3
Related Work

The interest in culture and its impact on the users' experience in HCI community has started in the 1980's with the development of multilingual versions of software applications and with the advent of graphical interfaces (GUIs) (Marcus, 2001a). Since mid-1990s the possible and desirable computer-mediated communication and collaboration among people from all over the world with the Web via the Internet have naturally fostered cross-cultural communication and increased the challenges for the HCI research area.

This chapter presents an overview of literature about cross-cultural HCI design. Although our work is on conceptual metaphors to help designers communicate cultural diversity, we investigated the approaches proposed to cross-cultural design and the main challenges in this research area. So, we can identify the gaps in the literature and define more precisely where our work is placed within cross-cultural HCI research.

In order to organize the kinds of work devoted to taming cultural issues in HCI, we present them in two distinct categories (see Table 1): work devoted to studying challenges in HCI cross-cultural design process; and work that proposes alternatives or solutions to change the design process. It is worth keeping in mind that the Int-Loc approach is pervasive in almost all previously published work about culture and HCI.

Works on cultural challenges in cross-cultural HCI design process	- HCI methods and practices
	- Cultural differences between designers and users
	- Usability and communicability problems
Solutions to the HCI design process of cross-cultural systems	- Cultural Differences elicitation
	- Collaborative design across cultures
	- Guidelines for HCI design
	- Culturally adaptive software

Table 1: Categories of work devoted to taming cultural issues in HCI.

Sections 3.1 and 3.2 present an overview of related work of such categories. Section 3.3 presents works about the use of metaphors in HCI design, since this thesis proposes a set of metaphors for designing cross-cultural systems (see Chapter 4). Finally, Section 3.4 discusses the learned lessons with this investigation.

3.1.
Work devoted to studying challenges in cross-cultural HCI design process

In the last 15-20 years, researchers have been trying to understand the impacts of culture on the users experience and on user interface design in order to frame cultural issues in human-computer interaction. By analyzing the literature we identified some studies about cultural challenges in HCI regarding the use of current HCI methods and practices to cultural studies and cross-cultural HCI design; and, others about the impact of cultural differences in HCI design process and on usability and communicability.

3.1.1.
HCI methods and practices in the context of cross-cultural design

Numerous studies have been investigating whether current HCI methods and concepts of quality are capable of producing the same results when applied in Int-Loc projects. Most of them are still looking for solutions or answers.

Winschiers (2006), for instance, investigated the challenges of Participatory Design (PD) (Schuler & Namioka 1993) in an intercultural context, wherein the end-users of the technology become co-designers and work alongside the design team from the initial concept sketch to the final system evaluation. Evidence showed that PD in a cross-cultural context goes beyond the involvement of users in the design of the product, but should include an appropriation of the design process itself.

Sakala (2009) also investigated how well PD can work in a cross-cultural design context. According to her, the initial developmental goals of the design

methods did not consider the specific challenges of operating in a cross-cultural design setting as these methods were particularly developed for western cultures.

Another study investigated the implications of cultural influences on software development teams and user involvement (Smith *et al.*, 2004). They conducted a qualitative research about people's receptivity to work in groups and to feel as part of a multicultural team. They concluded that "we cannot assume that Western methodologies, techniques for user centered design and participation can be used in other cultures, or within multicultural teams without adaptation" (*ibid.*, p.89).

Research about the adequacy of User-Centered Design (UCD) methods and theories to developing world (HCI4D) has also been carried out. A user-centered approach focuses on the target users from the beginning of the design process, continually checking the design with the users to ensure that they are in fact comfortable with it (Jokela *et al.*, 2003).

Maunder & co-authors (2007), for instance, claimed that the success and acceptance of UCD in the developed world do not guarantee its adequacy in the developing world. Throughout UCD case studies conducted in South Africa, the authors found out that UCD tools and techniques to requirements specification and producing design solutions such as Paper Prototyping Technique (Snyder, 2003) proved difficult to apply in the developing world context. Others, however, were useful and should be a key component of any developing world design approach such as Contextual Design[5] (Beyer & Holtzblatt, 1999).

