Proceedings

INDO – DANISH

HUMAN – COMPUTER INTERACTION (HCI)
RESEARCH SYMPOSIUM
Cross Cultural Issues in HCI

Edited by

Pradeep Yammiyavar & Torkil Clemmensen

14th & 15th May 2006.

Indian Institute of Technology Guwahati , Assam India.

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Apart from these 26 peer reviewed papers, 8 poster papers presented by students of Design with keen investigative interest in HCI & Interaction Design have also been accepted, taking the total number of papers in the symposium to 32. The total number of authors is 56. The authors have backgrounds of Engineering Psychology, Computer Science, Sociology, Information Technology, Interaction Design, Business Management, and Human Computer Interface design. This makes the Symposium a truly interdisciplinary event in content, spirit and outcome.

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Pradeep Yammiyavar and Torkil Clemmensen
Editors.

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THE KEY NOTE SPEAKER

Torkil Clemmensen has a background in psychology and a PhD in man-machine interaction from Dept of Psychology, University of Copenhagen. He has previously worked as a practicing social-clinical psychologist and established a social skills training program for people diagnosed with schizophrenia. His research has since 1990 focused on cooperation in small teams in safety critical and business domains, and on professional knowledge of usability. His focus is on methods and techniques for pre-investigation, analysis, design, testing and evaluation of human-computer interfaces, cultural-cognitive perspectives on user representations including online communities. He is currently Associate Professor at Copenhagen Business School's Department of Informatics.

He holds membership of professional associations in Psychology, HCI, SIGCHI-DK, and is a co- founder of IFIP. He has published widely and is a reviewer on the editorial boards for IRIS, CHI etc. Dr Torkil Clemmensen is the Chief project coordinator of the Cultural Usability Project supported by Danish Councils for Independent Research (DCIR)

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KEYNOTE ADDRESS

Cultural Usability: Cultural models in psychological Usability Evaluation Methods (UEMs)

Torkil Clemmensen

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Abstract

Cultural models in terms of the characteristics and content of folk theories and folk psychology have been important to social scientists for centuries. From Wilhelm Wundt's Volker psychology to the distributed and situated cognition theorists in the global world of today, thinkers have seen human action as being controlled by cultural models. The study of cultural models for humans interacting with computers should therefore obviously be at the heart of the scientific study of human-computer interaction (HCI). In this speech, I present the concept of cultural models, what they are, how they are related to HCI and how they can be used to do research in UEMs. I present the tentative findings from two pilot studies of the use of the think aloud usability testing method in Copenhagen and Guwahati. The aim of the speech is to take a step towards a tentative cultural model framework for research into cultural usability.

Keywords: Cultural models, HCI, Cultural Usability, UEM.

Use, User, Usability: Bounded rationality perspectives in cross cultural framework

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Abstract

User determines the usability and use of a product in a limited information scenario. The user itself has been understood in a limited intellectual, emotional and socio-cultural context. The logical and the intuitive interplay within the individual in it's socio-cultural setting creates shades of interpretations of the stimuli from outside, within a range of 'reality' coloured by emotional states. This paper proposes a framework for the HCI professional to determine the mutual relationship of use, user and usability in bounded rationality perspective in cross cultural framework.

Keywords: Bounded rationality, Usefulness, Utility, User, Cross-cultural framework. Useability

Language issues in cross cultural usability testing: a pilot study in China

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Abstract

In this paper we report one field experiment on the effect of language issue (Chinese vs. English), and the effect of power distance between evaluator and user on usability testing process of a localized clipart application, 12 participants from China, Swede, and Denmark formed 7 pairs of evaluator-test user. Test users were asked to design a wedding invitation for him/herself with a cultural clipart organizer, which was developed by researcher themselves. Evaluators were asked to conduct the whole usability test, and try to find usability problems. All the participants' conversation, behavior, and screen operation were recorded by behavior observation system with digital camcorders, and coded. Results showed that Speaking Chinese made evaluator giving more help, telling more introductions in detail, and encouraging users more frequently; Speaking English asked evaluator and user look at each other more often to make themselves understood, and evaluators paid more attention to check task list. Power distance also had effect on evaluators and users. When evaluator's title were higher than users, the evaluator would pay more attention to users' doing, would not like to give user more detailed instruction, usually loose more communication with user, and spent less time for task management. In contrast, talking to evaluators with higher rank, users tend to use more gesture to express

themselves. The paper ended with a discussion of why users were not affected by speaking different language, and did user really think aloud, not only describe their screen operation aloud during the test session?

Differences in task descriptions in the think aloud test - a proposal for a small scale research experiment.

Lene Nielsen
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Abstract

When looking through the literature of user testing there seems to be at least two different ways that recommendations for the test scenarios are described. One type favors descriptions of tasks where another favors identification with a user and specific situation. This research proposal suggests studying the implications of the differences in procedures. Does it have an impact on the test results if you use one or the other of the two? Are there differences in who prefers one or the other? If differences exist, can these be explained with theories of cultural differences?

Introduction

The literature that deals with the practical implication of the think aloud test describes the test set-up, but has limited descriptions of how the tests are to be implemented in detail. Looking through literature that introduces the methods to students (Jordan, 1999; Molich, 2001; Nielsen, 2000; Nielsen & Mack, 1994; Preece, Rogers, & Sharp, 2002; Preece et al., 1994; Rose & Sørensen, 2004; Rosson & Carroll, 2002; Shneiderman & Plaisant, 2005; Snitker, 2004) of guides for usability testing it was only possible to find three thorough descriptions of how to perform the test that included task descriptions while (Snitker, 2004) briefly mentions the demands to the written tasks. He mentions how to use the test person's imagination, but not a specific situation, a task description could start with "imagine you are to borrow a certain book" (pp. 104).

Emphasis on non-verbal cues for interpreting cognitive processes in protocol analysis

Pradeep Yammiyavar Kirti Meera Goel

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Abstract

The 'think-aloud' technique is being employed extensively by usability labs towards performing usability testing of software products. In this paper, we examine its limitations in analysing the cognitive process of the user, if it is applied classically. We shall discuss the classical model of Ericsson and Simon and indicate how recent studies have found its application inadequate in usability testing. In this paper, we posit that the inadequacy can be partially overcome by accompanying the analysis of verbal protocols with semantic interpretations of non-verbal (kinesthetic) cues of the user, produced while performing the task. The gestures, body language and facial expressions, which comprise the kinesthetic cues, of the user are natural and accompany the communication independently. Although verbal protocols give an account of the user's cognitive processes overtly, here we argue that the subtleties of the cognitive processes can be interpreted through the semantics of kinesthetic cues.

A proposal for a repertory-grid study of differences in Chinese, Danish, and Indian conceptions of usability: Cultural usability?

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Abstract

This is an unrefined proposal for a study that could form part of the exploratory phase of the Cultural Usability project. The proposed study compares three cultures (Chinese, Danish, and Indian) and two stakeholder groups (users and developers) with respect to their conceptions of usability.

Is a smile really a smile anywhere in the world? (Measuring user pleasure)

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Abstract

In the search for product and service discriminators, our notion of usability may have to expand beyond user performance to include user pleasure. However, measurement of user pleasure as part of a usability test is

not yet standard practice. This paper reviews various approaches to measuring user pleasure, the problems associated with putting the measures into a usability test paradigm, and the new technologies that make some of them more feasible today for wider use.

Cross-cultural Usability Issues of Bilingual (Hindi and English) Mobile Phones

Dr. Dinesh S. Katre

Abstract

Variety of information services like Short Message Services (SMS), e-mail, news, market reports, educational applications and other reading materials are now available on mobile phones. The size of the mobile phone and its size is shrinking day-by-day, whereas the volume of information content and services are growing. More importantly, mobile phones introduced in the Indian market have now become bilingual; they support various services in English and Hindi languages. Mobile manufacturers have consciously or unconsciously resorted to English oriented approaches, and as a result of this, they have diluted the culture specific rules and the original for of Hindi language. Therefore to restore the original characteristics of Hindi in mobile phones, it has become inevitable to study the cross-cultural usability issues between Hindi and English. This study involves consideration of various aspects like keypad design, mapping of Devanagari alphabets, text entry techniques, rendering of fonts, paralinguistic features, legibility, layout and pagination, navigation through text, grammatical structure of textual content, translation of user interface and reading comprehension. We have studied the application of Hindi in 4 bilingual (Hindi and English) mobile phones manufactured by different companies like Nokia / Reliance 3105 CDMA, LgRD5120, Motorola C118 and Samsung / Reliance C200. Ten linguistic usability heuristics have been identified and applied for revealing several linguistic

usability problem and cross-cultural issues in mobile phones. Our study provides sufficient reason for standardization of keypad layout, Devanagari alphabetical rendering, and Hindi translation of English technical terms used in mobile phones. This position paper provides the basis fro enhancing the usability of Hindi application in mobile phones.

Culture Vs Usability in Enterprise Applications

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Abstract

This paper explores how cultural issues are address in current Oracle Web Applications. Oracle web applications are translated in 32 languages and sold in many countries. Interaction issues related to Color, images, text and organization of design elements are addressed carefully in Oracle Applications in terms of Internationalization and localization.

Designing e-Learning that Bridges the Digital Divide: *A Case Study of Training Automotive Service Personnel Through eLearning*

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Learning Designer, Trina Systems

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Abstract

Established definitions of Human Computer Interaction get challenged when it comes to using information and communication technologies to reach people situated on the other side of the digital divide. As an example, while eLearning is a powerful new way to teach people who are computer literate, can it be effectively leveraged to scale up training and teach people who are not yet computer literate?

A large Indian automotive conglomerate was faced with the challenge of rapidly upgrading the service skills of its vast workforce across different geographies. To facilitate this, eLearning was proposed as a solution. However, to enable the transition from the traditional modes of learning to eLearning, it was necessary to:

1. Build interactive courseware that was easy to use even for the computer illiterate
2. Design learning that fitted seamlessly with the complex and ever changing performance needs of the workplace

To achieve these objectives, extensive user testing and contextual analysis was conducted to arrive at a solution definition. Enabling learning also involved planning the changes required in the contexts of use and models of learning besides developing courseware.

The results of this user testing and contextual analysis validated many assumptions while providing new insights on the nature of Human Computer Interaction design that will work in such scenarios. The validated assumptions and insights led to:

1. Design of an instructional method
2. Design of the Human Computer Interaction patterns
3. Defining the eLearning technology framework

The courseware was field tested (after design and development) to elicit learner feedback and enable further refinement.

This paper shares our experiences and the methodology adopted in designing a product that is sensitive to the culture and contexts in which individuals work, learn, share, think and behave, thus bridging the digital divide. It also shares insights on the potential of technology mediated learning to empower access to information and knowledge across hierarchies.

Validity of Usability Evaluation Methods in a Cultural Perspective

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Kurt Walecki

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Abstract

This paper presents the problem that widely used usability evaluation methods are not necessarily valid and that the degree of their validity may differ dependent on culture. Furthermore, the paper proposes a way to investigate the validity of usability evaluation methods in a cultural perspective. The investigation method suggested is meant as a framework to be discussed and elaborated.

A culturally sensitive exploration of Icons & symbols in Danish & Indian cultures

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Abstract

Symbols and icons play a significant role in the formation of Culture. Humans interact with symbols and icons to express, propagate and signify the culture which in turn becomes an identity for that group of people. Designers whether graphic design or in HCI have a tendency to use Symbols and Icons more for their functional and aesthetic roles rather than for any thing else. However Symbols and Icons are emotionally loaded as well as Culture sensitive. In this paper the author intends to explore every day symbols such as National flags, Birds, Anthems for their historical and emotional significance. The author takes the example of the emotions surrounding 'Love' and explores it in the Indian and Danish context to bring out the commonalities and differences. The author argues for greater cultural sensitivity on the part of a Designer with respect to the use of icons and symbols and pleads for cultural icons to be used intelligently and not merely for the limited purpose of hedonistic commerce. If 'culture' stands for the practices of producing meaning, making sense of the world, sharing values and engaging in everyday life, studying these practices might involve questions of representation, identity and power – and lead us to probe the boundaries of society, politics and ontology. If 'usability', on the other hand, is about human perception, memory and cognitive mappings, specifically relating to human-computer interfaces, research into these issues focuses on clearly defined pragmatic and functional considerations of technological design. Understanding Symbols and Icons in their Cultural context will aid there better Usability in HCI.

Social Computing: Experiences from Rural India

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Abstract

Social computing refers to the application of technology as a mediator of social interaction and collaboration. Interplay between the individual social behavior and their interactions with computer technologies are a part of the Social Computing process. Efforts and projects are under way to popularize Social Computing in rural areas because of the belief in the transformative potential of the technologies. This paper is an attempt to explore the possibilities of Social Computing in the rural areas. Do the rural people have the social capital to harness these technologies to serve their development goals? It is argued that while the debate about insertion and enhancing potential of the social computing into rural settings is substantial, its transformative power with respect to the lives of the common people is overestimated.The paper highlights some of the developmental strategies and initiatives to promote e-governance in Belandur Gram Panchayat in Karnataka state of Indian subcontinent. Belandur Gram Panchayat is the first village in the country to introduce computers at village level governance. This paper seeks to explore the theories, practice and the praxis of the social computing by discussing the experiences of Belandur Gram Panchayat.

Keywords: Information and Communication Technology, Social Computing, Belandur Gram Panchayat..

Conflicts in adopting to E-Services in rural India- A Study of Cultural Issues

Pradeep G. Yammiyavar
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Rajinder Arora
Vikas Vaishnav

Abstract

In this paper we address the cultural issues surrounding the use of metaphors that arise due to the implementation of Information and Communication Technology (ICT) in rural India. We argue that there is an emerging need to look into the doctrine behind the metaphors being used based on the Indian village culture and their habits. In other words one needs to identify some of the issues that might be pertinent to the design of better ICT products such as e-governance, e-choupal, e-seva and e-learning programs launched for the villages of India, keeping in mind the cultural integrity and aspects.

We illustrate this point by investigating the different consequences of the current designs introduced via some of the methods in villages, in the existing scenario. We review current theoretical and empirical works that are used in Indian villages and their foreseen effects on village life and culture.

A survey of Indian villages viz *Bellendur, Baramati* which are having an established ICT base was conducted. Along side, pilot study of a local village named Amingaon was done. Analysis of the survey revealed that there is a cultural feedback in the user's behavior and the significance of interface is rooted in local contexts. On the basis of analysis of survey results we propose a structured model describing guidelines that will help design, create and evaluate better output by ICT projects for cultural use.

This demonstrates that interface designers not only need to look into heuristics and translating aesthetically related issues but also deeper cultural understandings, perceptions and beliefs of their target audience. Consideration of regional specific cognitions must be taken so as not to lose customers by alienating them and having adverse effects on the cultural habits. It is hypothised that this paper should enable international designers to understand how metaphors are embedded within cultural and social backgrounds and also partially understand the complexities of local consumer behavior.

Keywords: Metaphors, Cognition, ICT, Heuristics.

An interface to aid rural health workers in diagnosing cataracts

Pradeep Yammiyavar, Satyendra Nainwal, Shaiz Kunhimohammed
Department of Design,
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Abstract

This paper describes the design and development of an interface for a handheld device that aids rural health workers in diagnosing and identifying the maturity of a cataract through an external visual inspection and comparison of the eye with stored images on the device. The design of the interface is driven by the geographical, social and cultural contexts that influence the work of the rural health workers in India.

We describe in this paper the challenges associated with such a diagnosis by semi educated rural health workers and illustrate how a consideration of the local culture and design innovations incorporated in the interface can aid them in making an informed decision about the maturity of the cataract and the status of the post operative care required, thus saving the patient – usually senior citizens- precious time, trouble and money by obviating the need to travel from remote villages to far away eye hospitals.

Keywords: User Interface Design, Cultural and Social cues in User Interfaces, Rural Health, Handheld devices, visual assistance in decision making.

Embedding complementarity in HCI methods

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Abstract

Differences in cultural contexts constitute differences in cognition and research has shown that different cultures may use different cognitive tools for perception and reasoning. The cultural embeddings are significant in relation to HCI, because the cultural context is also embedded in the methodological framework, and in the techniques and the tools that we apply. But we lack a framework for discussing what and who we are, when we talk about what and who of a person as a user of an ICT system that has to be designed, developed and implemented. We need complex and rich descriptions. We need to reflect critically upon our own frame for understanding and this requires critical reflections upon the forty years dominated by a rationalistic empirical understanding of the user as expressed in the literature and practice within the HCI paradigm in system development. As an initial step HCI needs to take up the research challenge which lies in conceptualizing and representing complexity and we suggest the theory of complementary positions.

