

ISO Standards for Standard Software: Accountability, Customer Expectations and Reality

Ulrich Kreichgauer

SAP AG, Dietmar-Hopp-Allee 16,
69190 Walldorf, Germany
Ulrich.Kreichgauer@SAP.com

Abstract. Using the usability ISO product standard 9241/110 as an example, the author will show that standard software manufacturers can lay the foundation for the requirements described in usability ISO standards. However, the final fulfillment of these standards comes through customization commitments from the customer buying and using the standard software.

Keywords: Usability, ISO 9241/110, standard software, accountability, customization.

1 Introduction

ISO 9241 / 110 describes “dialogue principles” for usable software. By following the principles “the ultimate beneficiary will be the user” [1], because the ISO standard “will lead to user interfaces (UIs) that are more usable, consistent and that enable greater productivity” [1]. The standard specifies seven ergonomic principles which apply to the dialogue design between people and information systems:

- Suitability for the task
- Suitability for learning
- Suitability for individualization
- Conformity with user expectations
- Self descriptiveness
- Controllability
- Error tolerance

The standard is used to define software requirements and to check software according to those principles.

2 Importance of the Standard

While an ISO standard is not the same as a law, it can be enforced using a law. For example, with the ISO 9241/110 this is done in the European Union the following way:

The generic "Council Directive 89/391/EEC" of June 12, 1989 [2] defines measures to encourage improvements in workers' safety and health at work. For computer based workplaces the more detailed "Council Directive 90/270/EEC" of May 29, 1990 [3] defines the minimum safety and health requirements for work with display screen equipment.

Each country in the European Union implemented laws, based on those directives, addressing the issues in a binding way. In Germany for example, the "German Health and Safety at Work Act (German: Arbeitsschutzgesetz)" [4] defines which requirements all workplaces must fulfill to ensure safe and healthy work and the "VDU work directive (German: Bildschirmarbeitsverordnung)" [5] defines requirements for computer based workplaces concerning hardware and software aspects.

In more detail, the VDU work directive states in the "appendix about requirements for computer based workplaces (Anhang über an Bildschirmarbeitsplätze zu stellende Anforderungen)":

"20. The principles of ergonomics have to be applied, specifically concerning the processing of information by humans. (20. Die Grundsätze der Ergonomie sind insbesondere auf die Verarbeitung von Informationen durch den Menschen anzuwenden.)" [5]

None of the directives link directly to an ISO standard, but experts usually refer to the more concrete ISO standards, which describe for example the principles of ergonomics. These are ISO 9241 (Ergonomics of human-system interaction) [6], ISO 9355 (Ergonomic requirements for the design of displays and control actuators) [7], ISO 14915 (Software ergonomics for multimedia user interfaces) [8] and various others. By fulfilling the detailed requirements of the relevant ISO standards, the high level requirements of the mandatory directives and laws will also be fulfilled.

3 Compliance

In countries with similar laws, companies have to prove that computer workplaces are compliant with the directives, i.e. that they are safe and healthy. In addition to hardware (monitors, desks, chairs etc.), software also plays an important part in the compliance and is enforced as described above. Under such laws workers can refuse to work at non-compliant workplaces. However, works councils, where they exist, usually enforce the required compliance for the workers in advance.

The directives and laws target the workplaces at the companies, not the hardware and software manufacturers. If we take the scenario where software is designed specifically for one company, compliance to the directives and laws can be assured, since during development the software is designed to fit explicitly to that company's and its users' needs. In contrast to this scenario, standard software is built using a "one size fits all" approach, with built-in adaption capabilities. Standard software must be configured, i.e. "customized" and "personalized" to fit the needs of the specific company, groups of users within the company, and even individual users.

By applying "customization" to standard software, the software is adapted to the company's needs (e.g. by adding information about the company's structures, typical

processes, company specific requirements). Customization settings are valid within the whole company and therefore influence all users equally.

Further adaptations are made by applying "personalization", i.e. the software is adapted to the needs of single users (e.g. by choosing font sizes, by setting personalized page views, by choosing column orders in tables). Personalization settings may vary between users, to support each user in his/her individual needs.

Nevertheless, companies buying and using standard software would like to have a simple and easy way to guarantee compliance. They often ask for a kind of certificate or statement from the software manufacturer that "the software is ISO / directive / legally compliant" or that "all aspects of the computer workplace usability are built into the software."

