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An overview of a decade of journal publications about Culture and Human-Computer Interaction (HCI)

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Abstract. In this paper, we analyze the concept of human-computer interaction in cultural and national contexts. Building and extending upon the framework for understanding research in usability and culture by Honold [3], we give an overview of publications in culture and HCI between 1998 and 2008, with a narrow focus on high-level journal publications only. The purpose is to review current practice in how cultural HCI issues are studied, and to analyse problems with the measures and interpretation of this studies. We find that Hofstede's cultural dimensions has been the dominating model of culture, participants have been picked because they could speak English, and most studies have been large scale quantitative studies. In order to balance this situation, we recommend that more researchers and practitioners do qualitative, empirical work studies.

Keywords: Cultural usability, Culture, Human-Computer Interaction, Literature review.

1. Introduction

During the recent years the interest in the correlation between culture aspects and Human-Computer-Interaction has grown significantly. Different terms are used in the HCI community to describe the phenomenon; started with Cultural Computing [8] to International Usability [6] and cross-cultural User Interfaces [1]. Many more terms are found. In this paper, we analyze the concept of usability in cultural and national contexts. Analyzing usability in a social, cultural and organization contexts is of increasing importance for connecting empirical work analysis and interaction design

(preface, this volume). As the context have changed from an industrial economy to a knowledge based internet economy, new trends in the development of information technology have emerged [7]. The globalization of the economy has changed the task for system developer of information technology products. Nowadays they have to consider more and more international user requirements and culture-influenced taboos or local application specifics. Therefore the interest on culturally related HCI topics and knowledge may possible have been increasing during the last decades, making it timely to do a review of the research. System developers and HCI Researchers are interested in knowing more about user specifics in other cultures, e.g. differences in navigation behaviour. They are also interested in knowing more about relevant differences in system design, e.g. icon design or colour coding, and any other HCI relevant characteristics influenced by the user culture.

1.1. Framework

Researchers and practitioners in the HCI Community are interested in the state of art in the field of culture and HCI. A first study about publications related to culture and HCI was published by Honold [3]. She looked at any kind of publication in the field of cross-cultural usability engineering up to 1998 and identified three main phases:

1. 1975-88: Classical ergonomic research is applied to non-Western countries
2. 1990-95: Practical solutions of UI-design for non-Western markets become a necessity
3. 1996-98: The need for a theoretical foundation of cross-cultural usability engineering is recognized

With this paper, we aim to continue Honold's work. We want to give an overview of publications in culture and HCI after 1998, with a narrow focus on journal publications only. Due to the emergent nature of the research topic, we would expect many publications about culture and HCI to be in conference proceedings, and not in the major journals. However, as Hornbæk ([4], p 81) stated: "journals might be more representative of carefully conducted and thoroughly reviewed studies". With our study we focus on journal papers. We give a general overview of 10 years of journal papers related to culture and HCI, analyze the characteristics of the papers published in journals and give some inspirations as how to publish the cultural usability papers in HCI journals. The purpose of this paper is to review current practice in how cultural HCI issues are studied, and to analyze problems with the measures and interpretation of these studies. Other objects of interest are the used approaches and models to plan data gathering and interpretation, and the way of data collection itself. This also includes the involved testers and participants in these studies and the focused topics and research questions. On that basis, we discuss quality aspects of the studies and challenges to improve the preparation and implementation of international usability studies.

Analyzing the studies in journals for culture and HCI has three motivations. First, we like to evaluate our own impression of an increase in number of publications in this field, and if possible, identify the development trend of phases or topics. Second, most text books describe western-oriented method to measure usability and to analyse user requirements. We like to find out what kind of methods researchers use in the

context of international usability research. For example, are ethnographic methods preferred, or is standard usability methods the researchers' preferred choice? Here we are looking for the criteria that determine what to apply and what to avoid regarding the use of specific methods. Third, we are interested in an overview of the used models and approaches in this field. Hofstede's Cultural Dimensions [2] appears to be a dominant model for explanation cultural influence on websites, and for the categorization of a user culture [6]. But there are also other interesting approaches in the HCI community with a relevance to this topic of culture (e.g. activity theory).

The present paper reviews current practice in conducting international usability studies, and gives a high quality basis to discuss how to realize international studies. Part 2 presents the hypothesis of our analysis and method used for reviewing a selection of studies from high-quality HCI journals. Part 3 summarizes and discusses the analyzed data. Part 4 discusses and concludes on the challenges identified.