Culture specific solutions for dealing with waiting time on computer applications

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Abstract

Time is a precious resource and computer time is an even more expensive resource. Waiting time is like friction which must be overcome to get any process done. Waiting is almost imperative with various computer products and systems and the user is often found to be at the waiting end of a rotating sand clock or a progress bar. Users may get irritated and restless, with repetitive interruption in work due to response times, leading to lowered work efficiency.

On the other end it may also cost potential business to a service provider, with users balking away due to excessive waiting times. For any process, waiting times can be reduced with better and more efficient systems but it would be economically futile to work towards bringing waiting time down to zero. Due consideration to the psyche of the waiting user, can lead to a better user experience and development of more productive applications. It may also provide with a good opportunity to involve the user with desirable activities.

An understanding of how people of different cultural orientations deal with waiting as an activity, and respond to it, can provide solutions to HCI(Human Computer Interface) designers to come up with culture-specific solutions, ensuring that users feel as good as possible while waiting. Cultural conditioning forms the basis for parameters such as attention threshold, Long-term versus short-term orientation, focus on objective and uncertainty avoidance. These further transcend

into response time and type, status report type and content, page load methodology.

This paper is aimed at dealing with various aspects of waiting time and its implication in HCI with respect to varying cultures. It is intended to analyze the issue with the help of surveys/ available statistics and Case Studies regarding Culture specific traits and expectations.

HCI in SE Process Literature

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Abstract

The fields of human-computer interaction design (HCI) and software engineering (SE) have evolved independently in the past two decades, apparently almost completely unaware of each other [1]. Over the same period, the importance of the HCI design in software has increased enormously. As software makes its journey from sophisticated scientific equipment of the 1970s to pervasive, almost invisible consumer products of the new millennium that touch the lives of many people, there is a greater need to mingle software engineering with design thinking.

SE literature tends to ignore or give little importance to traditional design methods and techniques in the software development process. There is a tendency to look at the 'user interface design' at only surface and skeletal levels.

This paper reviews and critiques the role of HCI as discussed in two seminal works on SE – Software Engineering – a Practitioner's Approach by Roger Pressman [2] and The Rational Unified Process Made Easy by Per Kroll and Philippe Kruchten [3]. The objective of the critique is to look for opportunities for improving the process and making it integrated across disciplines of HCI and SE so that the overall

product quality is improved and the efforts of software development are optimally spent. The paper summarizes areas of concern in the current literature and puts forth ideas for characteristics of a ‘truly’ unified process.

Why Some People are Addicted to Computer Games —an analysis of psychological aspects of game players and games

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Abstract

The purpose of this study is to investigate the status of computer game addiction, and the relationship between the addiction and personality. The study also examined, with investigation from game players, what kind of game elements are more important and whether game software usability makes a contribution to game addiction. 471 graduates and undergraduates, who had game experience, from four universities of Beijing were recruited to complete a set of questionnaires. The questionnaires included personal information questionnaire, game addiction disorder questionnaire, 16 personality factor questionnaire, game software elements questionnaire, and game software usability questionnaire. The study found that game addiction score of male students is significantly higher than that of female students. Relationship between game addiction and personality, game elements and game software usability did exist.

A cultural context directed design of a tool for usability evaluation of web interfaces

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Abstract

Globalization of user interfaces in the present WWW era has necessitated the need to take into account cultural dimensions in the design strategies. A major impediment is that there is very inadequate understanding of the role of culture in user interfaces and how they are built. Also, the present user interface design tools and guidelines are insufficient with respect to the role of culture in usability testing. The aim of this research work is to establish a set of objective guidelines to deal with the cultural aspects of user interface design. This paper presents a study of the existing websites of three diverse cultures of China, India and Denmark. Results of this study are used to frame heuristic guidelines to assist a designer in his cross-cultural user interface design strategy for each particular culture. Finally these guidelines are used to design a tool for evaluation of usability of websites in cultural context. This tool assists in the evaluation stage of the iterative design practice of user interface development. A discussion on how this tool integrates with the cross-cultural design strategy of a designer is also sought in this paper.

Keywords: Cultural models, Cross-cultural interface design, heuristic guidelines, usability, evaluation

Impact of user's aspirations on choice of interface: towards validating Indian Psychology Perspective

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Abstract

This paper reports an experiment conducted towards validating the Indian psychological perspective of *Samskar* (residual imprints of repeated behaviour leading to motivation for next deed) as a vital player in individual's preference of interfaces. Preferences of 800 Indian University students for a given task from four alternatives suggestive of different cultures were collected and validated against their reported aspirations. A high correlation was found which is in accordance with the Indian Psychology's perspective of the user. Paper further discusses the implications of other Indian traditional psychological framing of the user in context of HCI.

Digital Technology as a means to continuing Cultural traditions - Case study of a Tangible Interface to teach Dance

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Abstract

In this paper we demonstrate the development of a Tangible Dance Floor, that allows learning of various dance forms across cultures. Dance forms are very specific to cultures and its learning across cultures has become really difficult. Indian dance forms like Kathak and Bharatnatyam are extremely personal to the Indian culture and learning these in other countries is really difficult. Similarly, Tap dance and Ball Room dance are extremely specific to Russian and American cultures. Using Human Computer Interaction tools and methodology we design, specify and implement a system, which solves these cross cultural issues of learning.

In our methodology we studied various dance forms (Bharatnatyam, Kathak, Tap dance and Ball Room dance) from different cultures, conducted surveys. Studied the very important role of a teacher. We analyze that teachers to teach dance are decreasing day by day. Hence the need of a system to teach dance is really very important.

This Tangible dance floor teaches the dance in two steps. Firstly the user selects a dance form from the GUI where he is informed about the basic dance steps to be performed on the dance floor. When the user starts to perform on the dance floor a sound feedback alerts the consistency.

Using Culture based cues in Music for affective engineering of GUI

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Abstract — Music being digital has become a key expression of 21st century culture. Many people now have access to creative digital music tools through the widespread dissemination of computing and portable computing technology. New research questions are now emerging related to sophisticated human/computer interfaces, techniques and strategies for the control of information about music and creative musical processes. Music being universal and local, culture cues hold potential for being used as indices for a classification topology. Based on a posited topology, in this paper we propose an intuitive user interface which is useful for a layman who likes a particular genre of music but is unable to articulate it and therefore unable to seek out similar

genre music from another culture. This system is based on contemporary algorithms & techniques to extract complex descriptive information from audio signals, for music classification and summarization based on beat, rhythm melody etc, which are universal characteristics regardless of culture. The proposed GUI provides the user to exercise his/her choice of a known culture and helps him locate similar music samples from another culture.

A Cross-cultural Study of How Refrigeration Mechanics Interact with the System

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ABSTRACT

In the field of Human Computer Interaction, some studies have looked at aspects and theories in cultural studies in order to evaluate methods and design approach of computer system development. Cross-cultural studies, in particular, have been used to compare the use of methods and design results across culture [1,2]. However, these studies are structured based on the developers' understanding of the system. In our research, a cross-cultural study is meant to provoke our analysis on the ways a system is organized, given a cultural context.

In a project to design novel user interfaces for refrigeration electronics, we use an anthropological approach [3] to critically reframe our understanding of refrigeration maintenance. In this paper, we present the ways in which ethnographic studies of refrigeration mechanics in Denmark, Australia and Indonesia and India have sensitized ourselves to issues that matter to refrigeration mechanics and those who are involved in the organization of refrigeration systems. Accounts of social and technical role, skill and tool use, movement and place-making in work context have shed light upon our understanding of how social and technical interactions are both influenced and influencing the work of refrigeration mechanics. With this sensitivity to user's conditions across culture, we have allowed ourselves to look beyond our limited understanding of the system, and recognize various constraints and opportunities that were shaded by our own cultural perspectives. This approach calls for thinking critically beyond the usability of computer system and finding ways to develop system that matters to users and those who are part of the system organization.

Keywords: Ethnography, User Interface Configuration, and Cross-cultural Issues.

Website Navigation Systems on the World Wide Web for Indian Cultures

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Abstract

Vast amount of information is available on the Net in the form of Documents whether they are Pdf files, Word Files or as HTML files. The resources of information are various websites that have the target user groups which may be cultural specific or may not be cultural specific. They all contribute to the information systems in various working environments especially in the trade environments and information exchanges over the industrial communication.

These websites have to convey the information relevant to their target user in an efficient way by incorporating able navigation and visual systems like buttons, menus, text, color, hyperlinks, sounds , animations and graphics.

The paper highlights the website navigation systems and their psychology and perception by cross-cultural people of India who have different qualifying levels of education.
We have studied these cultural dimensions of the varied target groups of users that are from India and have also derived carefully the results that have been accumulated by a series of tests through usability pattern data on the visual ergonomics and various interrogations done on a wide range of users.

Thereafter, the paper converges on conclusions i.e. viable Graphical User Interfaces based on Cross-Cultural Differences. The cognitive patterns thus developed have been documented and form a part of the paper presentation.

Cultural factors influencing interface design used by Indian youth

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Abstract

Indian cultural integrity and cross cultural influences may infuse a selective approach to browsing particularly among the youth. We assume that Indian youth are influenced by customs, nature, music, festivals, making and keeping relationships and more specifically to cricket, matrimonial, bollywood, astrology, finance as interest areas. The reactions to these areas are culturally conditioned.

This paper intends to look at the factors which influence interface design for Indian youth and suggestions for an interface which suits them. It gives a brief overview of the internet usage as such and the elements on the page i.e. colour, language, icons, images, content, page layout which influence the youth.

Information for the above study was collected by a designed survey through internet and personal interviews of Indian youth belonging to age group 18-30 years. The response of around 50 people belonging to the above mentioned age group was collected through recording and analyzed. The findings of this paper can have their applications in HCI design.

A Study of Culturally Rooted Barriers Affecting Mobile Usage among Indian Women

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Abstract

The mobile phone has become ubiquitous in India like elsewhere in the world. While the youth has readily adapted to the device and find themselves at ease using it, the middle age population has difficulty in its usage.
This paper studies the barriers that inhibit the middle-age Indian women from adapting to the usage of mobile phone. The relationship between these barriers and their possible cultural roots if any is the focus of this study.
A survey was done to elicit information from 30 Indian women in the age group 35 to
55. Interviews, photo documentation and task analysis were adopted. The questionnaire was framed to connect the perceived barriers to cultural origins and was conducted in the interview mode.
The results indicate that cultural dimensions such as masculinity vs femininity, absence of individualistic perspective and economic dependence (in case of non-working Indian women) do play a part in creating barriers that prevent easy adaptation to the mobile phone.

Keywords: culturally rooted barriers, mobile phone usability.

Indianised Design of Automobile Dashboard Interfaces A Case Study

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Abstract

During the last two decades, the automobile has made the transformation from an analogue machine with mostly mechanical and hydraulic control systems to a digital car with a rapidly growing volume of computer-based control systems. This transition will continue for another decade or two as drive-by-wire or x-by-wire systems emerge and eventually proliferate. The addition of sensor-based intelligent vehicle functions will further advance digital technologies in future automobiles.

Some of the most visible recent innovations in automobiles, such as telematics, have little to do with the automobile's operation itself. The inclusion of hands-free kits and multimedia systems have less effect on the automobile's operation and more effect on improving the drivers' and the passengers' ability to do no driving activities, such as having a cell-phone conversation or watching a movie.

Automobile designers have always been aware of incorporating external features that target specific market/geographical segments tastes many of which are culturally motivated. However the Dashboard inside, continues to be based on a universal design template and is well standardized. Regardless of the geographic region or market segment dashboard more or less are similar.

In India, the dashboard and interior of an automobile has always been modified or decorated to reflect local cultural identity and tastes. This paper makes a study of current adaptation of dashboards in automobiles such as cars and trucks. It attempts to derive heuristics for a completely digitized, hands free, multifunctional dashboard in the form a large LCD/Plasma display. Design concepts are suggested to highlight the attributes of a culturally oriented dashboard.

Keywords: Automobile Dashboard, Cognitive Prototype, Cultural Dimensions, Metaphors, Cultural Populace

EVALUATING INTERFACES OF WEBSITES FOR EAST AND WEST

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Abstract

East and West have their different cultures and so are their needs. Website interfaces have been analyzed to find out what makes them eastern and western. We intend to find the factors, variation of which will result in interfaces that can be adequate or inadequate to any culture. Our study is converged to the Indian and western culture only, as western culture has got great impact on the Indian culture.

Interface made for the websites in one corner of the world are being used by users all over the world. But these are not able to cater the needs of the user to its full extent, as users of different regions have their different expectations, as each person has its own visual appetite and taste. Presently research is being conducted to facilitate the users to change the interface of the website depending upon their needs (www.start.com).But these are still at experimental level.

In this paper various factors and features which make the website, software and operating system interfaces well-suited to the users belonging mostly to eastern (Indian Subcontinent) and western culture (Europe & US) have been studied.

Keywords: Culture, Websites, Visual Appetite, Interface, Needs.

Cultural Usability: Cultural models in psychological Usability Evaluation Methods (UEMs)

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Abstract. Cultural models in terms of the characteristics and content of folk theories and folk psychology have been important to social scientists for centuries. From Wilhelm Wundt's Volkerpsychologie to the distributed and situated cognition theorists in the global world of today, thinkers have seen human action as being controlled by cultural models. The study of cultural models for humans interacting with computers should therefore obviously be at the heart of the scientific study of human-computer interaction (HCI). In this speech, I present the concept of cultural models, what they are, how they are related to HCI and how they can be used to do research in UEMs. I present the tentative findings from two pilot studies of the use of the think aloud usability testing method in Copenhagen and Guwahati. The aim of the speech is to take a step towards a tentative cultural model framework for research into cultural usability.

Keywords: Cultural models, HCI, Cultural Usability, UEM.

1 Introduction

Cultural models in terms of the characteristics and content of folk theories and folk psychology have been important to social scientists for centuries. From Wilhelm Wundt's Volkerpsychologie to the distributed and situated cognition theorists in the global world of today, thinkers have seen human action as being controlled by cultural models. The study of cultural models for humans interacting with computers should therefore obviously be at the heart of the scientific study of human-computer interaction (HCI).

I don't think it currently is so. Until recently, HCI researchers have only treated cultural models as a practical matter of occasional and peripheral interest. Depending on the actual system to be designed, designers might consider the influence on the human-computer interaction from one or more factors on a long and incomplete list of cultural variables (Dix et al. 2004; Schneiderman et al. 2004). The cultural models of HCI are understood as arbitrary, i.e. they could equally well have evolved into another form (Norman 1988; Preece et al. 2002) (for example the use of red as a warning color on a display could equally have been yellow or some other color), while most of HCI is regarded implicitly as non-cultural, and something that easily can be transferred across different cultural settings (for example the assumption that all humans can distinguish between the different colors (e.g. red, green, blue) on visual displays) (Carroll 2003). Consequently the use of existing cultural models to investigate to culturally determined usability problems has been inappropriate (Bourges-Waldegg et al. 1998) and not very visible in HCI research.

However, in the past few years attempts have been made to include cultural knowledge such as cultural dimensions (Marcus 2002; Marcus et al. 2000), cultural factors (Smith et al. 2004b), cultural constraints (Norman 1988), and also cultural models (Clemmensen et al. 2005; Jagne et al. 2004), in research into in HCI in general, and into cultural usability specifically, e.g. (Sun 2004; Tarkka et al. 2001). These approaches are in many ways different, but what are common to them are a focus on the diversity of users and use of technology around the globe, on social-cognitive approaches to usability (as opposed to psycho-physiological approaches to usability) and on a broad understanding of the utility of human-computer interaction. The last point, a broad understanding of the utility of human-computer interaction, means seriously considering the experienced utility of interactive products and not only instant measures, such as immediate satisfaction, efficiency and effectiveness.

A major finding from the existing literature on cultural models in HCI is that there are differences in cultural models in the East (Asia) and in the West (USA, Europe) and that the differences predict the need for localized designs (Marcus et al. 2000) and for local adaptations of usability evaluation procedures (Smith et al. 2004b). Specifically, empirical studies show that Chinese users adapt a more holistically approach to using software compared to European users (Smith et al. 2004a). This resembles the general finding from cultural psychology on human cognition that easterners are context focused, while westerners are object focused (Nisbett et al. 2001). An example of this may be that asked to report what is on a scene, easterners mention the background, while westerners report the focal objects. The cross cultural differences in cognition lead us to expect cross cultural differences in cultural models for HCI to be visible in usability evaluations.

