HCD standards to make the user viewpoint harder to ignore in design.** The activities and deliverables of HCD force the user viewpoint to be considered. Many governmental IT standards are compatible with the user viewpoint, but documents specific to usability (e.g. user requirements, style guides, usability evaluations) can be buried in the list of other requirements that receive greater emphasis.
- **Use standards for usability to make the user viewpoint harder to ignore in operation.** Big usability provides a policy-level counter to the point of view adopted by many service providers, and adopted in standards such as BS8477 (British Standards Institution, 2007). The viewpoint provided by HCD also provides a counter to the transaction-level view of service delivery and associated metrics (e.g., five days to reply to a letter), giving formal expression to the user task and context of use (e.g., a battered wife and her children taken into a refuge).

Summary

Standards have particular importance in the highly monitored world of government systems development, and there has been significant investment in this area. International standards for usability and HCD exist that are flexible enough to support appropriate user centered design and measurable enough to allow conformance. Conformance to these standards gives usability and user-centered design status in systems development. These international standards can be used in contract (both for specification and monitoring), and for the management of development and testing.

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Further Reading

The recommended further reading is ISO 9241-210:2009 *Human-centred design for interactive systems*.

Details of standards

Tables 17.2-17.4 below list the international ISO standards related to human-centered design. Table 17.5 describes the types of standard listed in the other three. ISO standards are available from your national standards body or directly from ISO at www.iso.org.

Table 17.2 Standards that define HCD

Title	Type of standard	Description
ISO 9241-210:2010 <i>Human-centred design for interactive systems</i>	Fundamental & Management system	Guidance and requirements for management of HCD projects. Requirements and recommendations for HCD activities. It is a revision of ISO 13407:1999, ISO's initial definition of HCD.
ISO TR 18529:2000 <i>Human-centred lifecycle process</i>	Assessment model	15504-compliant set of processes for HCD of interactive systems. Processes for enabling, executing, and assessing HCD within organizations. This model will be developed as

<i>descriptions</i>		ISO 9241-220 <i>Processes for enabling, executing and assessing HCD within organizations.</i>
ISO TS 18152:2010 <i>A specification for the process assessment of human-system issues</i>	Assessment model	A set of 15504-compliant processes that address issues associated with humans throughout the lifecycle. This specification provides a bridge between standardization in the area of Ergonomics (by ISO TC159) and the life cycle standardization being carried out by ISO/IEC JTC1/SC7 <i>Systems and software engineering.</i>
ISO/IEC 25060:2010 <i>General framework for usability-related information,</i> ISO/IEC 25062:2006 <i>Common Industry Formats (CIF) for usability reports,</i> ISO/IEC DIS 25063:2011 <i>Common Industry Format (CIF) for usability: Context of use description,</i> ISO/IEC DIS 25064:2011 <i>Common Industry Format (CIF) for usability: User needs report</i>	Information/work product	A developing family of information product descriptions related to HCD processes. These standards describe how to define and report information related to usability.

Table 17.3 Standards related to the design of usable systems

Title	Type of standard	Description
ISO 26800:2011 <i>General approach, principles and concepts</i>	Fundamental	Description of the ergonomics viewpoint and specific perspectives within ergonomics. Requirements for ergonomics design process.
IEC 62508:2010	Detailed/view	Elaboration of HCD for safety-related systems.

<i>Guidance on human aspects of dependability</i>		
ISO 9241-11:1998 <i>Guidance on usability</i>	Guide	Guidance on defining and measuring usability and defining context of use.
ISO 9241-110:2006 <i>Dialogue principles</i>	Design standard	Principles for the design of user interfaces.
ISO 9241-100 <i>Software ergonomics (series)</i>	Design standard	Recommendations for the design of software user interfaces.
ISO 16982:2002 <i>Usability methods supporting human-centred design</i>	Guide	An overview of existing usability methods that can be used on their own or in combination to support design and evaluation.

Table 17.4 IT process standards that set a framework for HCD and usability.

Title	Type of standard	Description
ISO/IEC 38500:2008 <i>Corporate governance of information technology</i>	Fundamental	Principles for executive/top management-level staff on the effective, efficient, and acceptable use of IT within their organizations.
ISO/IEC 15288:2008 <i>System lifecycle processes</i>	Process model	Defines a set of processes and associated terminology for the full life cycle, including conception, development, production, utilization, support, and retirement. This standard also supports the definition, control, assessment, and improvement of these processes.
ISO/IEC 25000 <i>Software product Quality Requirements and Evaluation (SQuaRE series)</i>	Fundamental & Management system	A family of standards defining aspects of quality and measurement for software intensive systems.
ISO/IEC 15504	Guide /	A family of standards that describe how to

<i>Process assessment</i> (series)	Assessment model	perform process assessments, set requirements for conformant assessment and provide exemplar assessment models derived from ISO/IEC process reference models, including 15288.
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Table 17.5 Types of standards

Type	Description
Fundamentals	Set requirements on or recommendations for the scope, definition, and implementation of processes. This includes principles, approaches, frameworks, vocabulary, conformance, formats, etc. Concepts and terminology are often included.
Information/work products	Specify the outputs from a process both in terms of a generic classification scheme products and a catalogue of descriptions of the content of particular instances of products.
(Process) assessment models	Elaborate process reference models for the purpose of assessing process capability. The elaborations usually consist of capability levels (steps towards a particular aspect of organizational achievement) and assessment indicators (work products, practices/tasks).
Detailed process descriptions	Elaborate one or more processes for the purpose of implementation. This typically includes setting in a range of contexts, further description of the outcomes, responsibilities, methods, and techniques for implementing tasks, content, and format of documents produced.
Guides	Provide advice on application, implementation, improvement, etc.
Management systems	Define a context and business purpose for process implementation and/or assessment and specific requirements on a range of procedure, lifecycle, competence, policy, method, and documentation matters for the implementation of activities or tasks. They usually set the requirements for a certification scheme.
Process views	Present life-cycle activities from a particular stakeholder perspective. This usually entails defining attribute or profession-specific purposes and outcomes and comments contextualizing the intent of activities and tasks.
Design standards	Contain sets of recommendations on some aspect of the properties, performance or features of an artifact or interface. As well as providing the basis for a design, they often specify how tests are to be carried out.