Intercultural Design for Use – Extending Usage-Centered Design by Cultural Aspects

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Abstract. In this paper the Usage-Centered Design approach is suggested as structured process for Intercultural HCI Design. Usage-Centered Design is extended by cultural models to take into account the cultural aspects in HCI design. The extensions cover as well common cultural aspects as system specific cultural aspects of the system to be designed. This approach makes it possible to track and trace the culture specific requirements and design decisions for internationalized user interfaces.

Keywords: Usage-Centered Design, U-CD, Culture, HCI, Model, Approach, Process, Structure, Intercultural, User Interface, Design for Use, Cross-Cultural User Interface.

1 Motivation and Goal: Structured Process for Intercultural HCI Design

Today in general there are just few complete methodologies helping user interface (UI) designers to design user interfaces. Amongst these there is no approach which embeds intercultural UI design. A UI design method helps designers

- starting the design process (what needs to be done and in which order),
- having guidance from requirements to the specification,
- creating better systems.

A UI design method empowered by cultural aspects enables the results from above for systems designed for one or more cultures. Using the proven and successful approach Usage-Centered Design (U-CD) as a starting point to integrate the aspects of intercultural user interface design, results in an intercultural Usage-Centered Design process that is provides the advantages listed above for intercultural user interface design. It provides clear guidance through the whole design process of an cross-cultural user interface and delivers an alternative to the trial and error approach of

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trying to fix a bad design by iterations of testing and repairing found defects and problems.

2 Cultural Aspects to Be Included in the HCI Design Process

The cultural influences on the design process are 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 ([1]). User interface characteristics capture the most relevant attributes of user interfaces containing metaphors, presentation, navigation, interaction and mental model ([2]). Intercultural variables cover the localization levels function, interaction and presentation ([3]). Direct intercultural variables concern HCI directly such as color, icons, language, layout as well as interaction speed and frequency. Indirect intercultural variables embrace HCI margins such as service manual or packaging. Cultural dimensions serve to describe the behavior of members of certain cultures ([4]). They can be related to HMI dimensions to get a link between the cultural imprint of users to their HCI style ([1]).

3 Usage-Centered Design (U-CD) in a Nutshell

Usage-Centered Design ([5]) is a systematic process using abstract models to design user interfaces for software systems fully and directly supporting all the tasks users need to accomplish. The user interfaces derive directly and systematically from a series of interconnected core-models. Center of the process is the robust, fine-grained task model comprising from user perspective the system‘s functionality expressed in use cases in essential form. Usage-Centered Design has a clear focus on user performance. Systems designed using this approach enable users to accomplish their tasks more accurate and reliable in less time (cf. [6]). First developed in the early 1990s, it is a proven, industrial-strength approach that has been used to design everything from industrial automation systems (cf. [7]) and consumer electronics to banking and automotive infotainment applications (cf. [8]). Because it is a streamlined process driven by simple models, it scales readily and has been used on projects ranging from a few person months to a 5 designers, 30 developers, 23 month project that produced the sophisticated integrated development and award winning environment “STEP 7 Lite” from Siemens AG ([5], [9]).

4 Analyzing U-CD

4.1 Process Overview

The U-CD process (Figure 1) can be split in analysis phase and design phase. Role model and task model are the results of a user and task analysis. The content models together with the implementation model are the results of the design phase.

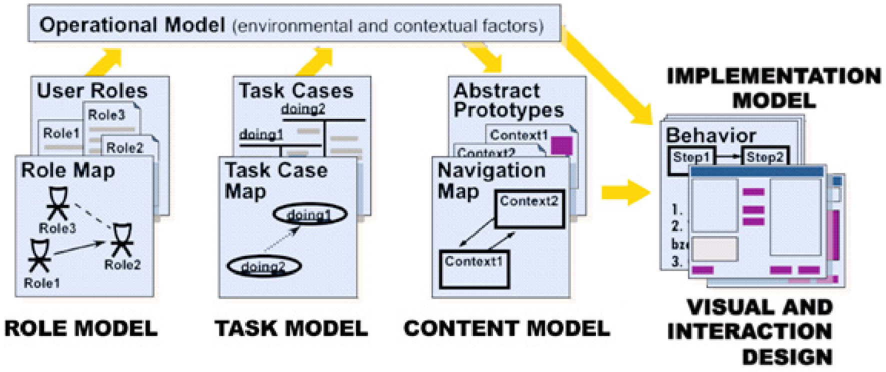


Fig. 1. Main Constituents of the Usage-Centred Design Process

4.2 Core Models

UC-D is built around three simple core models that represent the relations between users and system (role model), the work to be accomplished by the users (task model), and the contents and structure of the user interface (content model). The content model derives directly from the task model which is derived from the role model. All models consist each of two parts representing each its description and an additional model representing the relationship between the descriptions (role map, task case map and navigation map).