With a few exceptions, there are no guiding research models for empirical research into cultural models in HCI. Hence it is difficult to relate findings to research questions derived from theory in any of these studies. In this paper, the intention is to look at from a cultural psychological perspective (Hollan et al. 2000; Nisbett et al. 2001) on usability. I present a psychological perspective of cultural usability (Clemmensen 2005), which in this paper is used to define key concepts and predict their relations in the study of psychological usability evaluation methods.

In the paper, I propose to view cultural models as different kinds of culturally specific representations: internal cognitions, external artifacts and institutions. The perception of cultural models as distributed cognitions across individuals, tools and situations is central for much of modern cultural psychology (situated cognition, distributed cognition, cultural schema theory, activity theory, etc.). In the extension of this approach to usability, internal cultural usability models become the goals, actions and emotions that for an individual constitute effectiveness, efficiency and satisfaction (the usability) of interacting with a product. External cultural usability models become external artifacts (the interactive products) and external institutions (established UEMs). Contrary to the 'cultural variable approach', which assumes national culture to be most important, the cultural models of HCI that I suggest to study are historically developed ways of thinking, which are embedded firmly in individuals' and small groups' everyday use of interactive computer and other design products.

A disclaimer is necessary here. Usability must be considered a universal phenomenon, as I see it. As researchers from different countries we cannot base our cooperation on evolutionism, i.e. the assumption that some cultures are more developed than others. Relativism in its extreme form: the concepts and theories based on research in one cultural setting cannot be transposed to others settings, is also not adequate for cross cultural research (though relativism could be very adequate for a within culture study of for example the use of symbols in Indian software). However, the sort of universalism that I propose takes relativism and evolutionism into account also as empirical questions. It follows the moderate universalism (Pepitone 2000): 1) maybe there are cross cultural Usability universals, may be not, we need empirical documentation, 2) universals in Usability will most probably be found on the level of theoretical principles rather than phenomena, and 3) we need to make assumptions about universals in usability to help organize data into general theories.

2 Background

The cultural usability perspective (Clemmensen 2005) is a version of the general theory of bi-cultural frame-switching (Hong et al. 2004), which is adapted to the usability domain. It assumes users to hold one or more cultural meaning systems, even if the systems contain conflicting cultural models of technology use. The accessibility, availability and applicability of particular cultural models of technology use will then determine the usability of a product[1]. For example, the usability of a certain religious icon in a particular collection of cliparts may be high because the user can understand the icon (accessibility), in the current context identify the icon (availability) and consider it appropriate to use in the given situation (applicability). In other situations the user might decide not to use (not applicable) the religious icon. And for a different user, the religious icon may be incomprehensible (not accessible) or not even noticed (not available)[2].

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, hence the term cultural usability model. It can be understood as a folk

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[1] In this model, usability is always a result of cultural knowledge, hence the model's name is Cultural Usability Model.

[2] For example, when you write a letter to a friend, an icon showing the Indian elephant god Ganesh may be available in your word processor's clipart collection, it may be accessible to you if you have an Indian background or knowledge of India, and it may be applicable if the receivers of your letter accepts a Ganesh icon in letters. In other situations you might decide not to use the Ganesh icon because you judge that the readers of your letter will not appreciate that. If you have a European background, use European word processors and writes for European readers, the Ganesh icon would not be available, accessible or applicable.

theory of what is means to interact with the product in one or more contexts. In one sense, a folk theory of what is an appropriate mixture of usability components for the product makes it meaningful to measure the usability of the product. In another sense, a particular folk theory may not be accessible, available or applicable to the target users and therefore lead to biased and useless usability measures.

A cultural usability perspective may assume that cultural usability models can be described as either internal cognitions or external artifacts and institutions. This approach has been called ‘culture and context’ or ‘culture X situation’ approach to culture (Hong et al. 2004; Honold 2000). Internal cultural usability models are the goals, actions and emotions that for an individual constitute effectiveness, efficiency and satisfaction of interacting with a product. The content and internal relations among effectiveness, efficiency and satisfaction when interacting with a product may vary across the world’s population. The varying internal cognitions contribute in concert with external cultural usability models to measured usability. External cultural usability models can be further distinguished into external artifacts, e.g. the products themselves and also usability problem representations, and external institutions, which include the established UEMs.

The external artifacts have to varying degrees built-in a ‘model of use’. A product can (seemingly) be used for one specific thing in one specific way in one specific context only. This was found by the German gestalt psychologist Karl Duncker in 1934 and labeled ‘functional fixedness’, and confirmed many times since. Recently it has been shown that universally a design’s function may be a core property of an artifact concept within human memory even in technologically sparse cultural communities (German et al. 2006). This focus on artifacts with ‘built-in models of use’ is also central for recent distributed and situated cognitions theorists and it based on the assumption that “the tools of thought…embody a culture’s intellectual history….Tools have theories built into them, and users accept these theories—albeit unknowingly—when they use these tools”(Resnick, 1994, pp. 476-477, referred to in (Nisbett et al. 2001).

The external institutions such as established UEMs propagate usability representations (conceptions of usability, examples of usability problems, statements about usability, usability measures, think aloud protocols, etc.) across situations and produce and maintain specific models of usability. Initially, knowledge of what problems are usability problems is embedded in meaning systems that are widely shared among the members of the cultural group doing the usability test. This ‘usability problem knowledge’ is frequently used in communication among members of that group and thus becomes chronically accessible within the group. In the usability test situation, where people under time pressure look for readily available and widely accepted solutions to a problem, the chronically accessible knowledge will be used and typical cultural group conceptions of usability will emerge.

It is however not sufficient to have user task conditions that favor the activation of chronically accessible ‘usability problem knowledge’ in a usability test situation; the knowledge also must be available to the individual. Since individuals in a society increasingly are poly-cultural in their background and thus have more than one implicit theory of how to perceive and act in a given situation, the individual choose or implicitly apply the theory that is available in that situation. The availability of culturally accessible knowledge is primed by cultural specific materials such a religious icons and pictures of local sights etc. For example, a test of localized software applications that contain culturally specific icons and pictures may prime evaluators' and test users' culturally specific knowledge systems, while they complete a behavioral strategy such as a think aloud usability test.

Finally, the appropriateness of applying accessible and available cultural knowledge becomes particularly questionable when evaluators and users have different socio-cultural backgrounds, for example when they have different 'home grounds' such as China, India and Europe. Sharing knowledge of usability problems and coordinating descriptions of usability problems depend on the mutual perception of group belonginess; i.e. the participants may ask him or her self implicit questions about the appropriateness of the available knowledge, such as 'if I tell him or her about this usability problem, will he or she understand that this is a problem? Or will he or she think that I am ridiculing him or her?'

To summarize, the distribution of the thinking about usability problems across users, evaluators, clients, observers etc, the coordination between internal cognitions and external artifacts, and the history in terms of previously identified usability problems may all influence the list of usability problems found during a test of an interactive product.

A standard usability evaluation of a product with a particular built-in cultural model in a situation with one or more particular group of users will results in a particular list of usability problems. To avoid usability problems, it is not always enough to localize a product to fit cultural traits and/or demographic criteria. Because a UEMs function as a mediator of the meanings of cultural models and the perceived reality of interactive systems, individual evaluators may find the cultural context foreign (the meaning of the cultural models), but still go on to identify well known types of usability problems (the perceived reality of the interactive system). Hence a usability evaluation of a product for a market that is foreign to the evaluator may lead to the identification of the major usability problems that future users will experience, but this is not always the outcome of the usability evaluation.

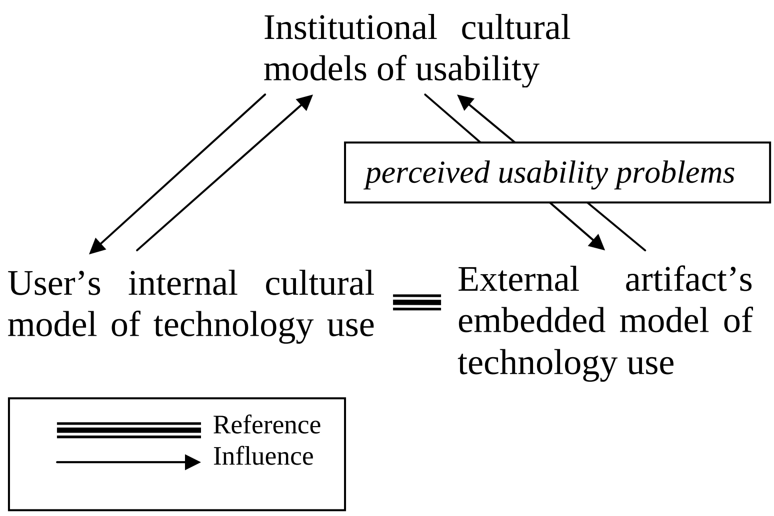

Figure 1. Cultural usability model

In the model of cultural usability in Figure 1, the relation between the internal cultural models of technology use (cognitive, psychological: to write a letter, do so-and-so) and the external artifact cultural models (how-to-use-this-product) is considered mutual constitutive (one makes not sense without the other), while the external UEM institution is considered a loosely coupled mediator that creates the perception of a specific set of usability problems in much the same way as other institutional cultural models produces views on technology use, such as system design methodologies or user participation approaches. This distinction is similar to a idea in social psychology of group perception that sees social reality and culture as referential (culture supplied shared symbols that people use to construct their reality which again underpin the cultural symbols), and sees individual communication as the concrete acts that get the process going and creates the psychological sense of reality (Kashima 2004). In a similar way, I see the psychological sense of usability problems as a product of the UEM-enabled communication about the references between the user's expectations to a technology and the specific artifact. A combination of specific internal cultural models and specific artifact cultural models may suggest a list of major usability problems, but the list may not necessarily be similar to the typical usability problems found by established UEM.

The gap between users' and artifacts' cultural models of technology use, and the usability problems found by using established UEMs, has been indicated by some empirical studies.(Bourges-Waldegg et al. 1998), in a study done in England, asked a small group of users with diverse cultural background to participate in a think aloud evaluation of a www system in order to identify breakdowns linked with cultural factors in user-task interaction (language, humor, icons and jargon), user-tool interaction (understanding the tools representations), user-environment interaction (working habits, institutional practices, technological mileau) and user-user interaction (understanding the intended meaning of utterances). It was in user-tool interaction and user-task interaction that the majority of cultural breakdowns occurred, and mainly because of users' lack of understanding of the representations of tools and tasks. The findings point to the hypothesis that cross cultural differences are basically representational differences, and that cultural factors such as religion, government, language, art, marriage, sense of humour, etc. are present in every culture, but it is the ways in which cultural factors are represented in interfaces that vary from culture to culture(Bourges-Waldegg et al. 1998). In a multi-cultural and multi lingual English speaking country, Botswana, (Onibere et al. 2001) conducted a nation-wide survey which showed end-users having overwhelming preferences toward localized interfaces, but little need for localized icons and no agreements as to which language – not even the nationally adopted local language – to be used for the interfaces. The little need for localized icons could be explained by the users' willingly adaptation to the work environment, to the extent that they did not perceive their 'home' environment as relevant for their work environment (Onibere et al. 2001). In a study done in China, (Shen et al.) developed and evaluated a culture specific metaphor (a Chinese traditional garden) to replace the western desktop metaphor for personal computing. Heuristic evaluation and user evaluation with a group of Chinese users of a metaphor based prototype suggested that background knowledge of language, logic and taboos was essential to the anticipation of user behavior in heuristic evaluation, and that Chinese users have little problems in identifying and interpreting the icons in the culture specific metaphor. The insightful choice of culture specific metaphor and related icons could according to the authors be explained by assuming that the metaphor linked directly to Chinese socio-cultural context and benefited from the fact that the Chinese language is character based. These findings tentatively support the assumption that local users using local tools do frequently experience usability problems that are not typically identified with established UEMs.

The existence of a gap between typical findings from established UEM and experiences from evaluations of local cognitions and artefacts has also been supported by studies focusing directly on the use of UEMs. (Vöhringer-Kuhnt 2002) surveyed 145 students and professionals from 30 different countries and found that usability professionals from various countries show different attitudes towards usability components such as efficiency, effectiveness, and satisfaction, i.e. usability professionals from different countries have specific inclinations towards one of these components and for them any usability study primarily concerns that specific component. (Vatrapu 2001) studied international usability enquiries with structured interviews, in India, and found that the culture of the interviewer has an effect on the number of usability problems found, on the number of suggestions made, and on number of positive and negative comments made. Those participants who were from the same culture as that of the interviewer (India) brought more usability problems than participants who are interviewed by the interviewer who was not of the same culture (in this case Anglo-American) (Vatrapu 2001). Other researchers have raised similar issues, and for example asked (Miller et al. 1994): Do language and cultural differences between staff and participants negate the outcome of usability tests? Are foreign nationals good representatives of users in their home country? (Herman 1996) studied verbal protocol techniques in usability evaluation and found that they are most effective when the tests are conducted using subject pairs who are familiar with one another, and that testing subjects individually should be avoided, as little information may be retrieved (Herman 1996). By focusing on Hofstede's power distance as an important cultural factor, researchers in Asian countries have reproduced these results: Having a test user of higher rank than the experimenter will result in more negative comments about the product than having a test user of lower rank than the evaluator, if the study is done in a country with a high power distance (Yeo 1998; Yeo 2001). To get the most honest results from usability testing, the evaluator should therefore be of the same rank or of lower rank than the test user subjects. The existing practice derived from the West of migrating software from a source culture to a target culture may also not be appropriate (Yeo 2001). This practice may work in the design and implementation phase, but not in the usability evaluation phase. The results of usability evaluations with different usability assessment techniques such as the thinking aloud technique (for objective evaluation) and interview techniques (for subjective evaluation) may be inconsistent (Yeo 2001). These inconsistencies arise due to the factors: 'computer experience', 'power distance (large)' and 'collectivist (as opposed to individual)' nature of the test users. The cause of these inconsistencies was the participants' reluctance to provide critical negative comments. They were reluctant because they wanted to 'preserve the face' of the designer and because they showed respect for hierarchy (Yeo 2001). These findings imply that to obtain data in countries with high power distance and in collectivistic countries, usability professionals should use objective usability techniques like think aloud usability testing. If usability professionals want to obtain data using subjective measures, then they must use participants who are experienced in tools similar to the product being evaluated, and who are familiar to the experimenter. To make usable user interfaces the localized interface should be made using the usability engineering methods similar to those used in the development of original user interface. The state-of-the-art recommendation on how to conduct international usability tests are (Dray et al. 1999; Molich et al. 2004a; Nielsen 1990): travel to the target country yourself or conduct the test remotely or hire a local usability consultant to run the test for you. These recommendations might not be sufficient.

The relationship between users of localized artifacts and established UEMs can be studied in many ways. An example is the pilot study done by my colleagues and myself in Copenhagen and Guwahati, in which we explored the relation between users having culturally diverse backgrounds (age, gender, nationality, mother tongue, familiarity, sexual orientation, etc.) working with a localized artifact (a clipart application with local cliparts) and an UEM (the think aloud usability test method) in a European (Danish) context, and in an Indian (Assam) context.

3 Copenhagen study

Previous studies on cross cultural usability evaluation show us that culture broadly affects the usability evaluation processes. Therefore it seemed worth investigating the assumption that the usability evaluator almost needs to belong to the target culture to completely understand how people will respond to the established UEMs such as the think aloud usability test. The classical cognitive account of what is means to Think Aloud (Ericsson et al. 1993) says that during the test there should be very little interaction between a test user and an evaluator. After a task begins, the only kind of interaction should be to ask the user to keep thinking aloud. This procedure should give the evaluator the optimal data about the information used by the test user during the task performance.

Participants. Test users and evaluators were chosen from Europe (Denmark) and India, see Table 1. We wanted participants that were able to Think Aloud in English. The local Danish cultural customs and symbols were expected to be either very familiar or to be very unfamiliar (but interesting) to the participants. We focused on conducting all the possible pairings of test user and evaluator pairs.

