

ISO 9241-210 and Culture? – The Impact of Culture on the Standard Usability Engineering Process

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Abstract. In this paper, some ideas are presented regarding the question of whether standards can be valid internationally, i.e. worldwide and independent of the different cultures in the world, and how this question can be tackled. Exemplified by the standard usability engineering process in ISO 9241-210, the impact of culture on the main steps in the usability engineering process is analyzed. The output of the process is influenced by the process. If the process of usability engineering is culturally influenced and different for different cultures, the output of the usability engineering process, i.e. the user interface of the product, is also culturally influenced and different. Furthermore, the results are possibly not those as expected by the desired target culture. The presented ideas represent a first step towards deeper research in this area.

Keywords: User-Centered Design, ISO 9241-210, Culture, HCI, Approach, Process, Structure, Intercultural, Intercultural User Interface Design, Standard, Usability Engineering, Intercultural Usability Engineering.

1 Introduction

Globalization led to the development of products for other cultures. Therefore, intercultural product development and intercultural usability engineering is needed ([1]). The usability of user interfaces (UI) depends on the cultural context of use as well as on the cultural imprint of the users (age, sex, language, education, knowledge, experience, religion, self-conception, dealing with power, politics, wealth, income, infrastructure) (cf. [1], [2], [3]). To reach intercultural usability for a product, detailed cultural knowledge of the specific user habits is necessary for a designer in order to develop products that fit all customer needs in cultural contexts. Even if it is impossible that one UI designer has all this specific information from all relevant user groups worldwide, he must have a profound knowledge of the circumstances in his own cultural environment in order to be sensitive to the relevant aspects in other cultures (cf. [4]). In addition, the people involved in intercultural UI design should at least know the basic structures and principles from cultural studies in order to consider other cultures in their work (cf. [4]) such as quantitative cultural models (cf. [5]). This is augmented by working within an intercultural HCI designer team (cf. [6], [7]) using the usability engineering process for interactive systems which is defined in the

European Standard EN ISO 9241-210:2010 (cf. [8]). In this paper, I raise the question of how standards acknowledged by CEN and ISO can be internationally valid, i.e. if they apply independently of (national) cultures. An analysis of this process is done in order to identify aspects that are influenced by culture and to decide if it is necessary to change or adapt this ISO standard in order to work in different cultural contexts. First, cultural influences that affect interactive systems and their usage are presented followed by the description of the resulting discipline called "intercultural usability engineering". Then the process for designing utilizable interactive systems is shown and the influence of culture on the main aspects of the process in ISO 9241-210 are identified using the cultural models introduced before. Finally, the implications of these relationships are listed for further research.

2 Influence of Culture on User's Interaction with the UI

Culture as a set of facts, rules, values and norms (structural conditions) representing an orientation system (cf. [4]) established by collective programming of the mind (cf. [5]) within a group of individuals can influence Human-Machine Interaction (HMI) in different ways. Masao Ito and Kumiyo Nakakoji already demonstrated in 1996 the influence of culture on UI design for the modes „hear“ and „speak“ between user and system (cf. [9]). In the „hear mode“, the presentation of information from the system to the user takes place within the phases perception, association and inference. From the first to the last phase, cultural dependency increases: colors and forms in the perception phase depend less strongly on culture than standards in language and metaphors within the phase of associating meaning. Finally, the inference mechanisms in the last phase that are based on logic and social norms depend strongly on culture. In the „speak mode“, instructing the system by the user happens in four phases. First, the user recognizes the possibilities of system usage. For example, he grasps the meaning of the layout, selects alternatives, or initiates functions. Then he tests their applicability by checking semantic consistency using trial and error. In the third phase, he determines the expectations of the system regarding his actions and acknowledges the system instructions in the final phase. These process phases involve the perception of time, which is strongly dependent on culture (cf. [10]). In addition, cultural dependence increases from phase to phase. For example, in Japan, on the one hand, short system response time is very important. On the other hand, Japanese users are obviously more patient doing long-winded tasks than users from European countries (cf. [11]). Moreover, culture influences HMI on all levels of the interaction model (cf. acting level model according to [12]). Following [5], during the intensive learning phase in childhood, primary culture imprints the human being with certain rules, norms and desired ways of behavior to which the members of the group adhere. Figure 1 shows cultural models based on the compilation from literature by [13] that can be used to analyze the influence of culture on the behavior of users with interactive systems.