4.2.1 Role Model

The role model consists of the user roles and the user role map. User roles are abstract collections of needs, interests, expectations, behaviors, and responsibilities characterizing a relationship between a class or kind of users and a system ([5]). The user role map is a representation of the interrelationships and dependencies between the user roles.

4.2.2 Task Model

The task model combines task cases and the task case map. Task cases are structured narratives, expressed in the language of the domain and of users, comprising a simplified, generalized, abstract, technology-free, and implementation-independent description of one task or interaction that is complete, meaningful, and well-defined from the point of the users in some role or roles in relation to a system and that embodies the purpose or intentions underlying in the interaction ([5]).The task case map is a representation of the interrelationships and dependencies between the task cases.

4.2.3 Content Model

The content model embraces canonical abstract prototypes with the navigation map. Canonical abstract prototypes are abstract representations of user interface contexts modeling the interactive functions, information and basic layout structure needed in the realized user interface utilizing technology-free, and implementation-independent canonical abstract components ([10],). The navigation map represents the overall architecture of the user interface by modeling the possible transitions between the interaction contexts ([5]).

4.2.4 Additional Models

Two more important models complete the U-CD process holding aspects affecting the design phase (operational model) and the results of the whole effort (implementation model). The operational model comprises the aspects needed to adapt the user interface design to the conditions and constraints of the operational contexts. The implementation model poses a blueprint and construction plan for the final system describing all aspects of interaction and visual design for the implementers realizing the system.

5 Detailed Analysis

When looking at the cultural aspects we find a diversity of different aspects.

5.1 Common Aspects for Intercultural UI Design

Intercultural variables ([3]), user interface characteristics ([2]), and HCI dimensions ([1]) are all sets of culture specific rules and guidelines with more or less overlap that affect the visual and interaction design of a system. Since they are static (i.e. independent of the purpose of the system) and apply almost for all systems they are not specific for a certain system.

5.2 System Specific Cultural Aspects

This type of cultural aspects is genuine to the system to be designed. The aspects are usually a result of the user and task analysis and can affect user roles as well as task cases. For instance, one user role has different salient backgrounds in different countries and therefore requires different task structures in different countries. Another example would be that one and the same task has a radically different flow in different countries. An example for the latter one would be address input into a GPS navigation system in US and in China. In China the usual strategy to find a location is not to use the postal address but either a street intersection or using a point of interest nearby the desired location. Which method is used is even dependent on the part of China where the navigation system is used. Besides the different kinds of cultural aspects it is important to consider localization as well as internationalization within an intercultural UI design process.

6 Integration of Cultural Aspects in U-CD

To integrate the cultural aspects and the internationalization requirements in U-CD it is necessary to extend and adapt the existing process at different places.

6.1 Cultural Model

The common aspects for intercultural UI design will be included in a cultural model similar to the existing “operational model” (Figure 2).

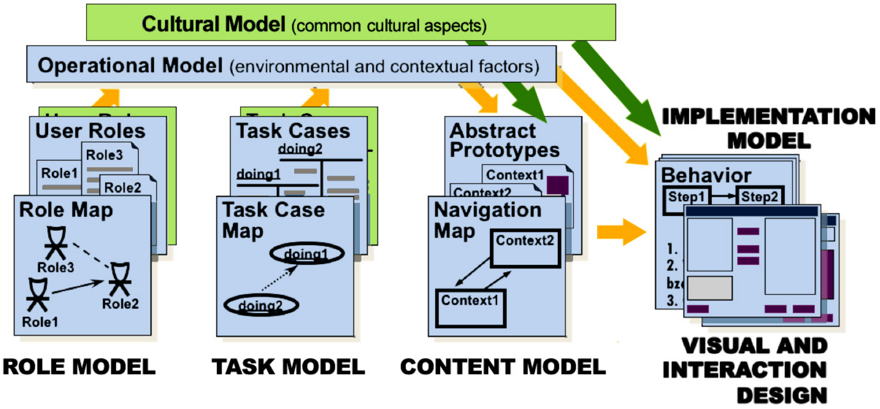


Fig. 2. Extended Usage-Centred Design Process by a Cultural Model

Since the content in the cultural model affects the visual and interaction design, this new model will affect the transitions from the task model to the content model and also from the content model to the implementation model. The cultural model captures the common rules for cultures the system will be designed for. For each culture one cultural model is used. Figure 3 shows the qualitative content of an cultural model.