1.2. Hypotheses

Before we started the analysis of journal paper we defined a framework and a number of hypotheses in order to do a structured analysis. The framework consisted of a matrix with journal papers as rows and common literature review topics inspired by the work by Honold [3] as the columns. To define the final hypothesis we carried out several workshop-meetings. These workshop-meetings started with brain storming about the general field of Culture and HCI and interesting research topics. The workshops were finalized in iterative loops of relevant questions for the HCI Community from a 'state of art' perspective with the general question: what can we learn from the published studies for our future work in this field? As result of all the discussions we formulated the following 10 hypotheses for the paper analysis.

1. The number of publications should be higher during the last 5 years. The HCI community has noticed the relevance of the topic and the sub-community for this topic grow up during the last five years.
2. There are more quantitative than qualitative studies. In the context of international studies it is easier to realize a quantitative data gathering. For qualitative methods local experts are needed, and this increase the costs of a study.
3. Most studies use foreign students to get information about cultural specifics. To realize an international usability study a good budget is needed to hire local experts, pay for participants and pay travel expenses. Most studies are realized in a university context (e.g. PhD work or Master thesis) and have only a very limited budget. Therefore foreign students participate on these studies and used as representatives of their culture.
4. Hofstede's cultural dimension framework is the only cultural model used. Over many years researchers have been using the Hofstede model to explain and predict cultural differences. With more knowledge about culture and HCI in the last years

the number of models of culture that have been used in research should however increase.

5. There are more empirical (experimental/field studies) than there are conceptual papers published. The work in this research field has just started. To start with defining concepts, empirical data, and in particular field data, are needed.
6. Most studies focus on the Asian market. The Asian market has become more interesting for industry and business during the last years. However, while the cultural differences between US/ Europe and Asia are non discussable, HCI people know less about the user requirements in Asia.
7. There are more cross-cultural than cultural studies. To explain the differences in user cultures it is easier to compare cultures; often in comparison to one's own culture.
8. Test material is localized. To get better information, especially in the context of a user requirement analysis, the studies use local moderator and/or local test material.
9. Most studies use country as a cultural variable. Countries are seemingly the way to separate between cultures because they exist already as official separations. Sub-cultural and regional specialties, especially in big countries, are often ignored.
10. All relevant HCI journals have published articles about Culture and HCI. This topic is highly relevant and therefore all journals should be publishing something from this field.

These hypotheses guided our analysis of the selected journal papers. Next is a description of the method for analysis. It describes the criteria for the paper selection and the collected information from the papers.

2. Method

The aim of the present study is to categorize and analyze the HCI papers related to culture and usability or design that have been published within the last 10 years in major HCI journals. Culture here means country boundaries, language, cultural conventions, race and religious, not including the papers about organizational culture or other group cultures, such as different virtual environments or customer groups. We used meta-analysis to analyze the papers. Meta-analysis is a commonly employed systematic reviewing strategy for addressing research or scientific questions [9]. It includes any methodology for combining information across sources. Nowadays, meta-analysis has become the most commonly used quantitative method in the social and behavioural sciences [5, p 741]. Meta-analysis can be used as a statistical literature synthesis method that combines and analyzes the results of several studies

and investigates a set of related research issues [5]. It is a “rigorous alternative to qualitative and narrative literature reviews” [5, p 741].

2.1. Selection of studies

This study focuses on analyzing journal publications of the last 10 years related to culture and HCI. There were four main criteria used when selecting the papers.

1. Cross-cultural studies or studies of HCI in a specific culture;
2. All the papers are related to the HCI area, but limited to methodologies and processes for designing interfaces, such as usability, interface design and evaluation methods, excluding the studies which only focussed on using the general concept of computers or products to measure or investigate people’s personality, attitudes, or feelings towards something or some social issues;
3. The papers in this study are all full journal papers, not editorials published in journals, and not conference papers.
4. As long as the paper accords with the requirements which are related to culture and HCI issues described above, it will be included, no matter if it is an empirical or a theoretical paper or a literature review. Hence, the set papers in this study do not only include empirical studies of experimental or field studies, but also include theoretical studies which discussing cultural issues in HCI area.

We selected 9 major HCI journals from 1998 to 2007. Two of them (“Human-Computer Interaction” and “Transaction on HCI”) were not found any paper relevant with culture and HCI issues described above. Hence, 7 journals are included in this study finally. In total we found 27 papers in these journals that matched our criteria, see the appendix for references to the selected papers.