Table 1. The eight participants

Pairing	Status	Age Relation	Gender
European - European	Assistent. Proff – PhD. Student	Older-Younger	Female- Male
Indian – European	Bachelor student – master student	Young-Young	Male- Male
Indian – Indian	PhD. Student – bachelor student	Young- Young	Male- Male
European – Indian	Research ass. – PhD. Student	Older - younger	Male- Male

Test application. We added a a collection of culturally specific images and icons and a text document with preformatted invitation text called ‘cultural clipart’ to My Collections in Microsoft’s clipart organizer, see figure 1. From the folder, the user supposedly could choose images and graphics to add to their invitation, wep page, etc..

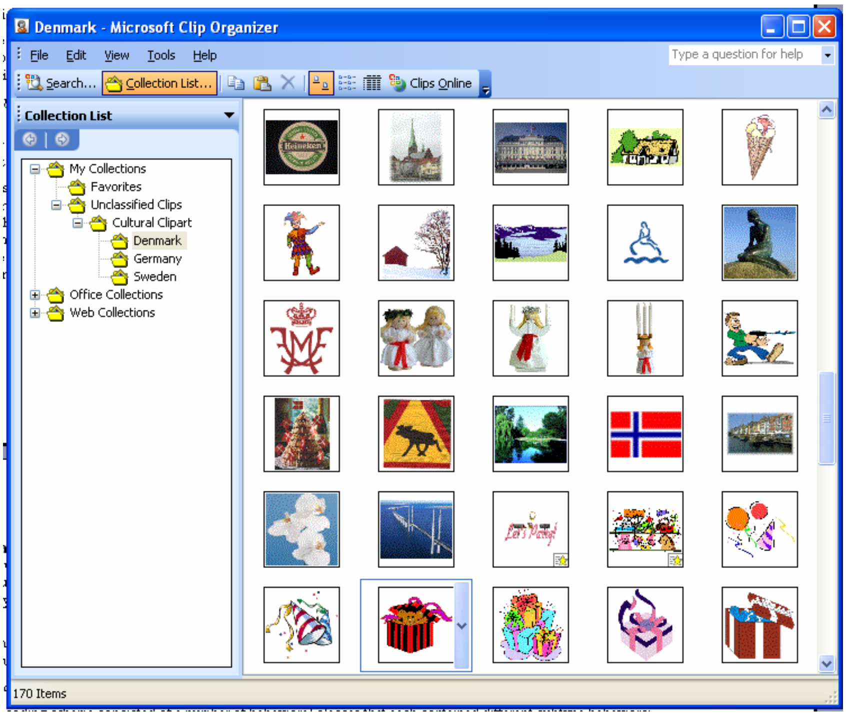

Figure 2. Denmark Cultural Clipart folder with built-in errors

We added culturally specific errors to the application, see Table 2.

Table 2. Potential usability errors in the Cultural Clipart test application

Wrong symbols	*Symbol Label errors*	*Invitation text errors*
A Norwegian flag in the collection An image of Norwegian parliament in the Denmark folder Image of Heineken beer (a Dutch beer) A Reindeer (which does not live in Denmark) A Norwegian skier Images of Birthday certificate – not Danish Eagle – not Danish Scenery – not Danish	The blind-fold game (not Danish) had the birthday keyword Wrong keywords to images of Danish flags An amusement park of Denmark had the birthday keyword Various cakes that were neither birthday cakes nor Danish cakes had the birthday cake keyword	Wrong address (not Danish address)

Procedure. The study took place at Copenhagen Business School in a standard office space that could have been found in any major company. In the experiment scenario, a company that has developed a new application has hired an evaluator from a usability consultant company to perform think aloud usability tests of the product and has also provided test users. The experiment begin when the evaluator arrives at the office and if needed discuss his or her task with the experiment leader. The evaluator takes over and the usability test session begins with the evaluator greeting the arriving test user. The evaluator asks the test user to perform tasks, see Table 3. Then evaluator interviews the user about the interface and the tasks, and makes a small report on the identified usability problems. This finishes the usability test session. The user is asked to stay and take part in the experimenter's experimenters' interview with both the participants, before they leave the office.

Table 3. The test user's task with the Danish Clipart folder application

Design a Danish birthday invitation for your son's birthday

1. Please write the text that you want to appear on the Invitation.
2. Please choose the appropriate font(s) for the text.
3. Please choose the appropriate style(s) for the text.
4. Please choose the colour(s) for the text.
5. You are free to choose any kind of formatting and layout that you require for this text.
6. Now using the Cultural Clipart sub-folder in My Collections folder in Microsoft Clip Organiser add some images and graphics so that its looks like Birthday invitation.
7. Please make this invitation look happy, colourful, and joyful as this is for birthday.
8. Since primarily all your guests are from Denmark and are Danes, make this invitation look Danish

Results. The reminders given by the evaluator to the test user in the European-European pair were affirmative rather than neutral, compared to any other pair. The time taken to complete the test session was shortest and the number of reminders given was highest with the local European users, not regarding the evaluator's background. Reminders and affirmative responses were most infrequent in the case of European-Indian test pair.

The European evaluator in European-European test pair after knowing that the user haven't used the Clipart before started helping the user. The European evaluator in European-Indian pair didn't help his/her user that much. Furthermore, the comments made by the evaluator were least in the case of Indian-European pair.

The European test user with the European evaluator was the most active think-aloud test user given the time spend on the test session, although the Indian test user with the Indian evaluator had more think aloud events in total.

During the think aloud session, the evaluator–test user pair that found most culturally specific usability problems was the European-European pair. They had most frequently usability problems with the symbols and images and the problems they found were those deliberately induced in the clipart application by us. In contrast to this observation, the Indian–European pair did not find a single usability problem with the cliparts, but found some usability problems with the Microsoft organizer and the word processor application. The evaluator – test user pairs with Indian test users mostly found problems related to the specific office software version.

Besides thinking aloud during the test session, the test users also commented on the test application and suggested improvements to it. Evaluator –test user pairs with distant test users commented more negatively and commented more on cultural differences than evaluator-test user pairs with local test users. Among the pairs with local test users, it is eye-catching that the Indian-European pair has zero suggestions to improve the test application, while the European-European pair during a short test session come forward with many suggestions to improve the test application. Also the Indian-Indian pair had, however, many improvements. In the post session research interviews we asked one of the distant Indian) test users about what a Norwegian flag was doing in a Denmark folder (this was intentionally done by us). He said *"Oh it's perfectly fine…because in my opinion Norway and Denmark share a common culture so it's perfectly fine…. "*. That it doesn't matter whether you use a Norwegian or a Danish flag on a Danish birthday invitation is not true to a Danish individual. The interview data on suggestions for improvement of the test application should not be interpreted as the - and the distant-distant pairs found similar usability problems.

Discussion. Having a local evaluator testing local users seems to be fasted and best way to find culturally specific problems with a localized test application. Why having a local evaluator testing local users is more effective than other combinations of evaluators and test users cannot be explained from standard text book procedures for TA (Ericsson et al. 1993). However, there are at least two types of explanations. First, in a 'culturalization' (Dormann et al. 2002) perspective the - relation is most effective in finding usability problems in a localized application because of the unique characteristics of the target culture (the Danish test users might be extraordinary fast and effective). Second, in a 'cultural representation' (Dormann et al. 2002) perspective the local-local relation is most effective in finding usability problems because of the meaning the evaluator- test user pair is able to ascribe to the localized application (the Danish evaluators and test users know the Danish symbols and context better that their Indian counterparts). Which explanation is optimal under which condition is not clear from the pilot study in Copenhagen.

4 Guwahati study

In the Guwahati study, we manipulated the evaluators' cultural background using pan-Indian test users as subjects and a localized version of the test application that would cater to the need of Pan-India culture. The user task that we had designed the usability test application to support - make an invitation such as a birthday or a wedding invitation - fall under meta-culture prevalent homogenously throughout India[3]. Specifically, intra cultural/regional differences in marriage, though very existing, would, we assumed, not have any differentiable influence at the meta-cultural level task such as designing a personal wedding invitation.

Participants. The test users and evaluators were chosen from India and Europe. The test users were 18 students from all over India that now studied at Indian Institute of Technology in Guwahati (one female, 17 male, age group 20-23 years). The students all attended an interaction design and usability testing workshop held at IITG. They participated in the experiment as part of the workshop, but on a voluntary basis. At the workshop, they were introduced to the think aloud usability testing method though texts of (Barnum 2002) and (Ericsson et al. 1993). We had two distant evaluators with European background (Danish, associate professor in Informatics, male, 44 years old and German, assistant professor in Design, 36 years) and four local evaluators with pan-Indian background Indian, professor in product design, male, 50 years, and two male and one female students, 23, 24 and 21 years, with backgrounds similar to the test users). The evaluators were required to learn/refresh themselves on the practical procedures for think aloud tests and think aloud usability testing before the test session by reading (Ericsson et al. 1993, the appendix) and a chapter on 'conducting the usability test' (Barnum 2002, chapter 7). We held a special two-hour training session for the evaluators.

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[3] The cultural model for marriage may however be only partly universal. For example, we know that people in Japan and USA may share many of the same metaphors and ideas of marriage, but differ in their understanding of what is required of marriage
Dunn, C.D. "Cultural Models and Metaphors for marriage: An Analysis of Discourse at Japanese Wedding Receptions," *ETHOS* (32:3) 2004, pp 348-373.

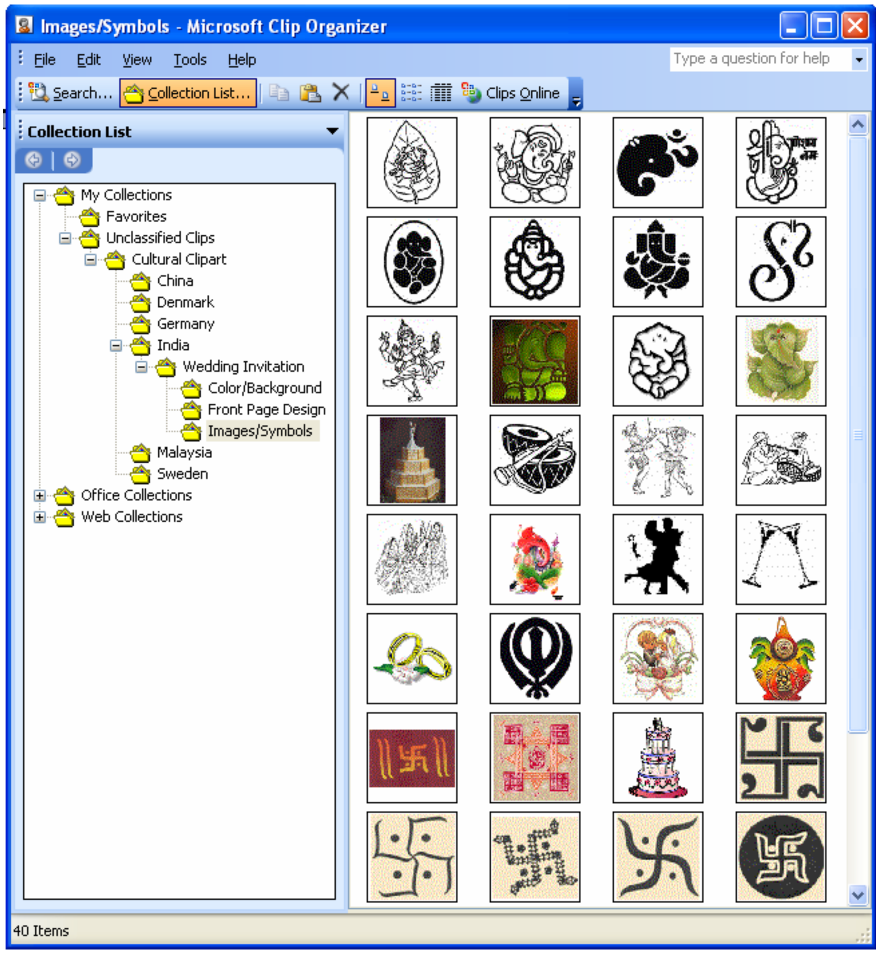

Figure 3. India Cultural Clipart folder with built-in errors

Test-application. The test-application was a set of localized symbols and ways of designing and doing things that was useful for the test task of making an Indian wedding invitation. The cliparts were placed in folders under the heading of India in My Collections in Microsoft word, see Figure 3. The collection included errors, see Table 4.

Table 4. Induced usability errors in 'India Clipart' application

Wrong symbols in 'symbol' sub-collection	*Errors introduced in 'Front page design' sub-collection*	*Errors introduced in the 'additional information' sub-collection*	*Errors in 'invitation text' sub-collection*
Western style Wedding cake (2 pictures)	Christmas hearts European style wedding couple with	We hope you have sufficient time and will join us along with your family for	Not-Indian address used Address on website

Cupidheart with angels (not indian) Mahil (Indian dance, not suitable for wedding) Broom and bride dancing at reception (not Indian) Two wine glas cheering (not Indian) Rings (not Indian) Wedding couple western style	horse carriage (2 pictures) European style wedding cake with champagne European 18th century style wedding post card	dinner. Not applicable to Indian wedding cards Gifts are welcomed only in blessings. Never mentioned like this You can drop in next day if you miss on the wedding. Not appropriate Bachelors last party is scheduled on 8th April 2005, if you are a bachelor join me. The concept of bachelor party is new in India	given, no Indian wedding use websites Non-Indian Poem used: In true marriage lies Nor equal, nor unequal. Each fulfils defect in each, And always thought in thought, Purpose in purpose, will in will, they grow, The single pure and perfect animal, The two-celled heart beating, with one full strike, Life.

Procedure. The study took place in the offices of IITG dept. of Design. Three test users were assigned to each distant evaluator and each local evaluator usability test condition, in total 18 test sessions. Otherwise the procedure was the same as in the Copenhagen study, except that the test user's task instead of a birthday invitation was to make a wedding invitation.

Results. The local evaluators tended to identify only culturally specific usability problems within the localized application, while the distant evaluators found more of low priority usability problems.

Regarding the evaluator's professional behavior during the think aloud test session, local evaluators were more affirmative in their reminders towards the test users. Using many or few affirmative reminders did not influence the identification of usability problems.

The evaluator's use of neutral reminders had an effect on the identification of culturally specific usability problems, see.

In the distant evaluator- local test user relation, the think aloud behavior events were many, short and followed by silence.

Discussion. The local evaluators tended to identify more culturally specific usability problems within the localized application than the distant evaluators did, while the distant evaluators found more low priority usability problems while reporting usability test results. This result may reflect a possibly 'evaluator effect' (Hertzum et al. 2001) that in this case may stem from differences in the evaluators' cultural knowledge. It continues however to be a hard problem to agree on criteria for empirically determining what usability problems are (Gillan et al. 2001). If the problem is conceptual in nature it may be even more important to apply culturally and contextually oriented theories of human interaction with technology (Hasu et al. 2000).

The total numbers of reminders given by local evaluators was higher than that given by distant evaluators, and local evaluators were significantly more affirmative in their reminders towards the test users. According to a recent study of usability professionals practice, affirmatives should facilitate the test users thinking out loud and the identification of usability problems (Boren et al. 2000). This did not happen in the pilot study. Only the evaluator's use of neutral reminders had an effect on the identification of culturally specific usability problems. Furthermore, it was in the distant evaluator-local test user relation that the test users had most think aloud events, which is a result that supports the classic think aloud theory recommendations for using neutral reminders (Ericsson et al. 1993).

5 General discussion

The major findings from the pilot studies were tentative differences in which kind of usability problems that local and distant evaluators identify. The distant evaluators identified more of the cosmetic usability problems, while the local evaluators focused on usability problems related to culturally specific symbols and texts. These results suggest that there is a need for local usability professionals.

Another possible explanation of the differences between evaluators is that the assumption of usability professionals having equal levels of professional expertise often do not hold (Molich et al. 2004b). The expertise of the evaluator can be difficult to assess in international usability testing and the question can be whether "…it is better to use a trained usability person who speaks the language, even if not perfectly, rather than a local person who is fluent, if they are not skilled in interviewing or open-ended questioning, or if they are not willing to work with a trained usability person to develop an appropriate style of probing…(Dray et al. 1999, p. 28)". Given the low level of formal training in human-computer interaction among many usability professionals in Denmark and India (Boutelle et al. 2004; Clemmensen 2004), this issue should be investigated further.

Standards for usability evaluation. In international usability evaluation, the principles of user-centered design is simply extended to an international context, and the issues involved in this are considered trade-offs such a where to go to do the empirical usability study, how to find and contract with local resources, how to adequately recruit local users and adapt the test plan, how to train local evaluators, how to get reports translated and whether to do studies in many countries in parallel or in serial (Dray et al. 2005).