However, due to the standard software's built-in adaption capabilities, a global statement or certificate about the ISO compliance cannot be granted by the software manufacturer alone. After customization and personalization is completed at the customer site, the standard software may look, feel, and function very differently for individual users of one company, and even more so for individual users of different companies. Therefore, to guarantee maximum compliance, both the software manufacturer and its customers have to work hand-in-hand.

This work is reflected in the ISO 9241/110 principles. Some principles are more dependent on the manufacturer's development work, e.g. error tolerance, suitability for individualization, self-descriptiveness. Others can usually only be made in the software by the final customization and personalization efforts at the customer site, e.g. suitability for the task, conformity with user expectations. Some are a mixture of both, e.g. controllability, suitability for learning.

4 The Responsibilities of the Standard Software Manufacturer

To fulfill the requirements described in the ISO 9241/110 [1] in standard software a software manufacturer must build the software in an adaptable way. Using a "user-centered design process" the needs and tasks of typical users ("personas") need to be researched. Researching various end-users / companies / locations usually demonstrates which tasks and user needs are:

- Typically valid for all companies / users / business processes / business steps. These are usually implemented in a standardized way into the software.
- Slightly different between companies / users / business processes / business steps. These are usually implemented so that the standard software can be customized and personalized via switches, to ensure "best fit".
- Very unique for specific companies / users / business processes / business steps. These are usually implemented in a way that dummy fields, dummy screens, etc. can be activated at the customer site; or separate add-ons, developed as custom projects, are plugged into the software and ensure a fine-grained fit.

The basis for this approach is the proper understanding of the end-user's tasks and needs, leading to the correct implementation of the software. This includes the adaptation options which of course must be documented. By providing this stable and

flexible approach to the user interface, the customer can then make the necessary adaptations to the software to fulfill the requirements of the ISO 9241/110 standard.

5 The Responsibilities of the Customer

Finally (and only!) at the customer site must the concrete tasks and user needs be known. An "on-site" analysis of those tasks and needs must be done to ensure a proper software fit. With these facts and findings, the customer can and must customize the software accordingly, for example by showing necessary or hiding unnecessary fields, field groups, screens or functions, by arranging field orders, or by providing customer specific search or filter options. They must also train the users, not only how to use the software to do their job but also how to adapt the software using personalization options for individual users.

Execution of the tasks and needs analysis is usually the job of usability professionals. Specialized usability consulting companies should not only have methodological knowledge, but also an understanding of the customization and personalization options of the used software [9].

After applying all of these required steps, the ISO compliance should be evaluated, either by using checklists provided by the ISO standards, or by using checklists like ISONORM 9241/110-S [10, 11].

6 Examples

Using ISO 9241/110 requirements in examples, you can see what the concrete responsibilities are for both the software manufacturer and the customer.

6.1 Example 1

Suitability for the task requirement 4.3.5 states: "The steps required by the dialogue should be appropriate to the completion of the task, i.e. necessary steps should be included and unnecessary steps should be avoided." [1] Suitability for individualization requirement 4.9.9 states: "If appropriate, it should be possible for the users to add or rearrange dialogue elements or functionality specifically supporting their individual needs when carrying out tasks." [1]

Software manufacturer. Based on user-centered design research, for a specific task and persona it is specified which:

- Required fields are needed in all variants of a business process (implemented as "fixed UI elements").
- Additional fields, field groups or screens are needed by specific business processes - (implemented in a way that they can be shown or hidden via customization).
- Additional fields, field groups or screens might be needed by company policies (implemented in a way that there are dummy fields, field groups or screens which need to be labeled according to the task or predefined APIs for add-ons providing specific fields or functions).

Customer. Based on customer, end-user and task analysis, additional fields, field groups or screens might be shown or hidden from users via customization and personalization. In addition, end-user adaptations can be provided. These could be color schemes, font-sizes, column orders or specific functions.

6.2 Example 2

Controllability requirement 4.7.5 states: "If the volume of data relevant to a task is large, then the user should be able to control the data presented." [1]

Software manufacturer. Based on user-centered design research, for a specific task and persona it is specified how "large volume of data" is presented. For example, this can be done by defining views, appropriate controls, filters and search functions.