2.2. Data collection from each selected paper

For each paper, we collected information about the cultural issues, methodology and HCI issues. We recorded the following information about each paper:

1. The type of the study (theoretical, experimental or field study paper);
2. Techniques used in the study (such as interview, questionnaire, observation, usability testing);
3. The studied design method or development process (such as thinking aloud usability test, interview, or some new design techniques or design/ development process);
4. Research approach (quantitative or qualitative);
5. Interface design issues (such as structure, icon design, etc);
6. Application area/work domain/business area (such as medical, education, entertainment, etc);
7. Approach to culture (cross-cultural study or a specific cultural study) and whether the study cares about user subgroups in the country/cultural setting;
8. Country(ies) of focus for the study;
9. Local test setting (including whether using local moderator, local language, etc);

10. Used models for study/ paper (such as whether using Hofstede's cultural model or some other research models);

11. Number of participants, using students as participants or not, and what the paper is about.

Three researchers with expertise in the field of culture and HCI (the authors and a PhD student) read the papers and filled in the information to Excel spreadsheet. When we finished the recording of all the studies according to the categories, we discussed the information, and got the overview of all the papers. We examined each category and tried to get the trends of the information in each category and in the relations between the categories.

3. Result section

In this section, we present the results that are relevant for answering each of our ten hypotheses.

3.1. Papers and topics

If the HCI community has noticed the relevance of the topic and the sub-community for this topic has grown up during the last five years, we would expect more papers to be published recently. The trend in publications can best be characterized by pointing to the peaks in number of publications coming from special issues culture in 2004 (IwC) and 2006 (IwC), Figure 1. The figure shows that there is small, but continuous stream of cultural usability HCI journal papers published during the recent 10 years.

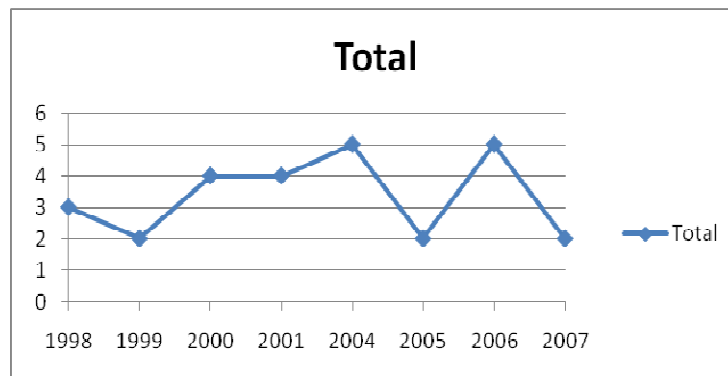


Figure 1. H1: The number of publications has been higher during the last 5 years

3.2. Participants and research type

In the context of international studies it seems easier to realize a quantitative data gathering, but on average the number of participants in the studies was higher than

would be expected had the studies been qualitative studies, Figure 2. Of the 27 studies, 20 reported doing quantitative research, while 5 reported doing qualitative research. A possible explanation is that for qualitative methods local experts are needed and this increases the costs of a study.

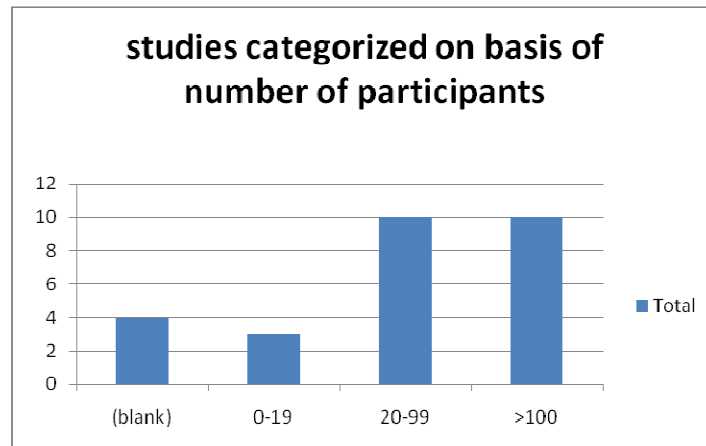


Figure 2. H2: There are more quantitative than qualitative studies published

3.3. Characteristics of participants

As is common in quantitative research, the participants were mostly university students, Table 1, though there were notable exceptions such as the study 2001 study with 324 'typical computer users'. In more than 60% of the studies with human participants, these were students.