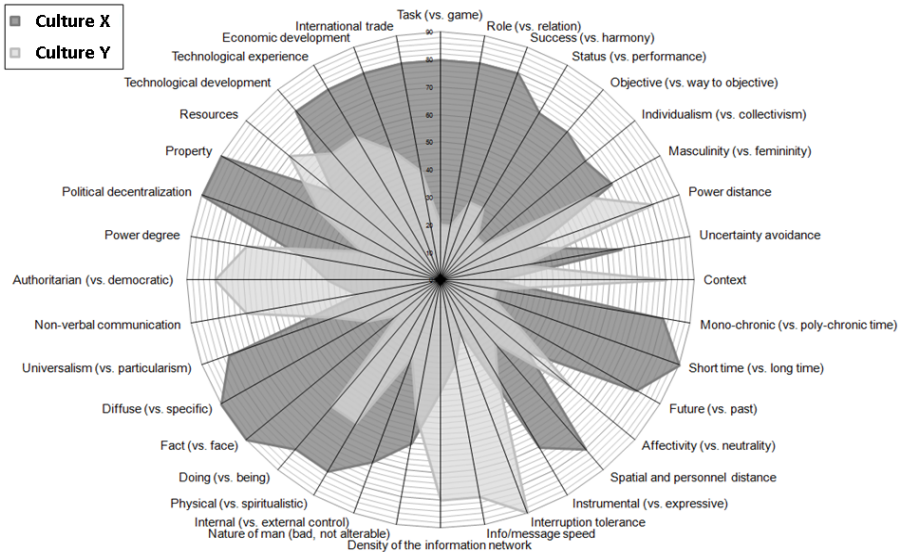


Fig. 1. Many cultural models can be used to analyze the influence of culture on the behavior of users with interactive systems (indexes are only valid for the cultural models of [5])

One type of cultural model are cultural dimensions, which serve to describe the behavior and values of members of certain cultures like uncertainty avoidance, individualism or collectivism or even power distance ([5]). For HCI, those cultural dimensions are most interesting that are directly connected to communication, information, interaction and dialogue design, i.e. the cultural dimensions concerning the culturally different concepts of space, time and communication (cf. chapters 1, 5 and 10 in [10]). Space and time are physical variables influencing the communicative behavior of human beings, which form the social processes of a group of humans and their culture: by learning certain kinds of behavior, the human being matures according to his cultural environment. The influence of cultural imprinting of the user on his behavior in interactions with other communication partners is immense. This is also valid for HMI because communication in HMI is determined by the interaction between the user and the system (cf. [3]). Hence, cultural differences in interpersonal communication can and must be transferred to the interaction with technical devices ([2]). Cultural dependencies in user system interactions (HMI) particularly concern interaction and dialog design (cf. [2]). Culture influences the interaction of the user with a computer system or a machine because of the movement of the user in cultural surroundings (cf. [2]). Therefore, culture has a direct influence on the interaction of the user with the system.

3 Influence of Culture on Usability and Usability Engineering

The usability of a system strongly depends on how the user can cope with the system (cf. [8]). The user articulates his desires and hence his needs regarding the usability of

the system. However, in addition to the common misunderstandings between developers and users, which lead to different product designs, there are also misunderstandings because of cultural conditions. There is not only a different comprehension of the requirements of the product but also culturally dependent perspectives and views of them (cf. [7]). Hence, the developer needs much more intercultural knowledge to understand the user of another culture. Furthermore, he needs competency regarding intercultural communication to enable the exchange of information with the user and to know exactly which product the user is likely to have (cf. [1]). [14] stated, “Individualism/Collectivism is connected to and has an effect on usability.” ([14]: 17). Therefore, the design, implementation and use of interactive systems should not only meet the general usability criteria but also take into account cultural issues which address relevant topics such as schedule, presence, privacy, authority, control, awareness, safety, error, trust, comfort, coordination, conflict, communication and collaboration as well as interaction style, thinking and action models (cf. [15, 16]).

4 Intercultural Usability Engineering

As explained above, the preconditions for intercultural usability engineering are knowledge about the cultural differences in HMI and its considerations in product design and product realization ([1]; [2]; [3]). “Intercultural” usability engineering is a method for designing products of good usability for users from different cultures. “Intercultural” in this context refers to the special methods that are necessary to do usability engineering for different cultures (cf. [1]). The “interculturally overlapping situation” arranged by a technical system is the most interesting (cf. [1]). [1] made the approach of [4] using “overlapping interaction situations” available for HMI design. These situations arise if a product is defined and formed within one culture and this product is then transferred and used in another culture. A change of cultural environment takes place at the transfer of a technology or a product from the developer's country to another country (cf. e.g., [1], [2], [17], [18]). Therefore, the work of [1] deals with the question of whether there is a reduction of the fit between user and product if products of one culture are used in another. Furthermore, the same data can have different meanings in different cultures due to the experiences within one's own, since every culture has its own values, symbols and behavior patterns with meanings and interpretations connected to them. These aspects have an effect on the coding or decoding of news during communication (cf. [2]). Miscommunication has negative effects on the usability of the product. Therefore, at the collection of culture specific user requirements and culture specific assessment of the concepts used, it has to be examined how far approved methods of usability engineering are suitable. The existing cultural models should be taken into account in the process of product design in the context of intercultural usability engineering. First, the product developers must be sensitized to the difficulties of cultural influences on product development and product use. Then cultural factors influencing HMI must be provided to the developers and considered in the product. This requires knowledge in software ergonomics and intercultural UI design as well as the application of usability engineering methods