To them, UCD for developing world (UCD4Dev) should have some characteristics such as:

"provide tools and techniques that probe socio-cultural attitudes towards technology, exposing socio-cultural intricacies that may affect the overall design and secondly, the development of the user and his/her supportive environment, thus ensuring a user that is able to actively participate in the design process and an environment that is able to support the associated tasks and activities" (Maunder & co-authors, 2007, p. 328).

Marsden & co-authors (2008) discussed the creation of technology to people who live in developing regions, since their understanding of Information

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[5] Contextual Design (Beyer & Holtzblatt, 1999) is essentially a fusion of user-centered and ethnographical principles, where the designer/researcher is an observer trying to gain an understanding of the user and their immediate context (environment).

and Communication Technologies (ICT) and their needs are hugely different from those people who live in a technology-rich environment. To the authors, the challenge now facing HCI, however, is: "how do we design appropriate digital technology for those who do not know what digital technology is?" (*ibid*., p.3798). They argued that understanding the differences in context has been the problem, a problem that HCI techniques do not fully address. Their research is seeking technologies to empower a community of users to create and refine its own digital technology. Vatrapu & Pérez-Quiñones (2006) studied the effect of culture in structured interviews in usability testing within Int-Loc projects. Empirical results showed that culture affects the type of responses participants provided in a structured interview. Participants responded more freely and accurately to the interviewer from the same culture than to the interviewer from a different culture.

Other studies revealed the need to redefine usability. Yeo (2000), for instance, conducted studies to verify usability techniques in non-Western cultures. Results of the usability evaluation found to be inconsistent due to cultural attributes of participants such as computer experience and familiarity with the researcher from another culture.

A cultural evaluation of Usability Engineering in the Namibian context (Winschiers & Paterson, 2004; Winschiers & Fendler, 2007) also revealed a number of good practices as well as locally inadequate methods, since "current usability testing methods are based on the assumption that an effective and efficient task completion correlates with user satisfaction" (Winschiers & Paterson, 2004, p. 277). They suggest cultural appropriation of the software development process itself, meaning that methods, concepts and project goals need to be redefined within the local context in a kind of 'sustainable software development' process.

3.1.2.
Cultural differences between designers and users in the context of HCI design processes

The influence of stakeholders' cultural background on design product and process is studied and discussed in some works. Sakala (2009), for instance,

investigated cultural related divergence between designers and target users at design time such as: misunderstanding of certain concepts; difficulties in reading and writing; and confidence in both the design style and speech. As a result, certain interaction breakdowns such as language barriers led to several omissions of design factors that could have perhaps been important to the interface design process. Communication and behavioral issues including facial expression, turn taking and surprising voice tones also occurred in the design sessions.

Virtual teams, i.e., the physically distributed, culturally and organizationally diverse members of software development have also been subject of study. The work of Wong & Burton (2001), for instance, focused on the characteristics of a virtual team, and their consequent impact on team performance.

Kersten & co-authors (2000) discussed the relationships between culture and software. According to them, "software, like any other product family, contains embedded cultural values and objectives". Some of the embedding occurs unconsciously, inherited via the cultural programming of its human creators; other parts of it are intentional via design requirements explicitly obtained by researching its target users. The Linux and Windows operating systems reflect decisions, for instance, regarding embedded cultural values such as openness and flexibility *versus* ease of use and stability. They suggest the development of tools that allow the manipulation and testing of the embedded values and ideas in software.

The awareness of cultural differences in cross-cultural design also is subject of research. Several subfields in HCI such as Participatory Design (Schuler & Namioka, 1993), End-User Programming (Fischer, 2003) and User Modeling (Kobsa, 1993) claim that "in the design stage, various viewpoints of stakeholders have to be identified and managed" (Winschiers, 2001).

However, the basic difficulty in intercultural communication between stakeholders is the difference that exists between the sender's and receiver's cultural backgrounds and way of communicating. The literature in intercultural communication is unanimous on the importance of awareness of cultural differences between interlocutors of a communicative context. According to Allwood (1985, p.22) "a first action to reduce the risks of misunderstanding would be to gather good insight into the differences and similarities that exist"

between cultures. For Chen & Starosta (1998) it is by studying communication styles and by understanding how to use them that we may be able to communicate more clearly, and promote intercultural dialogue.