Table 1. H3: Most studies use foreign students to get information about cultural specifics

<i>Studies</i>	<i>Total</i>
Did not mention where to find the participants	5
n/a (studies with no participants)	4
Not students	4
Students	14
Grand Total	27

3.4. Models and Method/technique use

More than 50% of the studies used questionnaires. Interview and observations were each used in 20% of the studies and think aloud usability testing in 10% of the studies. The preference towards questionnaires was probably not due to use of a specific theory of culture; e.g. only 3 of the 14 questionnaire studies used Hofstede's culture theory. Hofstede's theory was used by 7 of the 27 studies. Other models were

used in different studies, Table 2. So even if over many years researchers have been using the Hofstede model to explain and predict cultural differences, it is clear that also other models have been used. It remains a problem that a large proportion of the studies did not use any model at all.

Table 2. H4: Hofstede is the only cultural model

	<i>Hofstede</i>	<i>Other models</i>	<i>No models</i>
Studies	9	6	12

3.5. Research approach

The work in this research field has just started, and we expected that most research would be field study type of research, e.g. ethnographies, in order to explore which concepts are relevant for the emerging area of culture and HCI. However, cultural usability is an experimental science judged from the 2/3 (19 of 27) of the studies that are experimental, while only 1/6 (4 of 27) of the studies are field studies, Table 3. This is surprising in a science studying culture. The four field studies took place in Botswana (1), China (1) and India (2).

Table 3. H5: There are more experimental than conceptual papers

<i>Year</i>	<i>Theoretical papers</i>	<i>Experiment papers</i>	<i>Field study papers</i>
1998	1	2	-
1999	-	2	-
2000	1	2	1
2001	1	2	1
2003	-	-	-
2004	1	2	2
2005	-	2	-
2006	-	5	-
2007	-	2	-
Total	4	19	4

3.6. Country in focus of study

The Asian market has become more interesting for the industry during the last years. The cultural differences between US/ Europe and Asia are non discussable. But HCI people know less about the user requirements in Asia. Studies of cultural usability focus on relatively few different countries, with China (32%) or US (33%) as the anchor country in most of the studies (China and US together 54%, 11% are combined US/China studies), Table 4, which also shows that 67% of the studies focused on countries with English as official language.

Table 4. H6: Most studies will focus on the Asian market

<i>Country(ies) of focus for study</i>	<i>Grand Total</i>
Botswana	1
China	3

China (Hong Kong)	2
China, China (Taiwan) & India	1
India	3
Korea, Japan and Finland	1
Netherlands & Turkey	1
United Kingdom	2
US & Bulgaria	1
US & China	3
US & Sweden	1
US & Thailand	1
US & Turkey	1
US, Japan & Sri Lanka	1
US, United Kingdom & Hong Kong	1
(blank)	4
Total	27

3.7. Cross cultural or mono cultural study?

Most of the studies are cross-cultural. Questionnaires are used most frequent in cross cultural studies. When categorizing studies as cultural, i.e. the purpose of the study is cultural specific/all users are from same context, or cross-cultural, i.e. the purpose of the study is to compare different cultures/users from different contexts, a good case to discuss is the study by Shen (2006) about the road towards culture-centred design. This study aims specifically to develop a metaphor for one culture, but does evaluate this one culture metaphor by cross cultural comparison. Does this make the study mono or cross cultural? To explain the differences in user cultures it is easier to compare cultures; often in comparison to the own culture. In 1/3 (9 of 27) of the studies had as their topic the cultural (the purpose of the study is cultural specific/all users are from same context) while 2/3 (18 of 27) had as their topic the cross-cultural (the purpose of the study is to compare different cultures/users from different contexts).

Table 5. H7: There are more cross-cultural than cultural studies

<i>Count of papers main topic</i>	<i>cultural</i>	<i>cross-cultural</i>	<i>total</i>
Interview	2	2	4
Think aloud usability test	2	1	3
Usability test	2	6	8
Questionnaire	4	9	13
Observation	2	3	5
Association test	2		2
Break down analysis		2	2
Heuristic evaluation	1		1
Reading time, preferences	1		1
Review of ten books		1	1
Survey	1		1
Grand Total	17	24	41

3.8. Language of study

To get better information, especially in the context of a user requirement analysis, the studies could be expected to use local moderator and/or local test material. However, local moderators are used in only one third of the studies. This could be due to that most of the studies take place in English speaking countries, and that most of the researchers were English speaking. Other possible explanations for the no-use of local moderators could be that the researchers use students with foreign background as test participants, or that the researcher is multilingual and able to speak the language of the locals. More probable, however, is that the test participants are selected partly because they are able to speak English, since less than one third of the studies, distributed across countries and years, report that the test participants were allowed to use their local language.