in the intercultural context. In contrast, if the currently implemented functionality of a system of a certain culture is used as a basis for the analysis of UI characteristics, it may lead to erroneous or simply wrong design guidelines because those requirements need not necessarily match the real needs of the user. Therefore, the user's needs must be collected for every user or at least for the desired user groups (e.g., Chinese and German users).

5 Cultural Influences on the Standard Process for Designing Utilizable Interactive Systems

Questions concerning the interaction level, the mind and the cognition as well as behavior in using usability engineering methods and applying the usability engineering process itself within cultural contexts are either not answered or only partly answered until now. How do different cultures interfere and affect the navigation within applications? Are there significant improvements when comparing an application without taking into account intercultural differences with the adapted version of the application? Can users from different cultures have different experiences when interacting with applications from their own or other cultures? Such questions must be answered by research to acquire useful hints for designers and developers of user interfaces for the cultural context. Some of the questions are already answered (cf. e.g., [14]), but many of them are still open especially regarding the compatibility of processes in different cultural contexts. In the following, some ideas will be presented concerning the question where cultural influences affect the usability engineering process.

5.1 Process for Designing Utilizable Interactive Systems

Figure 2 shows an overview of the process for designing utilizable interactive systems according to the European Standard EN ISO 9241-210:2010. This process contains

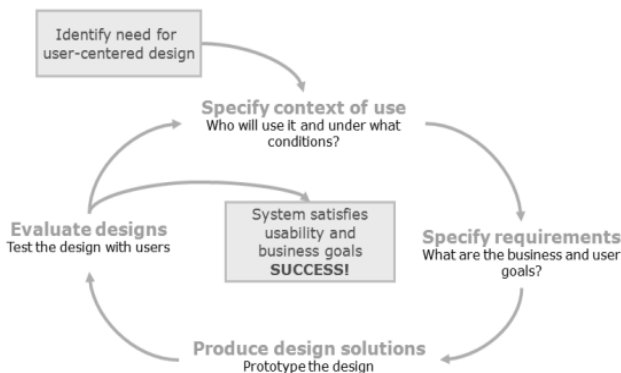


Fig. 2. Usability Engineering Process according to ISO 9241-210

several main steps, which will be analyzed in the following concerning their applicability in intercultural contexts. The weaknesses in every process step if used in intercultural contexts are identified in order to define and determine recommendations for improvement. Every process step is briefly described, followed by an idea of the possible cultural impact on the step and sometimes by implications from it on the process, the factual products and the total product where appropriate or presently achieved respectively.

5.2 Principles of Human-Centered Design

(i) "The design is based upon an explicit understanding of users, tasks and environments". Explicit understanding of users, tasks and environments is one of the most difficult tasks especially in intercultural contexts because of different explicit and implicit or tacit factual and procedural knowledge resulting from different world views, assumptions, methods and processes (cf. [7]). (ii) "The users are involved throughout design and development". However, there is cultural behavior in opposition to the expected and required user behavior throughout design and development (cf. [5]). Users from different cultures grasp things differently and behave accordingly in certain design and development situations (cf. [1]), which also impairs the next principle of human-centered design: (iii) "The design is driven and refined by user-centered evaluation". Here, there are cultural differences in reacting to questions and being observed (cf. [18], cf. also face saving aspect, [19]), which must be considered in order to adapt or change evaluation methods accordingly. (iv) "The process is iterative" seems not to be a problem on first sight for different cultures because iterative learning is necessary for all users all over the world. However, it has to be checked if there are hurdles when diving into details. For instance, there may be different styles of learning also concerning the iteration cycles such as iteration time and iteration frequency. (v) "The design addresses the whole user experience". This principle seems to be generally valid for all users of any culture. However, the perceptions and reactions from the expected usage of a product, system or service by the users can be different according to the user needs in the corresponding cultural context, which increases the effort necessary to follow this principle. (vi) "The design team includes multidisciplinary skills and perspectives". A good portion of empathy and frankness is necessary in order to comprehend and know things from other disciplines, which is even more important and difficult in intercultural contexts because of the complexity of culture (cf. [4]). Furthermore, some cultures are rather narrower than open minded (cf. [5], [20], [21]).