Since cross-cultural contact and exchange are fostered by the interactive and global nature of the Web, HCI research should give solution to what was claimed by Russo (1993, p.342): "to successfully build bridges between worlds, user interface designers must increase their awareness of cross-cultural differences."

In a cross-cultural system design setting, the forming and interpretation of viewpoint is problematic in that it depends on the interlocutors' perception of the environment, which depends on their habits which are shaped by their culture. Foreign HCI designers understand and model the environment as they perceive it through their personal culture-bound perspective, which rarely coincides with the view of the local users. This obviously has a major impact on system design, which in this case is based on a misconception of the initial situation, thus leading to the implementation of an undesirable system" (Winschiers, 2001, p.8).

3.1.3.
Usability and communicability in cross-cultural HCI design

Cultural differences resulting in usability problems have been identified by some authors. For example, Marcus states that "rarely can a product achieve global acceptance with a 'one size fits all' solution" (Marcus, 2001a, p. 47). Curzon & co-authors (2005), for instance, explore issues concerning information search strategies of older people in natural settings. Their studies suggest that people have a strong propensity to stick with familiar strategies for information searching developed over a lifetime.

Connolly (1996) investigated the problems in designing the user interface for systems supporting international human-human communication, namely systems whose purpose is to support Computer-Mediated Communication (CMC). Such is the case of differences in language between the interlocutors, in institutional conventions, environmental and social differences, and so on. He claimed that additional guidelines for CMC systems should consider these problems and be included in standard HCI guidelines.

Dunker (2002), in turn, investigated the cross-cultural use and usability of the library metaphor in digital libraries in the cultural context of the Maori, the indigenous population of New Zealand. The study examined how a physical library metaphor influenced the use of digital libraries in the context of the Maori. Experiments examined how prior knowledge about the organization of the material, namely the categorization of the books, in physical libraries, affected the use of a digital library.

Differences in communication styles across cultures also are expected to increase challenges to the ways in which websites communicate their messages. Following cultural factors from Hall's cultural theory (1959), in particular his high and low context cultural factors,[6] studies explored and identified the strategies used by high-context cultures in utilizing the Internet—a largely low-context medium—for communication and marketing purposes (Würtz, 2005). This study aimed at understanding how websites created for a target group in a high-context culture differ from those created for low-context culture audiences. Results described the tendencies by which communication through websites is adapted to various cultures.

Another study (de Souza *et al.*, 2008) using the Communicability Evaluation Method (CEM) from Semiotic Engineering HCI theory focused on how well the designer-to-user metacommunication (communication about communication) is received by users from different cultures. The most important result from the CEM study was an urgent need for cultural references to orient users as they move across cultural boundaries at interaction time.

Further empirical research has confirmed that culture influences interacting with computers (Vatrapu, 2008) and Computer Supported Collaborative Learning (CSCL) (Vatrapu & Suthers, 2010). Statistical results in (Vatrapu, 2008), for instance, show that in three independent groups of dyads from similar or different cultures, participants appropriated the interface resources differently in enhanced learning environments. Nevertheless, individual learning outcomes indicated no significant differences. Vatrapu & Suthers (2010) investigated to what extent

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[6] According to Hall, in a high-context culture, there are many contextual elements that help people to understand the rules. As a result, much is taken for granted. In a low-context culture, in turn, very little is taken for granted. Whilst this means that more explanation is needed, it also means there is less chance of misunderstanding, particularly when visitors are present.

culture influences objective (efficiency, effectiveness) and subjective (participants' preferences and perceptions) measures of usability in CSCL environments. They found that participants with different cultural backgrounds had different levels of engagement in different kinds of collaborative activities. Participants also created different numbers of artifacts, compared to each other. Furthermore, they provided different user interface satisfaction ratings and different quality and quantity of comments.

3.2. Work devoted to proposing solutions to the HCI design process of cross-cultural systems

3.2.1.
Cultural Differences Elicitation

In order to elicit and/or analyze cultural differences that should be taken into account in cross-cultural HCI design, a number of works have been using and developing theoretical and practical approaches for managing cultural aspects in cross-cultural website design processes.