In our study, we were not able to answer or study all these trade-off questions, and since in our study there were significant effects of belonging to the target culture on the evaluator's reminder behavior during the think aloud usability test session, we may question the whole idea of simply extending the principles of user-centered design to an international context.

For example, a usability company may develop a certain standard for international usability evaluation that promise that the company will "…develop a suitable test protocol in cooperation with the customer…and supervise standard think-aloud usability tests for each of the six test participants in each of the countries…..conducted in the local language by a native, local usability expert…[selected on basis of] their demonstrated knowledge in the field" (DialogDesign 2000).

There are a number of findings from the pilot studies that led us to doubt if such a standard is universally applicable. Firstly, we found in the Copenhagen study that the local evaluator helped out the local user more times when he was in trouble with the task or the equipment, answered more questions from the test user and did not stay as silent when the test user is in trouble as the distant evaluator did, but we didn't find this result in the Guwahati setting. Why not? Maybe because of the 'feminist values' of the Danish society (Hofstede 2005) that make the local evaluators put special emphasis ensuring the well being of the test user, or maybe because the usability test situation in Copenhagen included national symbols such as flags that were more easily shared by the local evaluator and local test user who both had lived all their adult life in Copenhagen, i.e. the symbols were unambiguously meaningful to both the local participants (Bourges-Waldegg et al. 1998).

Secondly, we found in the Copenhagen study that using a distant evaluator (or distant test users) creates more in-session comments on cultural differences than local evaluator-test user relations, but we didn't find this in the Guwahati setting. What's the reason? A cultural dimension explanation could be that the power distance of Danes are low and Danish test users openly sound their comments when they find it necessary with a distant evaluator present, while an Indian test user would simply adapt his thinking aloud to his or her perception of the distant evaluator's cultural knowledge, i.e. while thinking aloud the Indian test user will have in mind that the distant evaluator only has tourist knowledge of the local culture. A cultural representation explanation of these findings could be that the Guwahati usability test situation included pan-Indian symbols such as the Hindu elephant-god Ganesh that were of great interest also to the Guwahati local evaluator and local test users, because they came from different parts of India and could relate the use of Ganesh icon to many different contexts (Yammiyavar et al. 2003).

Finally we found in the Copenhagen study that local evaluators inspire local test users to think aloud more than distant evaluators do, but we didn't find this in the Guwahati study. Why? A cultural dimension explanation could say that Danes are individualists willing to open their minds to inspection given the right type of reminders, while Indians are collectivists, and think aloud out of respect for the distant evaluator who apparently wants this kind of behaviour. A cultural representation explanation would point to the difficulties in representing the concept of think aloud in a multi-lingual context as Guwahati as opposed to a mono-lingual context as Copenhagen.

A company's standards for international usability evaluation may or may not build on state of the art research in usability evaluation. The problem is that usability evaluation research itself may be biased and lead to results that are non-optimal for local test users and local interactive products. The concept of usability itself is an Anglo-Saxon idea that are imported into countries like Denmark and India by people trained at American or British universities, see for example (Pradeep 2003). While it may be helpful to import a concept like usability, we are only beginning to address HCI research in a way that "…embrace collaboration and multi-site testing…(Gould 2005, p. 97)". The story of how we have setup our pilot studies is important, because the Copenhagen-Guwahati setup illustrates that what counts as a "usability test situation" might change when we move to new symbols, users and contexts.

Did we gain anything from framing our research in as field experiments in different settings? An analogy may help: in a study of the effectiveness of laboratory usability tests versus on-site usability tests, the researchers concluded that it wasn't worth the additional resources to do field trials as nearly all relevant usability problems were found in the laboratory test (Kjeldskov et al. 2004), a finding later supported by other researchers (Goodman et al. 2004). The researchers also reported that some of the on-site test users expressed concern about the validity of data entered into the system, and whether it had been correctly saved in the database, which actually was a critical usability problem since the on-site was a hospital, the users were nurses and the data were patient-information. The analogy to the conduct of HCI research should be clear: maybe research conducted at western universities may answer nearly all relevant questions regarding the use of UEMs, but finding the real critical problems of international usability testing require that the research take point of departure in a deep understanding of the possibilities for the use of UEMs in the on-site situation.

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Impact of user's aspirations on choice of interface: towards validating Indian Psychology Perspective

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Abstract

This paper reports an experiment conducted towards validating the Indian psychology's perspective of *Sanskar* (residual imprints of repeated behaviour leading to motivation for next deed) as a vital player in individual's preference of interfaces. Preferences of 800 Indian University students for a given task from four alternatives suggestive of different cultures were collected and validated against their reported aspirations. A high correlation was found which is in accordance with the Indian Psychology's perspective of the user. Paper further discusses the implications of other Indian traditional psychological framing of the user in context of HCI.

Keywords:

Indian Psychology, Samskar, Interfaces, HCI.

Language issues in cross cultural usability testing: a pilot study in China

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ABSTRACT

In this paper we report one field experiment on the effect of language issue (Chinese vs. English), and the effect of power distance between evaluator and user on usability testing process of a localized clipart application, 12 participants from China, Swede, and Denmark formed 7 pairs of evaluator-test user. Test users were asked to design a wedding invitation for him/herself with a cultural clipart organizer, which was developed by researcher themselves. Evaluators were asked to conduct the whole usability test, and try to find usability problems. All the participants' conversation, behavior, and screen operation were recorded by behavior observation system with digital camcorders, and coded. Results showed that Speaking Chinese made evaluator giving more help, telling more introductions in detail, and encouraging users more frequently; Speaking English asked evaluator and user look at each other more often to make themselves understood, and evaluators paid more attention to check task list. Power distance also had effect on evaluators and users. When evaluator's title were higher than users, the evaluator would pay more attention to users' doing, would not like to give user more detailed instruction, usually loose more communication with user, and spent less time for task management. In contrast, talking to evaluators with higher rank, users tend to use more gesture to express themselves. The paper ended with a discussion of why users were not affected by speaking different language, and did user really think aloud, not only describe their screen operation aloud during the test session?

1 Introduction

With the progress of economic globalization, more and more international enterprises start to do usability test in different cultures during the last decade. In China only two, or three years ago, usability was quite a new word for most of people. Right now the situation has been changed dramatically. Many domestic enterprises have reckoned the importance of usability test for their products, especially for IT business. Foreign enterprises need to understand Chinese users, and Chinese enterprises need to understand western users. Since China is not an English speaking country, like India, and Singapore, and most users in China can't speak English at all. It brings the biggest communication problems when conducting usability test by international moderators.

There are several choices to avoid this problem. The first is using bilingual moderators to test user. The second is finding users who can speak English. But both professional moderators and English speakers are very rare in China, and they all are youth and probably with western education background, it means that there is no way to get the real feedback from all kinds of users in China. So the third and the most regular way they do is that, they use both remote and local moderators working together with Chinese users to ensure they really get the feedback from the right users and understand it.

Local moderators here mean someone who got training in Human Factors, or had working experience on usability test for at least one year in China. They usually can't speak English very well. Remote moderators mean someone who got training in Human Factors and had experience on usability test for at least one year in foreign countries. They usually can speak English and their hometown language very well.

Research design

Previous studies on cross cultural usability evaluation show us that culture broadly affects the usability evaluation processes. In the proposal of cross cultural usability test project, we try to address broad issues need to be investigated. The primary questions are how to avoid cultural bias in requirements elicitation and usability data collection, and what user based evaluation methods address cultural diversity in both the moderator and user? Before we can answer them completely, First thing we need to do is to find what kinds of cultural factors could affect usability test. In this paper we investigated specifically two factors: one was language, and the other was power distance.

The reason why we picked language as a factor to be investigated is that, language is a kind of representation of culture. And language situation among India, European countries, and China is totally different. Although English is not hometown language for Indian and Danish either, most people in these two countries can speak English very well. But in China few people can do it well. Therefore, if conducting usability test in China, First thing you have to do is to change the testing interface into Chinese. We usually say if someone is speaking English, he/she must be thinking in English. So, by which language test user and evaluator choose during the usability test, they probably think in the way of that language. It means that speaking different language could affect the process of usability test even if all the participants are Chinese.

Since China is a kind of society with very clear and strict hierarchy. Different kind of relationship between evaluator and test user could cause different results. So, power distance is considered as another factor.

The following section will describe the methodology, results, and conclusion of the pilot study and discusses the findings on language issue.

Materials

The pilot study was based on the 'usability test of cultural clipart' paradigm (Clemmensen, 2005). Here cultural clipart was a collection of culturally specific images and icons and several text documents with preformatted invitation text. The application was aimed at supporting a test user in the design of invitations. In this study, test users were asked to make a wedding invitation for themselves.

Totally 150 images and icons with wedding symbols were selected and saved in a subfolder with the name “Chinese clipart” in My Collections, in which 20 image and icons with Korean and Japanese symbols and another 10 with western style were mixed with others as interference (see table 1) to increase the chances of measuring culturally specific interaction between test user and evaluator.

Test user could access the images in “Chinese clipart” folder with Microsoft’s clipart organizer.

Table 1. Potential usability errors in Chinese Cultural Cliparts

Culturally wrong symbols	*Label errors*	*Invitation text errors*
A Korea flag in the collection		Wrong time
An image of cherry flower (Japanese national flower)		Wrong place for wedding banquet
Image of bride in traditional Korean wedding dress		Wrong name and tittle
Japanese rope node		Wrong telephone number

Procedure

The pilot study in China had the same three phases like the other two experiments did in Denmark and India: phase one was Questionnaire phase which gave us the information about the experience of the user and evaluator; phase two was Usability testing of the Cultural Clipart application with Microsoft word. This phase included two parts, first was the testing, and second was interviewing the test user by evaluator. The third phase was the interview phase: the researchers interviewed the evaluator and test user on the basis of their observations during phase two.

The whole experiment was conducted at a standard usability lab in Institute of Psychology, which included one test room with several video camcorders installed in different viewpoints, and one observation room with one-way mirror between the two rooms. All the conversation between evaluator and test user, their behavior, and the screen events were recorded by four-channel behavior recording system.

Participants

Table 2 showed the basic information of all the seven evaluator-user pairs. Here all the test users were chosen from China. They are young staff, or graduate students studying in the Institute of Psychology, which ensure them all familiar with think aloud technology, and speak good English. The evaluators were chosen from

Europe and China. Only one evaluator who was from Swede had not any knowledge about usability. But he got half an hour of training before he conducted the usability test. Since there is few people in China now could be treated as professional usability test leader, one of the evaluator was used three times with different test users.

Table 2. Description of participants

Name	*Role*	*Age*	*Gender*	*National culture*	*Language used in the test*	*Expertise in usability test*
Yanfang	Evaluator	34	F	China	Two in English One in Chinese	Professional
Su	Test User	31	F	China	English	
Xianghong	Evaluator	37	F	China	English	Professional
Xiuling	Test User	25	F	China	Chinese	
Torkil	Evaluator	45	M	Danish	English	Professional
Ning	Test User	27	M	China	English	
Yiner	Test User	29	F	China	English	
Wei	Test User	27	M	China	English	
Qingxin	Evaluator	25	F	China	Chinese	Non- professional
Jiaoyan	Test User	24	F	China	Chinese	
Christian	Evaluator	27	M	Sweden	Chinese	Non- professional
Haicheng	Test User	23	M	China	Chinese	

Table 3 showed different combinations of evaluator-user relationship.

Table 3. Participants' relationships

Cultural Pairing	*Status*	*Age Relation*	*Language*	*Gende r*
Chinese Chinese	Prof. – Prof.	Young-Young	English – English	F- F
Chinese Chinese	Prof. – PhD student	Young-Young	Chinese – Chinese	F- F
Chinese Chinese	Prof. – PhD student	Young- Young	English – English	F- M
European Chinese	Prof. – Prof.	Older–younger	English – English	M - F
Chinese Chinese	Prof. – PhD student	Young - Young	English – English	F - M
Chinese Chinese	PhD student – PhD stud	Young- Young	Chinese – Chinese	F - F
European Chinese	Bachelor – PhD student	Young- Young	Chinese – Chinese	M- M

Data analysis

Coding system Watching evaluator and test-users' conversation and behavior, it's found that, even for a single event, for example, silence, the duration of the event last were varied from several seconds to several minutes. But in the original coding system used in India and Denmark experiments, no matter how long the event lasted it was count as once. It brought us two problems. First, how long the event last could be treated as one event? Secondly, when we found the number of silence for one evaluator-user pair was higher than that of another pair, did it mean the former pair had more silence than the latter? It's probably not true. If the former pair fallen into silence 10 times during the test, and it last around 30 seconds each time, the total time in silence is 300 seconds. If the latter pair in silence twice, and 5 minutes each, the total time was 10 minutes. So the real situation could be opposite.

In order to eliminate the system error we encode, a chronological coding system was developed, by which we encoded the behavior data by time period instead of by event. Each time period last 10 seconds. For example, if the usability test lasted 20 minutes, there would be 120 time points were coded. Therefore, times that an event happened during the test must be equivalent to how long that user or evaluator spent on that event.

Since the focus of our study was the process of usability test, especially the interaction between user and evaluator, in the chronological coding system, evaluator's conversation, evaluator's behavior, test user's conversation, test user's behavior, and screen operation were all coded. (See Appendix. Coding system)

Language Effect The first row in Table 4 showed how many time points for each evaluator-user pair were coded. The third row illustrated which pair spoke Chinese (C), and which spoke English (E). Here the focused issue was whether for Chinese people speaking English, not native language – Chinese, would make the test process different. Since there was one European participant in the pair No.2, and pair No.3, we only do analysis with the other 5 Chinese-Chinese pairs.

Table 4 classification of participant pairs and the test duration for each test pair

E-U	1	2	3	4	5	6	7
Number of time points for coding	345	131	181	134	189	295	199
Test session duration (mins)	88	20	30	20	31	49	33
Language they used	C	C	E	E	E	C	E
Status (at same level, or not)	same	same	same	no	same	no	No

Table 5 showed different content of evaluators conversation. From the data, we found most of time evaluators were keep silent. But in speaking Chinese condition, silence kept longer than speaking English. Numbers of reminder kept the same between the two conditions. Numbers of affirmative express, and answering user's questions didn't show any clear trend. But under Chinese condition, evaluators tend to give more help, tell more introductions in detail, and encourage users more frequently.

Table 5 classification of evaluators' conversation

Language	Chinese		English		
	1	6	4	5	7
1 Affirmative express	12	8	52	1	16
2 Remind user keep thinking aloud	3	1	1	0	1
3 Tell user what is next step	**25**	**12**	2	7	17
4 Interrogative express	5	15	5	2	8
5 Answer user's question	33	4	3	1	18
6 Help out	**15**	**15**	1	9	0
7 Encourage user	**6**	**9**	2	0	0
8 silence	243	225	68	169	138

Table 6 showed different kinds of behavior of evaluators during the test. It's found watching PC screen was the most behavior. The second most behavior was checking task list to find what was the next step, or to ensure everything was done. Chinese evaluators seldom expressed their thought with gesture. They didn't turn their face only to look each other with user either. But when watching PC screen they did have a look of the user. Comparing the two language conditions, evaluator when speaking Chinese didn't do so much on task management as they did when speaking English. And English condition asked evaluator and user look at each other more times to make themselves understood. In addition, under English condition, evaluators paid more attention to check task list.

Table 6 classification of evaluators' behavior

Language	Chinese		English		
	1	6	4	5	7
1 Turn face to user	0	0	0	**1**	**2**
2 Express himself with gesture	0	0	0	2	0
3 Watch PC screen	295	111	125	208	162
4 Task management	14	20	**61**	**33**	**15**
5 1+3	28	3	**3**	**34**	**6**
6 2+3	1	0	**0**	**9**	**10**
7 1+2	2	0	0	0	1
8 1+2+3	5	0	0	8	2

Combining the above two results we found speaking different language affected evaluators' behavior. Speaking Chinese made evaluators easier to give help and more detailed instruction. And speaking English made evaluator and user have to look at each other more frequently to ensure there was no misunderstanding between them.

Table 7 and Table 8 showed user's conversation and behavior. From Table 8 it's found that, user didn't use gesture either, and seldom look back to evaluator.

Different from Table 6, user never spent time on task management. That meant they didn't check what task should do next. They gave the responsibility totally to evaluator.

