Usability Standards across the Development Lifecycle

Mary Frances Theofanos and Brian C. Stanton

National Institute of Standards and Technology
100 Bureau Dr
Gaithersburg MD 20878, USA
{maryt,brian.stanton}@nist.gov

Abstract. In 2005 the International Organization for Standardization published ISO/IEC 25062 "Common Industry Format (CIF) for Usability Test Reports." This standard focuses on documenting the results of usability testing in a consistent format in terms of user effectiveness, efficiency and satisfaction that allows comparison among products by purchasers of such systems. However, soon after its publication the user community advocated for additional standards to document the output of usability-related work within the development lifecycle. A second usability CIF, "A General Framework for Usability-related Information" (ISO/IEC Technical Report 25060) is now available that identifies seven outputs of the usability-engineering process. The framework focuses on documenting those elements needed for design and development of usable systems. To successfully use the framework it is critical to understand the relationship of these elements to the human-centered design process and the activities of the system life-cycle processes. These new Common Industry Format standards for usability-related information are a further step in standardizing usability engineering in industry.

Keywords: Usability, User Centered Design, Common Industry Format, standards, lifecycle, software development.

1   Introduction

In October of 1997, the U.S. National Institute of Standards and Technology (NIST) initiated an effort to increase the visibility of software usability, the Industry USability Reporting (IUSR) Project. Cooperating in the IUSR project were prominent suppliers of software and representatives from large consumer organizations. The goals of the initiative were to:

- Reduce uncontrolled overhead costs of software usability problems while improving user productivity and morale.
- Encourage software suppliers and consumer organizations to work together to understand user needs and tasks.
- Define and validate an industry-wide process for characterizing software usability to support product decision-making.

The result of this initial effort was the American National Standards Institute/ InterNational Committee for Information Technology Standards (ANSI/INCITS)-354

Common Industry Format (CIF) for Usability Test Reports [1]. The CIF, published in 2001, provides a standard method for reporting formal usability tests in which quantitative measurements are collected. The CIF is particularly appropriate for summative/comparative testing [2]. Most importantly, the CIF does not tell how to do usability testing; it tells you how to report on what you did.

Soon after its publication, the user community advocated for additional standards to document the output of usability-related work beyond the scope of the CIF, i.e., within the analysis, design and testing phases of the development life-cycle of interactive systems. For example, an intended purpose of the CIF was to enable consumer organizations to take into account usability when making purchasing decisions. But, organizations must determine whether the usability of the product meets their requirements. Ideally these requirements should be identified in advance. It makes sense to share these requirements with the supplier organization early in the development process so that they can be incorporated into the design, rather than waiting for the results of a usability test. Thus, the second phase of the IUSR project focused on identifying and specifying usability requirements. The results of this effort were published as NIST Internal Report NISTIR:7342 Common Industry Specification for Usability-Requirements (CISU-R) [3] in 2007.

NIST also found that organizations and usability practitioners were modifying the CIF for use in reporting other types of usability testing, particularly testing that informed the improvement of a product, so-called formative testing. The IUSR project participants agreed that this area required further investigation and held a series of workshops starting in 2004. They developed a set of guidelines to assist usability practitioners in the creation of reports that communicate effectively to guide the improvement of products [4]. The project resulted in guidance for reporting, rather than a formal template [5].

In 2005, the International Organization for Standardization (ISO) adopted ANSI CIF as the ISO/Electrotechnical Commission (ISO/IEC) 25062: Software engineering – Software product Quality Requirements and Evaluation (SQuaRE) – Common Industry Format (CIF) for usability test reports [6]. The ISO working group was aware of the IUSR group's additional products. The working group also recognized the user communities' desires for additional standards to document the output of usability-related work. As a result a Joint Working Group (JWG) comprised of members of the ISO Ergonomics of Human – System Interaction Subcommittee and the ISO Software and Systems Engineering, Evaluation and Metrics Subcommittee was established to document usability-related work products within the analysis, design and evaluation phases of the development life-cycle of interactive systems.

2 New Standards Development

The JWG began its charge by defining a framework for usability-related information, ISO/IEC TR 25060: Software engineering – Software product Quality Requirements and Evaluation (SQuaRE) – General framework for usability-related information [7]. This technical report defines a framework for an upcoming series of standards to document usability-related information throughout the development life-cycle.

The framework identifies seven outputs of the usability-engineering process "that are essential to provide the data required to allow systematic human-centred design of an interactive system under development." [7]

1. Context of use description
2. User needs report
3. User requirements specification
4. User interaction specification
5. User interface specification
6. Evaluation report
7. Field data report

Development of individual standards for each of these outputs is planned. Initial working drafts for items 1, 2, 3 and 6 are already in progress and should be available as ISO standards within the next 5 years. For each of these items, Technical Report (TR) 25060 provides a high-level description of the content of the information to be documented, as described in Table 1.