Culture

Appearance (Color, Layout, Font, Density…)
Navigation (Hierarchy, Menu Tree, Structure…)
Metaphors (Sound, Icons, Symbols…)
Mental models (Context, Cognitive Style, Metaphysics…)
Interaction (Speed, Frequency…)

Fig. 3. Content of the Cultural Model

The content of the cultural model is mainly based on user interface characteristics (cf. [11]) and HCI dimensions (cf. [1]) describing a user interface at abstract level filled with the special values for the desired cultures.

6.2 System Specific Cultural Aspects

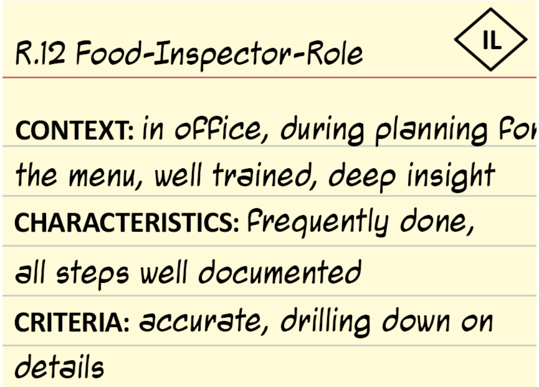
The system specific cultural aspects affect the role model and the task model. For the role model and task model in localized systems it is not necessary to have explicit cultural extensions. However in internationalized systems to be deployed in different cultures it is necessary to implement different cultures on the level of the role model and task model. There can be culture dependent versions of the same user role and also of the task cases.

6.2.1 Role Model

The user role model is composed of user roles plus the user role map (see chapter 4). To cover and include culture specific differences it is necessary to introduce culture specific user roles which will become part of a common user role map. An example could be an inventory control system for canteens and commercial kitchens which is deployed e.g. in Europe and in Israel. In Israel there exists an additional user role to support the tasks of the Mashgiach who supervises the adherence of the food and ingredients to the Kashrut, the Jewish dietary laws. This means that for a system designed to be deployed in different cultures there can be additional user roles for one or more cultures.

6.2.1.1 User Roles

The extension to the existing user role model is the introduction of a culture identifier. The notation for the culture identifier is a rhombus with the 2 digit ISO Country Code (Figure 4). To cover also cultural aspects that are not part of the ISO Country Code such as religious denominations, indigenous groups or any other cultural target group (e.g., car driver, elderly people, indigenous groups, etc.), it is possible to introduce project specific culture identifiers.



R.12 Food-Inspector-Role

IL

CONTEXT: in office, during planning fo

the menu, well trained, deep insight

CHARACTERISTICS: frequently done,

all steps well documented

CRITERIA: accurate, drilling down on

details

Fig. 4. Culture Identifiers used as Notation for Culturally Affected User Roles

The culture identifier is added according to the following rules:

- In its simplest form user roles are described by the context within they are played, the characteristic of performance, and the criteria for support. A culture identifier in the upper right corner complements this description.

- If applicable it is possible that one role is shared between two or more cultures. In this case the role gets multiple culture identifiers.
- User roles that are common to all cultures remain without culture identifier.

It is useful to introduce an inverse culture identifier to be able to exclude certain culture groups from one user role. An example would be a "Facebook Poster" role that does not exist in China due to legal restrictions. The invers/not culture identifier is shown by adding a circle to the left corner of the rhombus (Figure 5).