Table 7 classification of test-users' conversation

Language	Chinese		English		
	1	6	4	5	7
1 evaluation	21	21	16	36	24
2 suggestion	0	0	0	3	0
3 explanation	0	1	0	1	0
4 question	20	3	7	9	25
5 description	115	72	87	116	57
6 confirmation	29	2	5	24	16
7 silence	159	15	73	99	73

Conversation of user was classified into 7 types. From Table 7, we found that users didn't have so much silence as evaluators had, which was what users were supposed to do. Only one user made suggestion to the clipart organizer. Chinese users didn't explain how did he/she think, and why he/she picked this picture, not that one. What he/she spoke out mostly were what he/she was doing. So they just described their screen operations to evaluator.

Table 8 classification of test-users' behavior

Language	Chinese		English		
	1	6	4	5	7
1 Turn face to evaluator	0	0	1	2	0
2 Express him/herself with gesture	0	0	0	0	0
3 Watch PC screen	338	86	188	271	156
4 Task management	0	0	0	0	0
5 1+3	7	1	0	15	0
6 2+3	0	38	0	2	33
7 1+2	0	3	0	2	2
8 1+2+3	0	6	0	1	6

Comparing the two language conditions, there seemed no difference exist on the amount of evaluations to Chinese clipart, amount of questions, descriptions, and confirmation. So for users, whatever language they spoke, it didn't affect their conversation content and behavior.

Power distance Reviewing all the participant pairs, we found two of them were student-student pair, another two of them were professor-professor pair, and the other three were professor-student pairs (See the last row in Table 4 and Table 3). The first four pairs were treated as at the same status level. In each pair there was not power distance exist. The last three pairs were treated as at different level of status. Professor as evaluator in think aloud session was at least one layer higher than student.

Table 9 and Table 10 showed the evaluators' behavior at different groups. From the data in the two tables, we found if evaluator's title were higher than users, the evaluator would more like to ask user what was he/she thinking at that time, would not like to give user more detailed instruction, and didn't remind user so much on keep thinking aloud as evaluator at the same level with user did. In addition, from the Table 10, evaluator with higher rank would loose more communication with user, and spent less time for task management.

So, evaluator's status had affected the interaction between user and himself.

Table 9 effect of relation ship between evaluator and user on evaluator's conversation

Status	Same level				Different level		
	1	2	3	5	4	6	7
1 Affirmative express	12	5	49	1	52	8	16
2 Remind user keep thinking aloud	**3**	**7**	**1**	0	1	1	1
3 Tell user what is next step	**25**	**10**	**22**	**7**	2	12	17
4 Interrogative express	5	9	2	2	**5**	**15**	**8**
5 Answer user's question	33	1	10	1	3	4	18
6 Help out	15	2	3	9	1	15	0
7 Encourage user	6	0	3	0	2	9	0
8 silence	243	93	89	169	68	225	138

Table 10 effect of relation ship between evaluator and user on evaluator's behavior

Status	Same level				Different level		
	1	2	3	5	4	6	7
1 Turn face to user	0	6	4	0	0	1	2
2 Express himself with gesture	0	0	0	0	0	2	0
3 Watch PC screen	295	81	69	125	111	208	162
4 Task management	**14**	**11**	**65**	**61**	20	33	15
5 1+3	**28**	**17**	**23**	**3**	3	34	6
6 2+3	1	2	13	0	0	9	10
7 1+2	**2**	**7**	**2**	0	0	0	1
8 1+2+3	5	3	3	0	0	8	2

Table 11 and 12 showed the difference of users' behavior between participants at same level group and at different level group. It illustrated that, users in No.2 and No.3 gave more explanation to their evaluators, paid more attention to task management, and had more face-to-face communication with evaluators. But it didn't mean that user with the same title would give more communication and explanation than user with lower title would do. Since the evaluators in participants pair No 2 and 3 were from European countries, probably it's because they were foreigners, users in this two pairs had to explain more, and had more face-to-face communication.

But in the Table 12, there was a power distance effect showed in row 6: watching PC +communicate with gesture. When evaluator's rank was higher, users tend to use more gesture during the test session. What could be the reason? When we went back to review the videotapes, we found evaluators with higher rank would sit a little farther with user than they did in another situation, and users felt a little nervous when they talk to evaluator with higher rank. It could be the reason.

Combining the data from user and evaluator, we can say power distance affected not only e valuators' behavior, but also the users. But in this study, there was another factor involved with the power distance factor.

Table 11 effect of relation ship between evaluator and user on user's conversation

Status	Same level				Different level		
	1	2	3	5	4	6	7
1 evaluation	21	7	28	16	21	36	24
2 suggestion	0	0	1	0	0	3	0
3 explanation	**0**	**3**	**5**	**0**	1	1	0
4 question	20	8	15	7	3	9	25
5 description	115	55	107	87	72	116	57
6 confirmation	29	8	16	5	2	24	16
7 silence	159	39	9	73	15	99	73

Table 12 effect of relation ship between evaluator and user on user's behavior

Status	Same level				Different level		
	1	2	3	5	4	6	7
1 Turn face to evaluator	0	5	0	1	0	2	0
2 Express himself with gesture	0	1	0	0	0	0	0
3 Watch PC screen	338	98	143	188	86	271	156
4 Task management	0	**13**	**14**	0	0	0	0
5 1+3	**7**	**12**	**10**	0	1	15	0
6 2+3	0	1	10	0	**38**	**2**	**33**
7 1+2	0	0	1	0	3	2	2
8 1+2+3	0	0	3	0	6	1	6

Discussion and Conclusion

Comparing with the results in pilot studies in India and Denmark, we didn't find much data related to comments, especially to culture. Only when evaluator was from another country, not from China, users would explain more about his/her choices of pictures and icons (see Table 11). It implied that when evaluator and user came from same culture background, although the test session could go through very quick and smoothly, they could probably miss some cultural usability problems. Another reason could be that, users were not get used to the way of think aloud, especially in process of design. Five of seven users mentioned in the follow up session that they were not satisfied their wedding invitation design because of the time pressure. For this point, we need rethink the experiment design including the wedding invitation task, and the think aloud method.

Although there were three phases for each participant pair, we didn't analyze the amount of usability issues that evaluator found. That because in this study, one evaluator was used three times, the number of usability problems she found was cumulated test by test. So there was no way to compare them between different conditions.

Another reason for that, when we go back to the original videotapes, we found not any user found the invitation text error. Many user did noticed some culturally wrong symbols in images and icons, but they didn't mentioned them until evaluator asked them pick them up. So, after the think aloud session, when researcher asked users the reason why they couldn't find the culturally wrong things, they told us they were so concentrated to fulfill the whole task so that they missed out all the details. And sometime although they noticed the wrong picture, but what they were asked to do was find an appropriate one as a decoration, so they thought it's not necessary to point it out.

From the data shown in Table 7 and 8, there was not much behavior difference whatever users spoke Chinese, or English. It probably didn't mean that there was no influence of language on users. As mentioned before, it might because of the task requirement asking users doing what they did not do usually. The effect of task difficulty might have impact on the effect of language.

So, let's look back to the users' think aloud behavior (Table 7), and calculate the percentage of each kind of conversation content. We found Chinese user spent about 30% of time on silence, another 30% of time on description, the other 30% on other contents, such as asking question, and evaluate the interface. The question is that, do we think keep talking about 60% of test time mean a real think aloud? Do we think half of talking time were spent on describing what he/she is doing is really a think aloud? Is it true that what a person's doing is what the person's thinking? Do we need to give more training before we start the usability test session? All the questions need to be answered in further study.

Briefly we can make conclusions here that, speaking different language and power distance affected the process of usability test. Speaking Chinese made evaluator giving more help, telling more about introductions, and like encouraging users more frequently; Speaking English made evaluator and user look at each other more often to make themselves understood, and evaluators paid more attention to check task list. When evaluator's title were higher than users, the evaluator would pay more attention to users' doing, would not like to give user more detailed instruction, usually loose more communication with user, and spent less time for task management. In contrast, talking to evaluators with higher rank, users tend to use more gesture to express themselves.

Differences in task descriptions in the think aloud test

- a proposal for a small scale research experiment.

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Abstract

When looking through the literature of user testing there seems to be at least two different ways that recommendations for the test scenarios are described. One type favors descriptions of tasks where another favors identification with a user and specific situation. This research proposal suggests studying the implications of the differences in procedures. Does it have an impact on the test results if you use one or the other of the two? Are there differences in who prefers one or the other? If differences exist, can these be explained with theories of cultural differences?

Introduction

The literature that deals with the practical implication of the think aloud test describes the test set-up, but has limited descriptions of how the tests are to be implemented in detail. Looking through literature that introduces the methods to students (Jordan, 1999; Molich, 2001; Nielsen, 2000; Nielsen & Mack, 1994; Preece, Rogers, & Sharp, 2002; Preece et al., 1994; Rose & Sørensen, 2004; Rosson & Carroll, 2002; Shneiderman & Plaisant, 2005; Snitker, 2004) of guides for usability testing it was only possible to find three thorough descriptions of how to perform the test that included task descriptions while (Snitker, 2004) briefly mentions the demands to the written tasks. He mentions how to use the test person's imagination, but not a specific situation, a task description could start with "imagine you are to borrow a certain book" (pp. 104).

The following examples are from three textbooks:

Preece and Rogers (Preece et al., 2002) pp 434 gives an example of a procedure for user testing of a library of Medicine with health care practitioners:

"I'd like you to imagine that it's something you or someone close to you needs to know"
The tasks are described as following:

- Task 1: find information about whether a dark lump on your shoulder might be skin cancer.
- Task 2: find information whether it's safe to use Prozac during pregnancy.
- Task 3: find information about whether there is vaccine for Hepatitis C.
- Task 4: Find recommendations about the treatment of breast cancer, specifically the use of mastectomies.
- ……

In contrast Rolf Molich (Molich, 2001) pp 131 suggests writing a kind of script, a story that connects the different tasks. He gives the following example from a test of the DSB (transport) website. (Authors translation).

1. Find the DSB website
2. You are going from Høje Taastrup to Aarhus for a meeting on Friday. The meeting begins at 12.30 and there are approximately 15 minutes by cab from the station to the place where the meeting is held. When do you have to leave Høje Taastrup?
3. What is the price of a return ticket?
4. …..

Similar to Molich, Rosson and Carroll describes a role and a story (Rosson & Carroll, 2002) pp. 259 that the test person has to identify with. The introduction informs the user that the tasks are "introduced with a story line that describes the role and the situation we would like you to adopt". And the task instruction is described as follows: "imagine that you are Mr. King, an experienced science teacher (….). You are advising Sally Harris on her black holes project (…)"

The task is described

"Task 1
Find out the exhibit components Sally is working on and synchronize your views with hers.
Task 2
While sally works on her Title Page, upload the Word file "Bibliography.doc" (on your desktop) into the exhibit element named "Bibliography".
…."

I will in the following coin the two variations of procedures for scenarios *the task focused procedure* and *the scenario focused procedure*.

Method

As yet I have not decided on a set-up for the research proposal, but I view this as something that could be an integral part of other research questions and experiments.
I hope to be able to discuss the research set-up in the symposium and invite participants to comment .

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Emphasis on non-verbal cues for interpreting cognitive processes in protocol analysis

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The 'think-aloud' technique is being employed extensively by usability labs towards performing usability testing of software products. In this paper, we examine its limitations in analysing the cognitive process of the user, if it is applied classically. We shall discuss the classical model of Ericsson and Simon and indicate how recent studies have found its application inadequate in usability testing. In this paper, we posit that the inadequacy can be partially overcome by accompanying the analysis of verbal protocols with semantic interpretations of non-verbal (kinesthetic) cues of the user, produced while performing the task. The gestures, body language and facial expressions, which comprise the kinesthetic cues, of the user are natural and accompany the communication independently. Although verbal protocols give an account of the user's cognitive processes overtly, here we argue that the subtleties of the cognitive processes can be interpreted through the semantics of kinesthetic cues.

Introduction

During usability testing, the aim is to observe people using the product in as realistic a situation as possible, to discover errors and areas of improvement. Usability testing usually involves a controlled experiment to determine how well people can use the product. Hence it requires a method to study subjects' cognitive processes while performing the task. Ericsson and Simon's 'think aloud' technique allows probing the user's cognitive process.

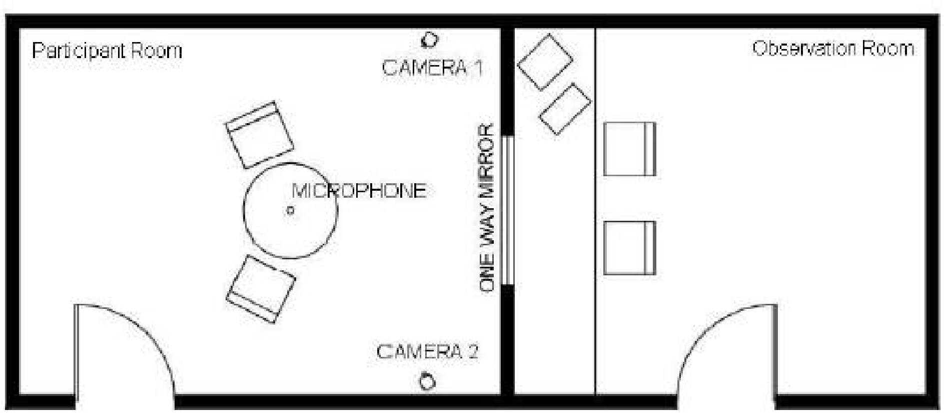

Fig 1. The controlled environment is provided in usability labs. The participant and the evaluator are in the participant room while the observers observe through the one way mirror, sitting in the observation room.

Ericsson and Simon's model

Someren et. al [1] explains the think aloud model as one in which the participant is asked to talk aloud, while solving a problem and this request is repeated if necessary during the problem-solving process thus encouraging the participant to tell what he is thinking. Thinking aloud during problem-solving means that the participant keeps on talking, speaks out loud whatever thoughts come to mind, while performing the task at hand.

The assumption is that, mentioned by Neilsen J et. al [2], everything we know has, at some point, gone through our short-term memory (STM) and we have been conscious of it. We can verbalise what we perceive while in the process of perceiving, and we can verbalise what we were conscious of.

The participant is encouraged to give a concurrent account of his thoughts and to avoid interpretation or explanation of what he is doing; he just has to concentrate on the task. The verbalizations are modeled into three levels by Ericsson and Simon [3]:
Level 1: Vocalisations of thoughts that are already encoded in the verbal form eg. mathematical symbols (talk aloud).
Level 2: Verbalisation of a sequence of thought that are held in memory in some other form, e.g. visually (think aloud)
Level 3: Other verbalisations (retrospective reports on thoughts not held in memory).

For Ericsson and Simon, it is primarily talk aloud and think aloud that are of interest, because these verbalisations express the content of short-term memory. Retrospective reports are only interesting as cross checks (not as anything that can make contributions), and only if carried out under conditions that may elicit information from STM.

They wanted to reinstate verbal data as a valid resource for understanding human cognitive processes to make it (a) possible to use verbal data to verify, provided (b) that verbal data was interpreted within a theoretical framework.

Applying think aloud technique in usability testing
The evaluator should follow the following while practicing ‘think aloud’ in usability testing, Boren et.al [4]

a) Participant introspection must not be valued. The level 1 and level 2 data should be used – as hard data.
b) The evaluator should give detailed initial instruction for thinking aloud to the participants that they should speak “as if alone in room” without regard of coherency and they shall be reminded whenever they fall silent.
c) The evaluator should remind participants to think aloud: A successful reminder should result in the immediate resumption of thinking aloud, without pause for reflection or retrospection. Eg. “Keep talking” is Ericsson and Simon’s recommended reminder.

There is no detailed description in usability literature of theoretically motivated rules of practice for thinking aloud; some sources cite a theory but then suggest inconsistent procedures. Without a firm theoretical grounding in and unified practice of this key technique, it could be argued that usability practice is not governed by a framework of principles of inquiry. This is why there are different degrees of intervention by the evaluator and different research motivations. Interventions range from completely “passive, unobtrusive” to “pragmatic flexibility” to “full partnership”.

Hence following discrepancies are found on part of the evaluator's role in practice of think aloud technique [4]

a) they often do not give think aloud instructions
b) they do not explain difference between explanation and think aloud
c) they do not give reminders in the prescribed manner

The Ericsson and Simon's model values "hard" (level 1 and level 2 data) data which can be used to validate hypothesized cognitive models, in their model under no circumstances are verbalizations to be valued for their subjective content. This eliminates the useful data.