Table 1. Proposed Content for Usability Standards

Proposed Standard	Content
Context of use description	• Overall goals of the system • Stakeholder groups who either use the interactive system or are affected by its output throughout the life- cycle of the interactive system • Characteristics of the users • Task goals and task characteristics • Information processed during tasks • Technical environment (hardware, software and materials) • Physical and social environments
User needs report	• Identified, stated, derived and implied user needs (cognitive, physiological, social) across all identified user groups • Results of the user needs analysis relating the described context of use and its development constraints to the tasks of each user group that is affected including any resulting human-system issues or risks
User requirements specification	• Reference to the context of use description intended for the design • Requirements derived from the user needs and the context of use • Requirements arising from relevant ergonomics and user interface knowledge, standards and guidelines • Usability requirements and objectives including measurable effectiveness, efficiency and satisfaction criteria in specific contexts of use • Requirements derived from organizational requirements that directly affect the user

User interaction specification	• Workflow design: the overall interrelationship (including sequences) between tasks and system components on an organizational level, including responsibilities and roles • Task design: all tasks broken down into sets of subtasks and allocation of subtasks to the user and the system and associated requirements • Task-specific detailed usability objectives • Dialogue model: for each task, the appropriate information exchange between user and system including sequence and timing as well as associated interaction objects and high-level selection of dialogue techniques • Information architecture: from the user's perspective
User interface specification	• Task objects and system objects needed to accomplish one or more tasks and the user interface elements that they are composed of • Properties, behaviors and relationships of task and system objects • Dialogue techniques employed for specific tasks (e.g., menus, form-based dialogues, command dialogues, combinations of those) • Graphical look of task objects and system objects for specific tasks, users and user groups
Evaluation report	• Reporting usability problems, derived user requirements and recommendations for improving the usability of the object of evaluation • Reporting a baseline for usability for the whole product • Reporting differences in usability across a set of products (two or more products) • Reporting conformity with user requirements (conformance test report)
Field data report	• Data on actual usage of the product (versus intended usage of the product) as input for upcoming product releases and identifies emergent user requirements. Sources of field data can include observation of use, user satisfaction surveys, usage statistics and help desk data. • Contains the field data and its sources including the actual context of use, the means of collecting the data, the reasons for its collection and any identified user needs and derived user requirements.

3   Relationship to Other Standards

The General Framework for Usability-related Information (ISO TR25060) is intended to complement and advance existing ISO usability standards. As such the framework is based on the human-centered design approach of ISO 9241-210 [8] (previously ISO 13407). ISO 9241-210 focuses on the process. The first step is acknowledging the need for user-centered design and the need to plan for it. Then the four major activities may be enumerated as:

1. Understand and specify the context of use
2. Specify user requirements.
3. Produce design solutions
4. Evaluate designs against requirements.

ISO 9241-210 focuses on the human-centered design process. ISO 25060 complements 9241-210 describing the outputs of the human-centered design process. However, the human-centered design process is generally performed within a larger system- development process. ISO 15288 [9] provides a common process framework covering the system life-cycle. The products from ISO 25060 must not overwhelm or burden developers and must complement the current development processes and environments in order for organizations to encourage adoption. Although the framework focuses on documenting those elements needed for design and development of usable systems, it is critical to understand the relationship of these elements and how they complement the activities of the system life-cycle and processes.

Fig. 1 illustrates the relationship between the CIF family of standards (ISO/IEC TR 25060), the human-centered design activities (ISO 9241:210) and the system life cycle technical processes (ISO IEC 15288). The figure shows where each standard from the CIF family of standards occurs during the human-centered design activities from ISO 9241 part 210 (as indicated by the four circles), as well as where it corresponds to the ISO IEC 15288 system life cycle technical processes from clause 6.4 for the systems engineering technical process. The figure provides a conceptual model of how the three standards coordinate.

The figure depicts the four major activities of the human-centered design process as a set of intersecting circles, each circle representing an activity. The circles overlap to represent that the activities are not separate, but rather, overlapping in time and scope; the outcome of each activity can inform the input of another. The Users are shown in the center referencing the need for user-centered design (UCD)[1] and the need to plan for UCD, as the first step. As each activity can inform any other, there is no start, endpoint, or linear process intended.

The UCD process centers on users. The users, tasks and the organizational and physical environment are identified during the context of use activity and described in the Context of Use Description [10]. User needs are also identified during the context of use activity and can be documented in the User Needs Report [11] (in progress ISO/IEC 25064). ISO/IEC TR 25060 states that "User needs are an intermediate deliverable that link the context of use data to the user requirements." Both documents are developed during the stakeholder requirements definition process as described in ISO/IEC 15288.