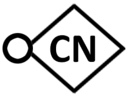


Fig. 5. Notation for a Culture Identifier Expressing Validity for All Cultures except China

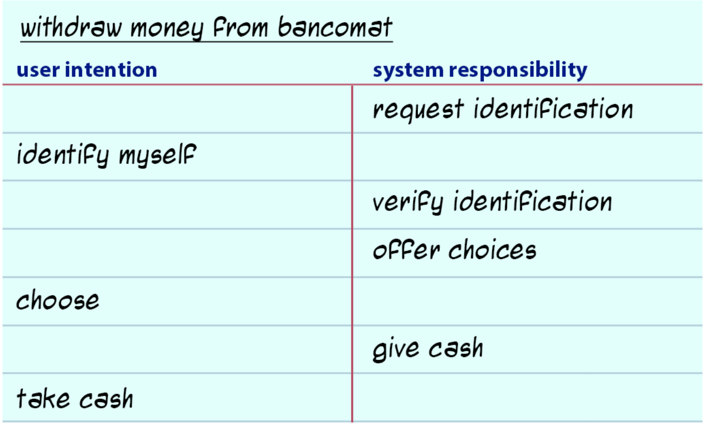
6.2.1.2 User Role Map

The user role map in general remains unchanged. There is still one user role map for one system; otherwise at this point the design process would split in the design of several different cultures specific systems. Nevertheless the culture specific roles keep the culture identifier and thus still can be identified.

6.2.2 Task Model

6.2.2.1 Task Cases

Task cases in their basic form are defined by a structured narrative in user's and domain language as two-column abstract dialog representing the user intention and the system responsibility (Figure 6, cf. [5]).



withdraw money from bancomat

user intention	system responsibility
	request identification
identify myself	
	verify identification
	offer choices
choose	
	give cash
take cash	

Fig. 6. Basic Form of Task Cases

In this basic form culture dependency is already included in the abstract dialog, which itself expresses the abstract interaction specifically for a specific culture group. The only change is again the addition of a cultural identifier to be able to track, structure, and organize the task cases according to the following rules (cf. Figure 7):

- Task cases are derived from the user roles, therefore tasks derived from a culture specific role are also culture specific and inherit the same culture identifier as the user role from which they are derived.
- From one user role may different culture specific task cases be derived. These task cases get their culture identifier when they are created.
- It is also possible that a task case can be shared between user roles from different cultures and being marked with multiple culture identifiers.
- Task cases common to all cultures remain without culture identifier.
- Task cases, which are common but exclude one or more culture groups, get the inverse culture identifier for the affected culture(s).

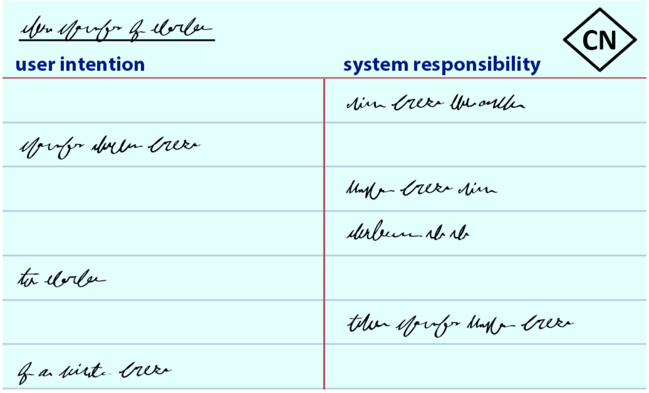


Fig. 7. Basic Form of Task Cases Indexed by a “Cultural Identifier“

6.2.2.2 Task Case Map

The task case map depicts the relationship between task cases in a system to guide content organization in the user interface. Thus all task cases including the culture dependent ones are shown in the task case map together, although some of them may be mutually exclusive due to a cultural setting.

In the task case map the task cases are shown by their name plus none, one or more culture identifiers (cf. Figure 8).

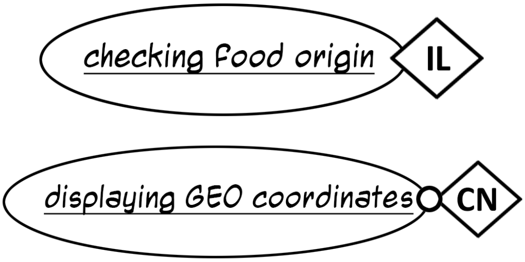


Fig. 8. Task Cases with Different "Cultural Identifiers"

6.2.3 Content Model

For consistency, completeness, and traceability it is possible but not necessary to use the cultural identifier also in the abstract prototypes and the navigation map. In both depictions the cultural identifier is used to mark up the contexts for specific cultures.

7 Conclusion

We suggest Intercultural Usage-Centered Design (IU-CD) as a method for designing cross-cultural user interfaces. This approach helps designers of cross-cultural user interfaces to get started, it provides structured guidance throughout the design process, it helps to retain insights in reusable models and thus to create better localized and internationalized systems.

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