Table 6. H8: Test material is localized

<i>Country(ies) in focus for the study (27 studies)</i>	<i>Local moderator/evaluator/test leader is used?</i>		<i>Local language used in the study?</i>			<i>Local material used in the study?</i>	
	Yes	No	Partly	Yes	No	Yes	No
English official language in all the countries:							
Botswana	1				1		1
China (Hong Kong)	2			2			2
India	3		1		2		3
United Kingdom		1			1		1
US, UK & Hong Kong		1			1		1
English official language in one of the countries:							
United Kingdom		1			1		1
US & Bulgaria		1			1	1	
US & China	1	2		2	1	1	2
US & Sweden		1			1		1
US & Thailand		1		1		1	
US & Turkey	1				1		1
US, Japan & Sri Lanka		1	1				1
China, Taiwan & India		1			1		1
Other official language in all the countries:							
China	2	1		1	2		3
Korea, Japan and Finland	1			1			1
Netherlands & Turkey		1			1	1	
(blank) & (blank)		4			4		4
Grand Total	11	16	2	7	18	4	23

Besides the oral communication, other communication could also be done in local language. For example, was the software in English or local language? In few of the studies, the test participants were instructed in local language or the test material (e.g.

software) was in local language, Table 6. The language of the study is a complicated issue. How to prepare and report an ideal localized test? For example, with online surveys, we believe that it is important that the paper report the country in which the respondents are residing - this is not always the case with the papers that we reviewed.

3.9. Test participants' cultural subgroup

Countries are the easiest way to separate between cultures because they are existing official separations. Sub-cultural and regional speciality, in particular in big countries seems to be ignored. Most studies used national groups as cultural groups,

Table 7.

Table 7. H9: Studies using Country as cultural Dimensions

<i>Country(ies) of focus for study</i>	<i>Did the study care about user subgroups in the country/cultural setting</i>		<i>Total</i>
	<i>Yes</i>	<i>No (blank)</i>	
Botswana	1		1
China	1	2	3
China (Hong Kong)	1	1	2
China, China (Taiwan) & India		1	1
India		3	3
Korea, Japan and Finland		1	1
Netherlands & Turkey		1	1
United Kingdom	1	1	2
US & Bulgaria		1	1
US & China	1	2	3
US & Sweden		1	1
US & Thailand		1	1
US & Turkey		1	1
US, Japan & Sri Lanka		1	1
US, United Kingdom & Hong Kong		1	1
(blank)		4	4
Total	5	22	27

3.10. Publication outlets

This topic is highly relevant and therefore all journals should be publishing something from this field. However, two major journals have not published any papers on this topic, while IwC seems to be a candidate to the prize of most publishing journal on HCI and culture, Table 8.

Table 8. H10: Relevant HCI journals have published articles about Culture and HCI

<i>Journal name (official abbreviation)</i>	<i>Total</i>
B&IT	2
Computers in Human Behavior	2
IJHCS	2
IJIE	1
IJoHCI	4
IJoHCS	1
IJoIE	2
IwC	12
Journal of usability studies	1
ToCHI	0
HCI	0

4. Discussion and Conclusion

The three most important findings of this study were:

1. Hofstede was the dominating model of culture; however most papers did not have any model of culture, just used the word culture.
2. Most of studies were quantitative studies with more than 20 participants.
3. In most of the studies, a major consideration in the choice of participants was if they could speak English.

Table 9. Four periods in Culture and HCI research

1998-2000: Overall culture-HCI frameworks		
	culture as meaning of representation	3
	culture as globalization fo software	2
	national cultural differences	3
	culture as (english) language	1
2001 - 2002: Display design		
	Local symbols and icons	2
	Current phrases in menus	1
	Color association	1
2003-2006: Effect of culture		
	individuals culturally linked reactions to applications	4
	behaviour and attitudes of participants from idfferent culturles in tests	2
	cultural influence on design process abstractions	1
	reliagion and IT	1
	cultural and CSCW	1
	culture and ecommerce	1
2006-2007: Localised interfaces		
	mobile data services	1
	affective avatars	1
	CMC	1
	Other	1
Total		27

We have organized the 27 papers chronologically and labelled themes or periods in time in Table 9. The first theme from 1998-2000 is ‘frameworks for understanding culture’ with 9 papers. The second theme occurring in 2001 is ‘display design’ with 4 papers. The third theme from 2003-2006 is ‘effect of culture’ with 10 papers, and finally the fourth theme from 2006-2007 is ‘localized interfaces’ with 4 papers.

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Appendix – The 27 papers included in the review

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