Inadequacies found in the technique

Branch [5] explains that participants found the following to hinder the process of producing concurrent verbal protocols:

a) experimental task directions that elicit an inappropriate level of verbalization
b) limited short-term memory capacity for talking and attending at the same time
c) hearing one's own voice
d) learning that occurs because thinking out loud increases subjects' critical attention to their activities
e) direct or indirect experimenter influence through verbal or nonverbal cues
f) think faster than they can speak, that their thought processes are much more complex than they can verbalise.

Hence, thinking aloud interferes with their interaction with the interfaces and the task.

Boren et. al [4] explain practicality of the usability test setups. Much of the cognition that is of interest is manifest not only through verbalization but also through interactions with the systems. The system being tested in usability testing is likely to display variability of behavior. Ericsson and Simon model does not consider some of the contingencies they regularly face in usability session – computer system crashes, software bugs and incomplete prototypes that require frequent and sometimes extended intervention all of which interrupt the monolog required by Ericsson and Simon's model research questions that are task-system focused instead of cognition focused. These contingencies are hostile to pure form of Ericsson and Simon's model.

Steps to make most out of the think aloud sessions

The Information Resource Management, University of Colorado [6] gives certain points about the usability practice.

Establish rapport: The evaluator should take some time to establish a rapport so that the participant will feel comfortable during the test.

Establish the context: The evaluator should explain how usability testing is part of the design and development process and ask the participant to verbalize their thoughts as they perform the tasks on the list. The participants should be made clear that they are not being tested; instead it is the system that is being tested.

It is of utmost importance for the usability evaluator to make the participant feel comfortable and at ease. After having developed a rapport with the participant and initial dry runs of think aloud, there are chances of the participant and evaluator entering into a comfort zone of communication. The repeated reminders and tone (eg. mmm, ok) given by the evaluator encourages participants to continue. During 'think aloud', the participant is expected to speak his/her mind while performing the task with full concentration. The evaluator is merely required to observe the pattern of usage and the verbalizations to later infer the cognitive process. However the evaluator may as well ask the participant certain pertinent questions to probe the participant's cognitive process.

Keeping in consideration that there are several kinds of participants like those who are shy or chatty; there are various situations like when the participant gets stuck, or the participant avoids vital functionality [4], the evaluator can play an important role in the smooth completion of the task. The hypothesis is that a communication may work better than a monologue to elicit verbal protocols. However, it is the evaluator's responsibility to judge the level of intervention and communication to enter into. It is worth noting that the usability testing requires judging the satisfaction level which is a subjective value. These can be achieved if the evaluator can read the non-verbal cues of the participant.

Non-verbal cues

Body movement, facial expressions, gestures comprise the non-verbal cues. The ability to read a person's attitudes and thoughts by their behavior was the original communication system used by humans before spoken language evolved. Ever since Charles Darwin published his scientific study –Expressions of the Emotions in Man and animals in 1872, Body language as an outward reflection of a person's emotional condition has been probed by researchers in disciplines ranging from anthropology to ethnography. Each gesture or movement can be a valuable key to emotion a person may be feeling at a time. What people say is not always what they mean or are feeling. [7]

According to Korchin [8] a gesture can seem as an intentional act of communication. Gestures along with bodily movements, postures, gait, facial expression and non verbal speech patterns can unintentionally yield information.
Way back in 1968 Mahal [9] found that personally meaningful gestures reappeared periodically during interviews. Mahal noted four types of relationships. Some movements had the same meaning and occurred simultaneously with verbal activity. For example an upward palm gesture is a communicative act with a culturally shared meaning. Some gestures were not related to the verbal content but foretold later implications of current themes. The third type of gestures betrayed meanings contrary to concurrent verbal content. The fourth type of gestures was clearly indicating interplay to communicate either sympathy or empathy.

Some examples of analyzing non-verbal cues as listed down in Pease et. al [7] Especially arms and hand gestures are illustrated bellow.

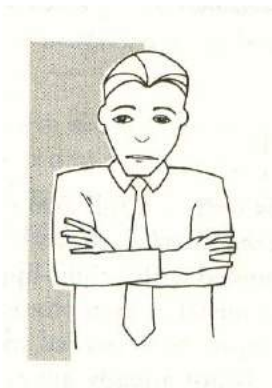
Fig 2


Fig 3


Fig 4

- Arms across the chest indicate that we're protecting ourselves or we're cold. (Fig 2 and Fig 3)
- Open hands and arms, especially extended, indicate importance.
- Hands to the mouth might indicate that we're hiding something.
- Resting hands on the chin and allowing eyelids to droop indicates boredom or tiredness.
- Stroking the chin indicates contemplation or thought. (Fig 4)
- Crossed legs may signal disagreement and self-protection. (Fig 4)
- Sloppy posture occurs when we're too loose.
- If we're too stiff, we appear tense and stressed.

Certain subjectivities can be understood through the non-verbal cues
<u>Readiness and enthusiasm</u>: When people are ready to take action, they will often sit forward in their seats or stand with their hands on their hips. They are anxious to get going. They will stand or sit in an erect position. They are alert, with wide, bright eyes. Their body motions are alive and animated.

<u>Frustration</u>: People are seen doing these gestures: hand-wringing, running fingers through hair, clenching hands or jaw, an exasperated sigh, or tension in the small muscles of the face.

<u>Nervousness</u>: Nervous people cover their mouths when they speak. Their voices are often high and may even break. Their speech is hesitant, and they use "ums" and "ahs" incessantly. They may clear their throats and wring their hands while looking down at their shoes. You may also see their facial muscles twitching as they shift back and forth on their feet.

Highlen and Hill (1984) [10] working in the area of counseling psychology have identified areas of study in verbal behavior as *paralinguistics*, *kinesics, facial expressions, visual behavior* , *proximics,* and *touch.*

Later day researchers from cultural anthropology and linguistics have added *occulesics, artifactics,* and *chronemics* to the list. Researchers like Albert Mehrabian [11] have held that transmission of message is effective only when all the three aspects of communication – the verbal (words - 7% impact) , the vocal (intonation, pitch ,volume - 38% impact) and the visual (gestures ,postures –55% impact) are in tandem with one another. It is posited in this paper that some of the nonverbal behavior can act as clarifiers of the communication that is happening in a standard think aloud protocol situation. Some of the cues are defined in the following paragraphs.
Paralinguistics deal with vocal cues that accompany speech. Different types of paralinguistic cues are pitch, tone, intonation, modulation, & speech rate.
Kinesics deals with postures, gestures, head -nodes and leg movements. There are three types: *emblem*– direct translation like nodes of head for 'yes'; *Illustrators* - emphasized action such as banging the table; *adopters* – unconscious moments of body like snapping knuckles, shaking legs.
Occulilesics involve eye movements . The Eye Accessing Cues indicate whether a person is thinking in images, sounds, self-talk, or through their feelings. Having this information enables us to communicate in a way that more effectively matches their current thinking style. Researchers in Clinical Neuropsychology [12,13,14] have dealt with relationship of eye movements with respect to recall of information and recognition. Neuro Linguistic programming practioners [15] have identified a Grid of three zones – upper, middle, and lower. These zones correspond to the visual, auditory and self-talk/feelings areas (for the majority of, but not all, people).

The upper zone of the Grid is the visual one and begins at eye level. If their eyes move or flick upwards this often indicates 'visual accessing' – this tells us that they may be visualising images.

The middle zone refers to 'horizontal' eye movements that look directly to the left or the right. These often indicate that the person is listening to remembered or invented sounds. The 'standard' eye movement directions based on as mappings by NLP co-developers John Grinder and Richard Bandler [15] are:

Vc - Visual constructed ***(Upper left corner)***		**Vr - Visual remembered** ***(Upper right corner)***
Ac - Auditory constructed ***(Lateral Left)***	**V - Visual Constructed/ Remembered** ***(Eye Level Normal)***	**Ar - Auditory remembered** ***(Lateral Right)***
K - Kinaesthetic ***Lower Left corner)***		**Aid - Auditory digital** ***(Lower Right corner)***

(Imagine this diagram ***superimposed*** *on the person's face. So their Visual Construct direction is to YOUR left as you face them.)*

Proxemics is the study of distance between people and objects. Essentially it is a study of space as an element in the interaction. Edward Hall an American anthropologist who coined the term defines proxemics in terms of four zones namely

(a) Intimate - which extends from 0 to 0.5 mts; (b) Personal – 0.5 to 1.2m ; (c) Social -1.2 to 3m; (d) Public – 3m.

Artifactics has been associated with the study of non verbal messages sent out by personal appearance, dress, accessories etc by the person.

Chronemics is related to the study of time and its relative understanding by the persons involved. Pauses, silences, response lag are some of the issues.

Non verbal cues and cultural differences

As much there are differences in cultures there are commonalities too. Nonverbal cues are cultural based . Ribbens & Thompson [16] have stated that people form the west are inclined to " think" primarily in terms of pictures, sounds and feelings where as in the east they 'think' in terms of smell and taste too. Roughly 45 % of population has primary preference for thinking in terms of feelings (kinesthetic) compared to 35% in terms of visual image and 20% in auditory form. For a researcher using think aloud tests in a multicultural situation, nonverbal cues that are to the extent of 35 % , if observed and analysed, either for commonalties or differences, can yield valuable insights which can supplement results from think aloud tests. In other words It is posited here that the subtleties of the cognitive processes, that the think aloud test yields, can be interpreted further through the analysis of semantics of accompanying kinesthetic cues.

Towards a framework for analysis of nonverbal cues: a proposal

Based on the literature studied and presented above a matrix consisting of the cues is proposed bellow. This matrix can be used in addition to other variables for each frame / interaction / dialogue in a think aloud video retrospective analysis. Keeping the nature of think aloud test applications in HCI, especially in cross cultural situations, non verbal cues can be grouped under two main sets named here as primary and secondary. The primary set is proposed to consist of Kinesthetic, Occulesics, Paralinguistic and Chronemics cues. The secondary set are made of Proxemics, Artifactics, and Tactilics cues. Given the HCI set up of a closed door session mainly involving a computer screen (see Fig 1) the most sensitive variables have been grouped under the primary set and the variables that are likely to be less significant have been grouped under secondary set.

A documenting and measuring matrix for observing and noting one frame / instance or one scene on the video is proposed in table 3 bellow for the primary set of observable non verbal cues.

Scene 1	**Kinesthitic cues**			**Occulesics**	**Paralingusitics**				**Chronemics**
	Emblem	Illustrator	Adopter		Tone	Intonation	Modulation	Rate	Pauses / delay in secs
Dialogue 1									
Dialogue 2									

Conclusion

An analysis of the non-verbal cues of the participant by the evaluator are likely to enhance the fruitfulness of the think-aloud sessions. If the evaluator is briefed with possible gestures and their emotional/subjective content within their cultural biases, he/she can accordingly enter or retreat into communication with the participant. Participants feeling nervous can be made relaxed or those already in the enthusiastic mode need not be much intervened. Nonverbal cues can afford better rapport between the observer and the observed.

For a researcher using think aloud tests in a multicultural situation, nonverbal cues, if observed and analysed either for commonalties or differences, can yield valuable insights that can supplement results from think aloud tests.

A matrix for measuring, observing and documenting non verbal cues has been suggested .The matrix will document and aid the possible semantic interpretation of non-verbal cues as exhibited by participants during task performance in a think aloud test situation.

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A proposal for a repertory-grid study of differences in Chinese, Danish, and Indian conceptions of usability: Cultural usability?

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Abstract. This is an unrefined proposal for a study that could form part of the exploratory phase of the Cultural Usability project. The proposed study compares three cultures (Chinese, Danish, and Indian) and two stakeholder groups (users and developers) with respect to their conceptions of usability.

Introduction

The concept of usability has been debated for decades (e.g., Shackel, 1984; Hornbæk, 2006). Concomitantly, the diffusion, acceptance, and conception of technologies have been researched in, among others, the areas of diffusion of innovations (Rogers, 2003) and the technology acceptance model (Davis, 1989). However, much of this work under-recognizes that conceptions of technologies and their usability may be culture dependent. Typically, culture has not been considered at all. Recently, the importance of culture in relation to usability work has been acknowledged (e.g., Barber & Badre, 1998; Honold, 2000; Markus, 2002; Markus & Gould, 2000), and a concept of cultural usability is emerging.

The first aim of this study is to contribute to an elaboration of the cultural usability concept by investigating whether similarities and differences in people's conceptions of usability correlate with their cultural background. Cultural background is, in this study, taken to mean people's country of birth and residence.

The second aim of this study is to compare and contrast users' and developers' conceptions of usability. This is seen as interesting in its own right (see, e.g., Holcomb & Tharp, 1991) but also as a means of investigating whether the more prominent differences in people's conceptions of usability are between people from different cultures or between users and developers.

The study is currently a proposal, and further progress is dependent on participation from other people on the Cultural Usability project. To make matters concrete, the rest of this proposal is an incomplete and preliminary draft of a methodology section.

Method

To investigate the cultural aspects of usability empirically, we interviewed users and developers with three different cultural backgrounds about their conceptions of the usability of selected technologies. The interviews were based on the repertory-grid technique, which originates from Kelly's personal-construct theory (Kelly, 1955).

Participants

The participants were three groups of experienced software users and three groups of experienced software developers. Each group had eight participants. Groups were similar with respect to participants' age, gender distribution, and level of education. Further, the participants in the user groups had comparable levels of experience using software and the participants in the developer groups had comparable levels of experience developing software. The groups differed, however, with respect to participants' cultural background.

(This section should be extended with a description of the three user groups (Chinese, Danish, and Indian) and the three developer groups. Also, the section should describe how participants were selected for the study.)

Stimulus material

The stimulus material used in the repertory-grid interviews consisted of six images. Each image (see Figure 1) was colour printed on a separate sheet of paper and supplemented with a brief textual description. As an example, the upper, left image in Figure 1 was accompanied by the text "Google is a search engine for the

World Wide Web, providing access to billions of web pages by means of queries". All six images were instances of systems in the broad class of information and communication technologies.

(This section should go on by defining the set of images. Also, we must consider how we can ensure that participants know the technologies)

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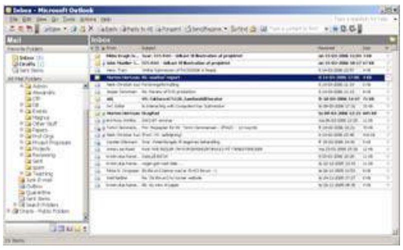	?
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Figure 1. The images used as stimulus materials in the repertory-grid interviews.

Procedure

Participants were interviewed individually. First, the study was described to the participants and the repertory-grid technique explained to them. Then, participants filled out a questionnaire with information about their background. After completing these preparatory steps, the actual repertory-grid interview was conducted. The interviewer placed three images (a so-called triad) in front of the participant and asked:

"Based on your experiences using these technologies, can you think of any way in which two of the technologies are alike and different from the third?"

The first part of the question emphasized the participant's personal experiences of the technologies and framed these in terms of his or her use of the technologies. The last part of the question, adopted from Kearns (1992), asked the participant to define a pair of images and state how this pair differed from the third image. Apart from indicating the pair, the participant was asked to provide an explanation for it. Explanations consisted of a word or short phrase defining the pair of images and another word or short phrase defining the contrasting image. This represents the construct for that triad. Once a construct had been elicited, the interviewer wrote the words/phrases as anchor points on a five-point rating scale and asked the participant to rate each of the six images with respect to that construct. The participant was also asked to indicate which end of the rating scale was the more positive.

After creating a construct for one triad, the interviewer presented the participant with a new combination of three images. This process was repeated for all 6×5×4 / (3×2×1) = 20 possible triads, in a randomly generated order. However, the process was aborted if the participant was unable to provide a new construct for two successive triads. If a participant came up with multiple constructs for the same triad they were treated sequentially. After completing the last triad, the participant was asked to rank the created constructs in order of importance, as suggested by Hassenzahl and Wessler (2000). Finally, the participant was debriefed and thanked.

Participants were interviewed by a person from their own culture. Interviews were conducted in English or the participants' native language, consistent with the individual participant's preference. The words or short phrases defining the two poles of the constructs were, however, always formulated in English. The interviews lasted an average of X minutes.

Data analysis

The data analysis will probably involve:

- Qualitative analysis
- Analysis of individual people's repertory grids with RepGrid or WebGrid (see http://repgrid.com/RepIV/)
- Factor analysis of multiple people's grids with SPSS (see Bell, 1997)

In addition, Baber (1996) describes a lightweight approach to analysing individual people's repertory grids.