3.2.1.1.
Theoretical approaches

A number of cultural models aim at supporting cross-cultural design in Int-Loc projects. These models act as frameworks to measure different cultures on a number of cultural dimensions, variables or factors and to guide designers in designing for a multi-cultural approach. Such is the case of cultural models (Hall and Hall, 1990; Hofstede, 1997; Hoft, 1996; Trompenaars, 1993); and cultural filters (Shen *et al.*, 2006).

Hoft (1996) proposes the development of a cultural model to study culture, compare the data you gather, and apply it in a meaningful way to your product's design and implementation. According to her, "a cultural model compares the similarities and differences of two or more cultures by using international variables" (*ibid.*, p.41). A cultural model can be used, for instance, to identify global information for internationalization (Fernandes, 1995) to assess the degree of localization, i.e., the interface of a system is customized for a particular

audience (Marcus, 2001a), which is necessary to evaluate the effectiveness of an international user interface, to avoid making cultural mistakes that can offend or mislead. To select meaningful international variables we need to understand and identify which layer or layers of culture we want to study. Hofstede's theory (1980, 1997) is the most widely applied intercultural communication theory in HCI research. His cultural dimensions provide support for a methodology to anticipate cultural differences. His Pyramid Model determines the patterns of thinking, feeling, and acting that form a culture's mental programming and some international variables (cultural dimensions) which identify differences in mental programming: power distance, collectivism versus individualism, femininity versus masculinity, and so on.

Hofstede's cultural model has been used as a guideline in support of many studies. Marcus & Gould (2000), for instance, analyzed the preferences, needs, and expectations of different cultures based on the Hofstede's (1997) cross-cultural theory. They aimed at investigating how Hofstede's model might affect user interface designs. As a result they presented guidance for each of Hofstede's dimensions based on a theoretical analysis of websites. Doing so, their work was the first attempt to build a bridge from evaluations on Culturability (Barber & Badre, 1998) to their application in HCI design.

Zahedi & Pelt (2001) also developed a conceptual model based on the Hoftede's theories in communication, cultural studies, and information systems. It includes propositions to measure and to analyze how cultural and individual factors influence users' satisfaction, which will assist researchers, educators, and communicators working with various web designs. By combining Hofstede's cultural dimensions as a starting point, their model attempts to identify the influence of cultural and individual differences in the perceived effectiveness of and satisfaction with various web designs.

Over the years, however, many studies have criticized the cultural models approach. Smith & co-authors (2004) argued that there is a lack of explicit demonstration that such theories of culture (Hall, 1976; Hofstede, 1997) are actually applicable to, and significant within, website usability.

Fitzgerald in his concluding remarks indicated that cultural dimensions are mainly focused on description of different cultures rather than on prescription for

best website communication practices (Fitzgerald, 2004). Marsden & co-authors (2008) argue that it is not clear how this knowledge might be directly leveraged to create better technology.

Irani & Dourish (2009) suggested that Postcolonial Studies may offer richer frameworks for analysis than taxonomic models of culture such as the extensively used Hofstede's dimensions of cultural differences. They proposed an approach where non predictive boundaries are set in advance, instead it allows that relationships, technological objects, and knowledge practices of everyday life arise as contingent.

Another approach is Shen, Wooley & Prior's Culture-Centred Design perspective (CCD) (Shen *et al.*, 2006). According to the authors, the design process should be concentrated around the target user and his/her specific cultural conditions. For that to happen they propose two 'cultural filters': the designer's and the end user's filter. The CCD cultural filter should not to be seen as a tool, but as a reflective mental map between the designer's perception and the end user's perception. By respecting and understanding the user's cultural filter, a designer could improve the usability and help convey cultural identity.

More recently, Vatrapu (2010) presented the outline of a theory of cultural influences in socio-technical systems. In his approach, interacting with technologies is conceptualized as perception and appropriation of affordances, and interacting socially with others using technologies as structures and functions of technological intersubjectivity[7]. To the author, the integration of this theory in a methodological framework (Computer Informatics) with empirical findings of cultural variation in behavior (House *et al.*, 2004, Hofstede, 1997), communication (Hall, 1990) and cognition (Nisbett & Norenzayan, 2002) puts forward the following research question: to what extend does culture influence the perception and appropriation of affordances in computer supported intercultural collaboration, and the structures and functions of technological intersubjectivity?