Customer. Based on customer end-user and task analysis, user and task-specific filters, specific search options, additional search fields, specific default views, individual column orders, etc. should be defined and activated via customization and personalization.

7 Effect of Customization and Personalization Efforts

Efficiency is one of the usability criteria of ISO 9241/11, defined as "resources expended in relation to the accuracy and completeness with which users achieve goals" [12]. And the customization and personalization efforts at the customer site are especially important for efficiency as proven in a usability study, which compared non-customized standard software with optimized/ customized standard software [13]. Users working with the non-customized software needed two to four times longer to fulfill a task compared to users of the customized software. The amount of keyboard and mouse interaction for data input and navigation was as much as two times higher in the non-customized software.

This study relied only on customization. No additional programming was done, no add-ons were used, and no personalization was made. The study mentioned that by applying these additional adaptations even more efficiency could be reached.

8 Collaboration Model

Software manufacturers must of course ensure a high level of usability for standard software, even without customization and personalization. Nonetheless, it is in their interest to make the benefits of these adaptations transparent to their customers and easy to implement. If they don't, the software may not offer enough flexibility or too much flexibility, making the adaptation effort too high for customers.

On the other hand, customers must realize that standard software is built to fulfill many companies' and users' needs. If they do not invest enough time and money to customize the software and train their individual users how to personalize it, even standard software with the best built-in usability will not fulfill usability's primary goals of "efficiency, effectiveness and user satisfaction".

References

1. ISO 9241/110: Ergonomics of human-system interaction – Part 110: Dialogue principles (ISO 9241-110:2006). International Organization for Standardization / TC 159/SC 4 - Ergonomics of human-system interaction (2006)
2. Council Directive 89/391/EEC of 12 June 1989 on the introduction of measures to encourage improvements in the safety and health of workers at work (1989)
3. Council Directive 90/270/EEC of 29 May 1990 on the minimum safety and health requirements for work with display screen equipment (fifth individual Directive within the meaning of Article 16 (1) of Directive 89/391/EEC) (1990)
4. German Health and Safety at Work Act (German: Arbeitsschutzgesetz / Gesetz über die Durchführung von Maßnahmen des Arbeitsschutzes zur Verbesserung der Sicherheit und des Gesundheitsschutzes der Beschäftigten bei der Arbeit vom 7. August 1996, zuletzt geändert durch Verordnung vom 31. Oktober 2006) (1996)
5. Work Directive, V.D.U. (German: Bildschirmarbeitsverordnung / Verordnung über Sicherheit und Gesundheitsschutz bei der Arbeit an Bildschirmgeräten vom 4. Dezember 1996, zuletzt geändert durch Verordnung vom 31. Oktober 2006) (1996)
6. ISO 9241: Ergonomic requirements for office work with visual display terminals (VDTs). International Organization for Standardization / TC 159/SC 4 - Ergonomics of human-system interaction (1998)
7. ISO 9355: Ergonomic requirements for the design of displays and control actuators. International Organization for Standardization / TC 159/SC 4 - Ergonomics of human-system interaction (1999)
8. ISO 14915: Software ergonomics for multimedia user interfaces. International Organization for Standardization / TC 159/SC 4 - Ergonomics of human-system interaction (2002)
9. Abele, P., Jurtienne, J., Prümper, J.: Usability Management bei SAP-Projekten. In: Grundlagen, Vorgehen, Methoden, Vieweg, Wiesbaden (2007)
10. Gesellschaft Arbeit und Ergonomie - online e.V.,
http://www.ergo-online.de/site.aspx?url=html/software/verfahren_zur_beurteilung_der/fragebogen_isonorm_online.htm
11. Prümper, J.: Der Benutzungsfragebogen Isonorm 9241 / 10. Ergebnisse zu Reliabilität und Validität. In: Liskowsky, R. (ed.) Usability Engineering: Integration von Mensch-Computer-Interaktion und Software-Entwicklung, Software Ergonomie, Teubner, Stuttgart, pp. 253–262 (1997)
12. ISO 9241/11: Ergonomic requirements for office work with visual display terminals (VDTs). Part 11: Guidance on usability. International Organization for Standardization / TC 159/SC 4 - Ergonomics of human-system interaction (1998)
13. Liebstückel, K.: SAP Enterprise Asset Management. SAP Press, Maryland (2009)