The stakeholder requirements definition process also occurs during the user and organization requirements activity. It is during this activity that the requirements analysis process, as described in ISO/IEC 15288, also occurs. As a result of the requirements process, the User Requirements Specification (work in progress ISO/IEC 25065) would be developed. ISO/IEC TR 25060, states that "The user requirements specification provides the basis for design and evaluation of interactive systems to meet the user needs."

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[1] For the purposes of this document "User-Centered Design" is the same as "Human-Centered Design".
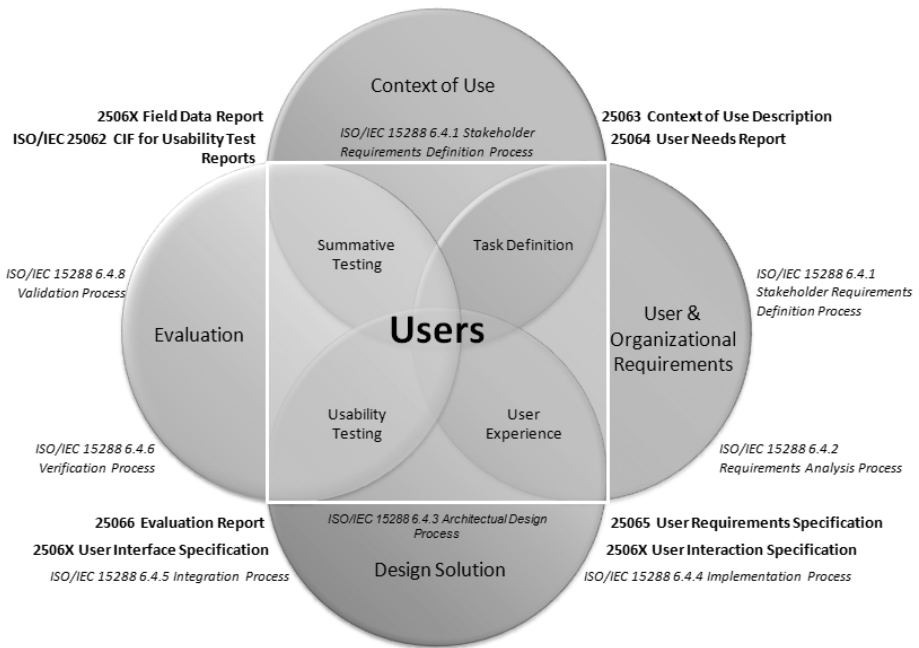
Fig. 1. User-Centered Design Process and Proposed Usability Information Items

The design of the interactive system happens during the design solution activity. This activity encompasses the architectural design, implementation, and integration processes of ISO/IEC 15288. These processes enable the User Interaction Specification and the User Interface Specification to be written. The User Interaction Specification "specifies how users will accomplish tasks with the system at a high level rather than describing what the system should look like. The user interaction specification provides the basis for the design of the user interface, not the design of the user interface itself." (ISO/IEC TR 25060). The actual user interface is documented in the User Interface Specification. This specification "provides the basis for the construction of the user interface as it contains the task and system objects needed to accomplish one or more tasks and the user interface elements that they are composed of." [7]

The evaluate activity can occur at any point in the development process and in an iterative manner (as can the other activities). ISO 9241:210 states that "Even at the earliest stages in the project, design concepts should be evaluated to obtain a better understanding of the user needs." The user needs, the resulting requirements, and the design of the system can be evaluated multiple times as the interactive system is being developed. The verification process, as documented in ISO/IEC 15288, is an evaluation done to ensure that the design requirements are fulfilled by the system. The validation process confirms that the system complies with the stakeholders' requirements, developed during the context of use and the user and organizational requirements activities. From the verification and validation processes the Evaluation Report [13], the CIF for Usability Test Reports [6], and the Field Data Report can be written. The Evaluation Report is a general purpose report format that can be used to document any

user-centered evaluation that is performed during the development process. The CIF for Usability Test Reports [6] is a format to be followed when a formal evaluation is performed for comparison or baseline purposes. The Field Data report "provides data on actual usage of the product (versus intended usage of the product) as input for upcoming product releases and identifies emerging requirements."

4   Conclusions

This new Common Industry Format for usability-related information is a further step in standardizing usability engineering in industry. While ISO 9241 provides process-related guidance in the human-centered design process, as well as product-related guidance on dialogue principles, menus, forms, and presentation of information among others, it provides no guidance for deliverables or work products of the usability engineering process. ISO TR25060 and the upcoming standards specified in the technical report address this gap. These standards will enable usability professionals to share a common understanding of deliverables of the human-centered design process. Moreover the standards define the minimum content and to some degree the quality of those deliverables providing for consistency across the practice.

Working drafts for the Context of Use Description, User Needs Report, User Requirements Specification and the Evaluation Report are already in committee. The JWG hopes to have ISO standards available within the next five years for these documents.

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