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[7] "Technological intersubjectivity refers to a technology supported interactional social relationship between two or more actors" (Vatrapu, 2010, p.113).

3.2.1.2.
Elicitation by HCI Evaluation

In order to define which cultural issues should be considered in HCI design, some approaches propose methods and perspectives by adapting or using HCI evaluation techniques or methods.

3.2.1.2.1.
Cultural Usability

Usability Evaluation is the most popular method of eliciting localization requirements. The first attempts to change the design process proposed adaptations to usability evaluation procedures. In 1996 Nielsen argued that a "first method to improve international usability might be called international inspection" (del Gado, 1996, p. 3). It involves having preferably usability specialists from many countries evaluating the interface to say whether they think it would cause problems in their country. A variant of international inspection is the international user testing, which involves real users doing real tasks with a system without getting any help.

For del Gado (1996), usability goes beyond accommodating of requirements of localization and translation. The author proposed "questions that investigate the cultural metaphors, preferences, attitudes and impact of our products when they are introduced into cultures for which they were not specifically designed" (*ibid.*, p.84).

Barber and Badre (1998), after studies on hundreds of websites, developed a systematic cultural usability method to identify specific cultural markers originated by the culture or by the website gender or domain. Cultural markers are "interface design elements and features that are prevalent, and possibly preferred, within a particular cultural group" (*ibid.*, p.1). The detailed list of cultural markers corresponding to web design elements contains color, spatial organization, fonts, shapes, icons, metaphors, geography, language, flags, sounds, motion, preferences for text versus graphics, directionality of how language is written, help features, and navigation tools. They argued that cultural markers could be used for implementation of Culturability guidelines and that usability should be redefined

in terms of cultural context. Such guidelines would offer web and software designers specific information about the region and country for which they are developing an application.

Some studies investigated the usage of those specific cultural markers for website design. Kondratova & Goldfarb (2007), for instance, studied colors, font usage, number of images, and webpage layout in a number of countries. Others investigated how cultural markers affect website usability (Sheppard & Scholtz, 1999; Sun, 2001; Juric *et al.*, 2003).

Over the last two decades, however, cultural usability research primarily focused on the cultural dimensions developed by Hofstede presented in Section 3.2.1.1. Evaluations applying his cultural dimensions include studies by Marcus (2001a, 2001b); Dunn & Marinetti, 2002; Dormann & Chisalita, 2002; Ford & Gelderblom (2003).

Clemmensen (2009) has proposed a theory of cultural usability that builds on the concept of Cultural Models of Use. To the author, a new theory of cultural usability must explain how users with multicultural backgrounds interact with technology. The usability, i.e., effectiveness, efficiency and satisfaction of an interactive product, is always an outcome of the human application of cultural models of technology use. It can be understood as a folk theory of what it means to interact with the product in one or more contexts. In another sense, a particular folk theory may not be accessible, available or applicable to the target users and therefore leads to biased and useless usability measures.

3.2.1.2.2.
Other Approaches

Smith & co-authors (2004) developed the concept of a 'cultural fingerprint', which "can diagrammatically compare the cultural profile of a website (Site Fingerprint) with that of the target culture of an international usability project (Country or Culture Fingerprint)" (*ibid.*, p.65). This approach was created to provide an accessible means through which the cultural characteristics of a particular website can be discussed with clients who would be unfamiliar with theoretical cultural models.

They argue that the first step is to understand how successful local websites in the domain of interest or in related domains in a country/culture are built within, and for, that particular target culture or sub-culture. So, it is necessary to investigate the different signs in a local culture, their context of use, and the meanings that the locals attribute to them. So, an inspection would be carried out by a usability expert who belongs to that target culture or has a good understanding of that culture, either via first-hand personal experiences or through extended family or friends. The inspection aims at identifying the use of specific cultural attractors, i.e., the interface design elements of the website that reflect the signs and their meanings to match the expectations of the local culture. Such is the case of: colors, color combinations, banner adverts, trust signs, use of metaphor, language cues, currency formats, navigation controls and similar visual elements, which together create a 'look and feel' to match the cultural expectations of the users for that particular domain.