5.3 Planning Human-Centered Design

(i) "General". The phases of the product lifecycle seem to be independent of culture because they represent generic human behavior: having an idea (conception), gathering the necessary things to realize the idea (analysis), thinking about the physical realization of idea (design), physically realizing the idea (implementation), checking

if the realization of the idea represents the idea (test), supporting your realized idea until you do not like it anymore (maintenance). Every human being has to do these steps independent of their culture. Nevertheless, also here are cultural differences. For example, Japanese plan very long before the realize things in contrast to Germans (cf. [22]). (ii) "Responsibility". In contrast, responsibility is strongly culturally influenced. Cultures with high power distance and high uncertainty avoidance do have a different attitude about accepting responsibility than cultures with low power distance and low uncertainty avoidance (cf. [5]). (iii) "Content of plan" and (iv) "Integration with project plan". According to the Weltanschauung, different methods have to be used in order to obtain reasonable results (cf. [7]). For instance, the plan can be very detailed or very loose and agile. Their acceptance depends on culture. Negotiation and contracting is another issue along with agreement about time prescriptions for the iterative process cycles that can be problematic in different cultures according to mono-causal or multi-causal thinking (cf. [2]). (v) "Timing and resources". Here there are cultural influences described by the cultural models of time behavior (cf. [21], mono-chronic vs. poly-chronic) and usage of resources (cf. [13]).

5.4 Human-Centered Design Activities

(i) "Understanding the context of use". The objective of this process step is to collect all needs, interests, expectations and behavior patterns of the different user groups. In an international context, it is important to determine that there is not one homogeneous user group but that there are thousands or even millions of individual users worldwide. To specify the individual cultural context of use in the relevant usage situations it is important to develop a profound understanding of the individual culture specific needs of the users. The current process does not cover this aspect fully for the intercultural context because there is not sufficient focus on the profound analysis of the cultural aspects and their influences represented by HCI dimensions, UI characteristics, intercultural variables and cultural dimensions. HCI dimensions describe the style of human machine interaction expressed by information frequency and density and order as well as interaction frequency and speed. User interface characteristics capture the most relevant attributes of user interfaces containing metaphors, presentation, navigation, interaction and mental models ([13]). Intercultural variables cover the localization levels function, interaction and presentation ([23]). Direct intercultural variables concern HCI directly such as color, icons, language and layout as well as interaction speed and frequency. Indirect intercultural variables embrace HCI related topics such as service manual or packaging. [20] defined cultural dimensions that are related to human interaction such as universalism, neutrality, specification, continuity and control. They can be related to HCI dimensions to establish a link between the cultural imprint of users to their HCI style ([15]) in order to describe the analytical basis to specify the context of use in the intercultural context as well as to support the next activity: (ii) "Specifying the user requirements". The task is to acquire a deep understanding of the complexity of the task and its requirements (cf. [6]) by analyzing the current market situation concerning existing products, main competitors, environmental factors like politics, new legislation, economic trends, sociologic and tech-

nological developments of the target markets. The implications for optimization of ISO 9241-210 can be extended to the tasks and the roles in this standard for its application in intercultural contexts. Here also elements from usage-centered design process such as cultural specific user tasks and roles as well as an additional cultural model can be applied in order to systemize the intercultural usability engineering process (cf. [24]). (iii) "Producing design solutions". In this process step a culturally diverse UI design team has the task to generate new innovative design solutions. The better and more precise the product targets are defined at the beginning of the development project, the easier it is to compare them with the current state of design. Thereby, communication is a challenge in diverse teams as mentioned before: misunderstandings caused by talking the same language which is, however, not the mother tongue for most of the team members will happen frequently and can lead to anger and frustration. Thereby, also task distribution and feedback loops are strongly affected negatively, which possibly drives the final activity ad absurdum because of wrong or lacking (interpretation of) feedback: (iv) "Evaluating the design". In addition, in intercultural context, it is important to evaluate the design status from the perspectives of the different cultural user groups defined to ensure that the design fits the different and sometimes even contradictory requirements of all stakeholders.

6 Discussion and Conclusion

Even if these initial ideas provide a basis for further research, they are just preliminary and must be detailed and investigated in depth in order to become general statements. Hence, an even more profound discussion is outstanding. Nevertheless, some ideas indicate that the existing HMI development process defined in ISO 9241-210 could be extended by roles and tasks in order to be successful in all cultural contexts worldwide and to fulfill the expected validity at least internationally (cf. also [6]). Furthermore, the user interface design methods should be systematically complemented with cultural aspects to ensure that new systems can be designed right from the beginning for one or more cultures while designers better accommodate the diverse global user requirements and respond faster to change using agile methods and modules from usage-centered design (cf. also [24]). In any case, it is reasonable that experts in international standardization committees related to HMI have intercultural experience and knowledge in intercultural user interface design as well as intercultural usability engineering.

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