Smith & co-authors believe that reusable libraries of such sets of cultural attractors and their meanings would provide a set of useful building blocks for future commercial website localization projects.

Other approaches integrated with the observation and evaluation stages of Hartson & Hix's star model (Hartson & Hix, 1989) to cultural issues in HCI design have also been presented. The Meaning in Mediated Action (MMA) methodology proposed by Bourges-Waldegg & Scrivener (1998) is an "HCI cross-cultural design approach which focuses specifically on how representations and meaning mediate action" (*ibid.* p.307). The aim of the observation stage is to observe the user interaction with the system to identify how (culturally rooted) representations mediate the user's actions. The evaluation stage looks at the user's interpretation of the meaning of the representations and informs the designer with explanatory data on possible socio-cultural reasons.

Unlike Int-Loc approaches, which assume that it is possible to enhance the design of usable websites by evaluating differences between cultures (using models with specific dimensions), Bourges-Waldegg & Scrivener believe that interface elements and their meanings could be evaluated to make them comprehensible for all users of the target cultures.

The main difference between the works presented in this section and ours is that they support the stage of elicitation of cultural requirements centered on user. Our approach, in turn, aim at modeling cross-cultural intercultural contacts. We believe, however, that both approaches may be complementary, if their application considers cultural exchange as part of the design intent.

3.2.2.
Collaborative design across cultures

Some studies in HCI claim that Int-Loc projects should be conducted by merging the different viewpoint of stakeholders involved. Ito & Nakakoji's (1996) approach, for instance, views cross-cultural HCI design as cross-cultural collaborative work. Since the functionality of a system is unconsciously affected by the culture where the system is designed and there is no universal interface that can be applied to every culture, they suggested the following steps: understand the target culture and reflect the findings in the human-computer interaction design.

To them, collaborative work in internationalization and localization of a system between designers and users from different cultures takes place at design and interaction time. At design time, it happens when designers identify the requirements of the system. One approach to support this collaboration is to integrate design artifacts and to communicate ideas within a hypermedia environment to serve as a context to be shared. At interaction time, Ito & Nakakoji's work is in line with Winograd & Flores (1986), who view computer as communication media, so "interaction with computer implies asynchronous communication with people who designed and programmed the system" (Ito and Nakakoji, 1996, p. 122).

Yeo (1996) also proposes an approach which considers cross-cultural collaboration within a strategy to localize the software by creating a Cultural User Interface (CUI) for each of the target cultures. These different CUIs are developed collaboratively with the target cultures, thus problems associated with localization such as misinterpretation of elements in the CUIs, are unlikely to occur. The strategy for acquiring information of the target culture is to select experts of the target culture to actively participate in deciding which sort of elements will go into the CUI.

As a response to those works, Winschiers (2001) proposes a dialogical system design across cultural boundaries where designers and users may communicate with each other. She proposes a culture-driven framework to facilitate cross-cultural dialogue by merging the different viewpoints of the involved stakeholders.

Sengers & co-authors (2005) propose reflective design drawing on existing critical approaches in computing and arguing that reflection on unconscious values embedded in computing and the practices that it supports (by both designers and users) can and should be a core principle of technology design. Reflective design is a set of design principles and strategies that guide designers in rethinking dominant metaphors and values unconsciously left out and engaging users in the same critical practice. It supports both designers and users in ongoing critical reflection on technology and its relationship to human life. Reflection on the limitations of the HCI methods and metaphors can help designers and users to see the world in a new way, identifying and weighing new technical possibilities.

3.2.3.
Guidelines for HCI design

Recommendations and guidelines for HCI design have been the most prominent kind of contribution (Nielsen, 1990; Russo, 1993, Fernandes, 1995; del Gado, 1996; Marcus, 2001b; Aykin, 2005) of Int-Loc approaches. Delgado (1990) proposed some guidelines for HCI design for international use. The author described a selection of aspects in HCI affected by 'culture, language and local conventions'. This selection includes character sets, collating sequences, numeric formats, date formats, currency formats, icons and symbols, colors, and so on.

Russo (1993) presented a cross cultural checklist of issues including text, local formats, images, symbols, colors, flow, product functionality, and suggestions for an effective international product development cycle: to establish a relationship within the target market and conduct an international usability testing. Some authors recommend a multinational design team, collecting cultural information (cultural attitudes, practices, norms) that affects the product's overall model through storyboards, contextual inquiring, task analysis, etc.

Aykin (2005), more recently, confirm the usefulness of a list of topics and potential problem areas as the top layer of internationalization in any cross-cultural design. Such is the case of graphics and icons, language, data object formatting, color, and layout.

3.2.4.
Culturally adaptive software

Whereas some studies propose alternatives to eliciting cultural differences that should be taken into account in Int-Loc projects, User Modeling research argues that cultural adaptation of software reveals that the elusive nature of cultural background makes it hard to recognize one's own preferences and, thus, where the system should be adapted (Kobsa, 1993). According to the author, for adapting computer systems to the needs of different users, so-called "user models" are most often needed.

So, Reinecke & Bernstein (2007) promote the idea of moving beyond Internationalization by culturally adaptive software, which automatically adapts software to the user's cultural frame by combining insights from the related fields of international usability, user modeling, and user interface adaptation. According to the authors, it is a response to time-consuming and costs of international usability projects with manual localization.

Another approach discussed challenges of 'user interfaces for all' when there is a need for different designs for different levels of user experience. They argued that, when information needs to be made available to people with varying levels of background expertise in the task domain, a technique of User Modeling called audience-splitting is often used. "Audience-splitting is when you present an interface that is maximized for the use of a group of users with similar interests". The goal of an audience-splitting interface is to get people to the categories of information that interest them, as fast as possible. They can easily understand the information presented to others, but it is not the content that they are looking for. (Meiselwitz *et al.*, 2009)

Others propose an intelligent agent, which could learn from user behavior and modify the interfaces accordingly (O'Connell, 2000). Each of these

approaches has its strengths and weaknesses, but all emphasize the importance of heeding the needs of culturally diverse users.

3.3.
Work about the use of metaphors in HCI design

Because our work is about conceptual metaphors for organizing multi-cultural communication, from now on we present some related work about metaphors.

Over the years, the role of metaphors in HCI design is subject to some debate. Whereas some authors advise about the importance of interface metaphors (e.g. "Designers of systems should, where possible, use metaphors that the user will be familiar with." (Faulkner, 1998, p. 89)), others discuss their risks (e.g. "Analogy, used as literary metaphor, is effective for communicating complex concepts to novices. But analogy is dangerous when used for detailed reasoning about computer systems" (Halasz & Moran, 1982, p. 386).

Most of the HCI research on metaphors took place between the early eighties and the mid-nineties and was influenced by Lakoff & Johnson's (1980) theory of metaphor (see Chapter 2 for details). Much of this work aimed at facilitating the user's learning process (e.g. Carroll *et al.*, 1988; Erickson, 1990; Dieberger & Frank, 1998) and at describing certain styles of interfaces, such as the desktop metaphor (Johnson *et al.* 1989); and as a vehicle for representing and developing designs of interfaces (Erickson, 1990; Madsen, 1994). In these examples metaphors were either intended as interface metaphors or imagined to form part of designs.

Metaphors can also support the design process itself. Some design researchers view metaphor as a strategy (or a tool) for creative design. Schön (1983, 1993), for instance, describes the value of metaphor and analogy in helping all kinds of designers to see things in new ways, gaining new perspectives on the world. Moreover, Madsen (1994) and Mohnkern (1997) explicitly argue that the benefit of metaphors could go beyond users and be experienced also by system designers. Blackwell (2006, p. 493) adds that "the increasing understanding of HCI as a design discipline has led to recognition of the way that metaphor can function as a creative tool for design." The author also talks about metaphor as a

process of reification "by which an idea has become a design tool". Erickson (1990) sums up that metaphor is important for designing interfaces precisely because Lakoff & Johnson showed it to be so pervasive in thought.

In reviewing the HCI literature we also found out the work of Frøkjær & Hornbæk (2008) proposing a novel technique based on metaphors of human thinking to usability inspection. The authors argued that "metaphors are intended to stimulate critical thinking, generate insight, and break fixed conceptions" (*ibid.*, p.20:5). The technique builds on metaphoric descriptions of central aspects of human thinking—for example, habit, awareness, and associations based on the descriptions of human thinking made by James (1890) and Naur (1988, 1995, 2000, 2007).

HCI literature has made several distinctions between different types of metaphors in HCI. Neale & Carroll (1998) reported many classifications such as Hutchins' categorization (1986) in activity, interaction, and domain metaphors; Marcus's distinction (1995) in operational and organizational metaphors, and Heckel's (1991, 1994) in familiar and transporting metaphors.

Fineman (2004) inherited some of those classifications to explain that designers may use metaphors for three different purposes: familiarizing, transporting, and invention. Familiarizing metaphors make a product or interface easier to understand by creating correspondences with a more familiar domain (Heckel, 1991). "It helps the learning process, not the thinking process" (*ibid.*, p.499). Such is the case of the desktop metaphor (Johnson *et al.* 1989). Transporting metaphors allow users to view and solve problems in new ways by providing connections to many real world problems (Heckle, 1991). Such is the case of the path metaphor in web browsers, which "allows computer users to go back retracing their steps in web browsers" (Fineman, 2004, p. 5).

Invention metaphors (called generative metaphors[8] by Schön (1983)), in turn, help designers come up with ideas during the design process. These invention metaphors might never be explicitly understood by the user, and they are not intended to be. Whereas many conventional metaphors operate tacitly,

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[8] When the two things seen as similar are initially very different from one another, falling to what is usually considered different domains of experience, then seeing-as takes a form I call "generative metaphor". (Schön, 1983, p.183-184)

people explicitly invoke invention metaphors to help them see problems in new ways.

In the next chapter we present our conceptual metaphors. They may be classified as invention metaphors, since they have the potential to spark innovative features in design, helping HCI designers to reason about cultural communication and cultural information at different stages of design.

3.4.
Learned lessons

This section presents learned lessons after reviewing the HCI literature on cross-cultural HCI design. Research on cultural issues has typically focused on the internationalization and localization of software and on analyzing users and systems in order to tease out cultural differences that affect human-computer interaction among users with distinct backgrounds and heritage. Besides that, many studies were carried out to discuss the challenges in cross-cultural design.

Our work contributes directly to an old challenge discussed in the literature about the awareness of cross-cultural differences in cross-cultural design (see Section 3.1.2). Chapter 4 and 5 show how our work contributes to bring out the cultural biases of designers regarding application's domain and user, since the use of CVM increase designers' awareness of the effects of cross-cultural differences in HCI design.

Our research differs from those presented in Section 3.2.1 (cultural differences elicitation), because ours may use scientific and empirical knowledge as possible inputs. For instance, the identification of basic cultural variables for specific domains by modeling culture (as presented by Hoft (1996)) should generate the requirements for designing cross-cultural systems using our conceptual metaphors.

Regarding the gaps in the literature we have identified an important one regarding the work devoted to propose solutions to HCI design process: only the research focused on elicitation of cultural differences has some approaches based in theory. The Culture-Centred Design perspective (CCD) approach is based on Cultural models which is based on Intercultural Communication theory. The most

prominent kinds of contributions to HCI cross-cultural design are fragmented in recommendations and guidelines for Int-Loc projects.

Another gap in the literature regards the pervasive focus on the Int-Loc perspective. This approach leads HCI designers to decide whether to *design for all* (aiming to neutralize or minimize cultural differences) or to *design for each* (aiming to provide specialized interfaces for users from different cultures). One way or the other, the result is that the end users will probably not know that such cultural differences exist among the user population targeted by the cross-cultural system. The literature does not discuss nor propose solutions to increase visibility and awareness of cultural diversity.

Regarding the HCI challenges presented in Section 3.1, two of them indicate future work to this thesis. Firstly, studies regarding the adequacy of HCI methods and practices to cultural studies and cross-cultural HCI design (see Section 3.1.1), since our approach should be investigated in different cultures. Secondly, usability and communicability problems caused by the communicative strategies embedded in the interface language (see Section 3.1.2) are also something that should be investigated, since designers may choose among different communicative strategies with our approach.