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Is a smile really a smile anywhere in the world? (Measuring user pleasure)

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ABSTRACT
In the search for product and service discriminators, our notion of usability may have to expand beyond user performance to include user pleasure. However, measurement of user pleasure as part of a usability test is not yet standard practice. This paper reviews various approaches to measuring user pleasure, the problems associated with putting the measures into a usability test paradigm, and the new technologies that make some of them more feasible today for wider use.

INTRODUCTION

As the information systems world increasingly comes to endorse usability or ease of use, we must begin to consider what's next for us human factors engineers. If competing products are equally easy to use, what then will be the discriminator? Patrick Jordan (2000) and others have argued that the discriminator of the future may well be hedonic. Consumers will choose one product over another based on the pleasure and satisfaction that they experience in using the product. Ease of use being equal, products that are emotionally appealing and satisfying will be the most sought after.

The future that Jordan talks about will affect both design and what we now know as usability testing. My concern is that we are rather unprepared to meet the future of design and evaluation as Jordan envisions it. Therefore I thought it would be worthwhile at this conference to review some of the ways in which pleasure or displeasure is elicited by and can be manipulated in a product or user interface. The role of culture in determining what is considered pleasant is extremely important and is also discussed. Finally, what is the state of the art in methods for measuring user pleasure and satisfaction? Can we arrive at measures that are culture-free, that cut deep to something in the human psyche that, in all cultures, amounts to pleasure and satisfaction? Is a smile really a smile anywhere in the world?

CONNECTING GRAPHICS TO USER VALUES, ATTITUDES, AND LANGUAGE

The graphical images we portray in user interfaces, particularly web pages, are often loaded with social and cultural connotations, statements of values and attitudes. Users will react to the social and cultural content in images by either identifying with the values and attitudes depicted or by rejecting them. Comfort or discomfort, satisfaction or dissatisfaction, pleasure or displeasure, positive or negative emotional feelings will result. Graphics and images should be well-planned to match the social and cultural biases of the target culture. To illustrate, we will review two particular design problems for websites: 1) image-viewer relationships and 2) connecting images to language.

Image-viewer relationships

Whether we intend them to or not, the images and graphics we use in graphical user interfaces convey values and attitudes about human relationships. Every culture has a set of values and attitudes that surround face to face social interactions (Hofstede, 1997). Some cultures are characterized by hierarchies of authority which govern social interactions between the levels of society. Others emphasize equality in human interactions. Some value and encourage inclusiveness and group membership, while others value individualism. The sexes are considered equal in some cultures, while in others, males or females are dominant. The manner in which we depict people in images on the screen quite directly affects the user or viewer of the image (Kress and van Leeuwen, 1996). Just as people in different cultures have different attitudes toward social interactions, so too will people in different cultures have different affective or emotional reactions to the same image (Gould, 2001; Gould, Zakaria, and Yusof, 2000). They will be more or less comfortable with the image and more or less accepting of the graphical message.

What exactly is it about an image of a person or persons on the screen that users respond to emotionally and with culturally-determined attitudes and values? Consider three characteristics of the graphical image you put up on the screen:

1. Social rank and gender of the people depicted and the activity in which they are engaged.
2. The perceived or apparent distance of the user/viewer to the person in the image (manipulated by size of the image).
3. The position and orientation of the person depicted on the screen relative to the user/viewer (manipulated by viewing angle).

Kress and van Leeuwen (1996) developed a whole theory of graphic design around the notion that people emotionally react not only to the image per se, but also to the social relationships depicted in the image and to the perspective from which they are required to view the image. Gould (2001) has related specific aspects of the viewer-image relationship to Hofstede's cultural values and attitudes and derived a visual design grammar.

Social rank and gender. Images of people on a computer screen often depict their position in society and what they are doing. The people in the image could be authority figures, carrying out their work of managing subordinates, making money, wielding political power, etc. Or, the image could depict people on the same social level as the user or viewer. Two university web site home pages, one from Malaysia and one from The Netherlands, illustrate this. Malaysia is a culture that traditionally has recognized the inequality between the powerful and less powerful members of society and valued respect and deference to authority. Then, it is no surprise that the Malaysian university web site depicts university officials performing ceremonial duties, not students engaged in student activities. The images are well-tailored to the social attitudes of the Malaysian viewer. In contrast is the Netherlands, which traditionally is characterized by very few social barriers between levels of society. So it is no surprise that the Dutch university web site shows students instead of leaders, and the students are engaged in informal social behavior. Well-tailored to the Dutch and pleasant for them to view, but perhaps somewhat inexplicable to the Malaysian.

Perceived distance. Relationships of unequal power or authority are conveyed also by the perception of physical distance between the viewer and the person in the image. An image of a person in authority at a significant distance from the viewer (e.g. relatively small image on the screen) conveys aloofness, the impossibility of social contact. In contrast, "close-up" images of people tend to reduce social distance, suggesting that social interaction is within reach and perhaps even welcomed. The same two university web sites illustrate this characteristic of perceived distance. The university officials in the Malaysian web site are portrayed as a relatively small image on the screen, at a great apparent distance from the viewer. The images of students in the Dutch web site are much larger and at a much closer perceived distance.

Image position and orientation. All images of people on the screen have a specific orientation to the viewer in terms of two parameters: vertical angle and horizontal angle. Think of these as "camera angles". These visual angles have emotional connotations for the viewer that are culture-based. Consider first the vertical angle of an image relative to the viewer. A high vertical angle (positioning the viewer above the person in the image) conveys social power to the viewer. A low vertical angle (positioning the viewer "below" the person in the image) conveys social power and authority to the person in the image. Eye level vertical angles place the viewer on an equal social level with the person in the image.

Consider now the horizontal angle of the image to the viewer. Images that are positioned facing directly at the viewer and perhaps even making eye contact, draw the viewer into the group or activity depicted on the screen. In contrast, oblique image-to-viewer angles serve to isolate the viewer and exclude him from the group or activity depicted in the image. The latter effect can be used to further enhance the exclusiveness or position of the person in the image.

To summarize then, if we understand the cultural values and attitudes of our user, we can manipulate these characteristics of a graphical image on the screen to make the user feel comfort and pleasure with the interaction. Alternatively, if we use images carelessly we run the risk of creating a mismatch between his values and attitudes and the ones conveyed by the image on the screen. Offending the user or even making her uncomfortable reduces the chance that she will continue to browse the web site to the desired conclusion.

Connecting Images to Language

In 1996, fully 80% of web users spoke English as their first language (Luna, Peracchio, and de Juan, 2002). In the near future, only 30% of web users will have English as their first language (Crockett, 2002). Designing web sites in languages other than English will become increasingly common and the use of language an increasingly critical usability issue. But is language strictly a usability issue or does it also have implications for user pleasure?

DeGroot's (1991) theory of language and culture focuses on the semantic link between language and culturally-specific concepts and values. He theorized that words map to concepts and concepts have culturally-specific attributes or features. Thus a word may generally mean the same thing in two languages, but the semantics of the concept associated with it may be different. For example, the word "dinner" in American English means an evening meal that is quick. In French, the word for dinner "diner" has quite different associations of a long evening meal with family and conversation. This has lead Luna, Peracchio, and de Juan (2002) to propose a web design guideline that relates language to web site content. They suggest that allowing the user to select a local language is not sufficient. Rather, the content that follows the selection of a local language must be semantically consistent with the concepts and values of the culture. So a site in which all text has been translated from a foreign language into the user's first language may fall short of the mark if the content linked semantically to the text, particularly images, is not also modified to reflect the user's culture. Failing this, the user has to work too hard to connect the text with the less culturally familiar concepts presented in the images, etc. of the web site. Conversely, a web site with text in the user's second language may be rendered more effective and emotionally satisfying if the text is linked to content that reflects the user's own culture, rather than the culture associated with that second language.

MEASURING USER PLEASURE

Rating Scales

One of the more studied and validated scales of emotional experience is the Self-Assessment Manikin or SAM (Lang, 1985; Morris, 1995). The SAM classifies user emotional experience along three independent bipolar dimensions: pleasure-displeasure; degree of arousal (strength of the emotion), and dominance-submissiveness. Each dimension is presented to the user in the form of standard graphical characters which vary in their facial and bodily expression. For each dimension, the user selects the character that matches her emotional experience. SAM was validated against facial muscle responses by Lang, Greenwald, Bradley, and Hamm (1993). They reported a high negative and linear correlation between corrugator muscle response and ratings on the pleasure scale, but not the arousal scale. Zygomatic muscle response showed a U-shaped quadratic relationship to pleasure scale ratings. Zygomatic responses were highest at the highest pleasure ratings, lowest for neutral ratings, and slightly higher again the lowest pleasure ratings. There also was a strong linear relationship between zygomatic response and rated arousal level.

The SAM is quick to administer (requiring about 15 seconds to complete). Also it appears to be free of cultural influences, being based on simple graphical characters rather than human photographs or text (Morris, Bradley, and Wei, 1994; Bradley, Greenwald, and Hamm, 1994). It has been used primarily in advertising research. How could SAM be used in a usability test? Most simply, the user could be interrupted at regular intervals for 15 seconds to complete the ratings. But it might be more effective if each round of rating was closely connected to some event occurring in the user interaction with the presentation. For example, ratings could be prompted automatically by a new image appearing on the screen, by dwell time on particular area of the screen as determined by an eye tracker, etc. The point is that emotion is event driven. The more closely we can associate the user's self-assessment of pleasure with events, the more accurate and meaningful the self-assessments will be.

Behavioral Measures

Picard (2000) has explored several behavioral measures of emotional computer use, but has perhaps had her best results with the dynamics of mouse use. Placing sensors on a mouse to sense aggressive behavior, Picard has linked mouse use to difficulty with computer interactions. Rather than focus on recognizing classic affective states with names like joy and anger, Picard, in her own words, has "tried to recognize things like 'the state you're in when all is going well with the computer vs the state you're in when encountering annoying usability problems'." She believes that each of these states is most likely a complex mix of emotions, rather than a clear indication of pleasure or displeasure. Most importantly, whatever emotion mouse use reveals, it is recognizable by the computer. The problem with Picard's work, from an affective design perspective, is that these measures may be more related to frustration, than pleasure or displeasure. It would be interesting to see how these frustration measures, such mouse use, correlate with some of the measures of pleasure that are reviewed here.

Facial Expressions

Long before the formal studies described below, folk theories developed relating facial expressions to emotions. The Chinese have a folk art called siang mien which details observable correlations between facial expressions and character and temperament (McKevitt and Gammack, 1995). Ekman (1993) developed a classification system for facial expressions which fostered more formal study of the connections with emotional states. Ekman was motivated not by the prospect of extending usability testing, but rather by the age-old question of the universality of facial expressions. His research concluded that there is no great difference across cultures in how the emotions of fear, disgust, anger, sadness and enjoyment are expressed by the face. Wang and Gammack (1995) later confirmed Ekman's findings. A smile WAS a smile across cultures. This leads to the conclusion that perhaps facial expressions could be a reliable indicator of pleasure and arousal in response to particular displays or interactions during a usability test. Further, their findings hold out the possibility that facial expressions might just be a measure of pleasure that is robust across cultures.

As mentioned earlier, facial muscle activity has been correlated with ratings of pleasure. The clearest relationships have been between corrigator muscle response and ratings of pleasure (e.g. valence) and between zygomatic muscle response and ratings of arousal. Zygomatic response correlations to pleasure ratings have been U-shaped- high for high pleasure ratings, but also somewhat high for the most negative ratings. These are rather clear responses, but difficult to interpret in a usability test aimed at assessing pleasure.

The clear relationship between corrigator muscle response and ratings of pleasure lead Kapoor and Picard (2002) to focus on upper facial expressions and more natural ways to monitor them. "Expression glasses" developed by Scheirer, Fernandez, and Picard (1999) are an attempt to provide a more natural and comfortable monitor for upper facial expressions compared to pasting EMG sensors to the user's face. The system detects the pupils using an infrared camera equipped with infrared LEDs. Eye and eyebrow regions are localized from the infrared images. These are then analyzed using PCA to acquire parameters related to the shape of the face. These parameters are used as classifiers to recognize upper facial action units and their combinations, such as inner eyebrow raising and eye widening, which are among the components of facial expression. The system is robust to head movements, pose changes and occlusion. Facial expressions are recognized with an accuracy of 69.3% for each individual action unit compared to a human judge of the facial expression.

So what does the science of facial expression measurement hold for assessing pleasure in a usability test? The most reliable measures still appear to be EMG techniques which would have to be analyzed in close connection with significant events in the user's interaction with the interface. But placing electrodes on the faces of users also runs the risk of distracting the user from using the system in a natural manner. Less obtrusive techniques, such as those in development by Picard, are more promising in the long run, particularly if they are closely validated by other measures of pleasure.

Physiological Measures

A number of researchers have explored the possibility of measuring emotional response from physiological measures such as heart rate acceleration and skin conductance (Vyzas and Picard, 1999; Picard, Vyzas, and Healy, 2001; Lang, et al., 1993). Lang, et al. found that heart rate acceleration was significantly larger when subjects viewed pleasant as opposed to unpleasant pictures, although the correlation was not as strong as that found for facial expressions and measurement reliability was lower. Skin conductance was strongly related to arousal regardless of the valence. In his factor analysis, heart rate acceleration clustered with the Emotion Valence factor, as did facial expression. Skin conductance clustered with the Arousal factor. Picard et al. (2001) provides an excellent description of problems involved in correlating physiological measures with emotional responses and the situational variables that can affect the user test results. She also presents results on data transformation techniques to enhance the extraction of patterns from raw physiological data such as heart rate and skin conductance.

Thanks to the telemedicine industry, new technology abounds for simple unobtrusive measurement of variables such as heart rate and skin conductance. Many of these devices also include wireless communication of the data which serves to completely free the subject of any physical boundaries. For example, a Timex Digital Heart Rate Monitor Watch/Sensor will cost you only US$ 50. Picard's lab also has been a leader in creative unobtrusive ways to measure physiological responses, their Galvactivator glove (Picard and Scheirer, 2002) being an example. Also, Peter, Ebert, and Beikirch (2006) have developed a data glove that records and wirelessly communicates skin conductance, heart rate, and blood pressure.

Eye Movements

Lang, et al. (1993) showed that image viewing time had a U-shaped relationship to ratings of pleasure but had a strong linear relationship to the arousal dimension of pleasure. So could at least the strength of the affective experience be estimated from a record of viewing time for a particular graphical object on the screen? Viewing time could be captured using an eye tracker. From Lang's data I would also note that this would not be a particularly good way to estimate the valence (pleasant or unpleasant) of the user's experience.

CHALLENGE AND OPPORTUNITY

So why aren't some of these measures of pleasure commonplace in our usability tests? There are a number of reasons, none of which are prohibitive. First, for some decades now, we have fought the battle for ease of use and improved performance. As usability experts, it is our instinct to design tests that measure performance. By contrast, pleasure seems abstract and possibly not as important. Something advertising people measure. Second, we doubt the sensitivity of these measures of pleasure. Most of the published results that confirm the ability to measure pleasurable responses have used graphical stimuli that evoke rather strong emotions of one kind or another. Just how sensitive are these various measures to the kind of typical user interactions that we design for and test every day? Third, we worry, justifiably, about unnatural ways of measuring emotion, particularly using physiological measures.

Despite all of these objections we have a challenge and a great opportunity here. First, we need to get on with the next generation of HCI and make pleasure a normal part of our usability tests. But we need to do it in a way that does not interfere with the great things we already do in measuring human performance. Second, we can do something that has never been done before, that is calibrate the sensitivity of these measures and determine whether any or all of them provide the level of emotional discrimination that we need to have value for the broad range of user interactions. Third, new technology for less obtrusive measurement of physiological indicators of emotional response are being developed all the time. The ability to record reliable measures of emotional response without upsetting normal interaction is at hand. Fourth, the state of technologies like eye tracking are such that we now can easily link emotional stimuli in a user interface to emotional reactions recorded by a wide range of means. Finally, many of these measures appear to be culturally neutral and robust across cultures.

In conclusion, the exciting thing to me is that no one in the usability profession is much doing any of this right now. This frontier is our's for the exploring. We can be the first to develop a practical paradigm for measuring the user's pleasure or displeasure within the context of a usability test. We can be the first to understand what that usability test subject, no matter where he or she is from--India, China, Denmark, or the U.S.--, is really smiling about.

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A Position Paper On "Cross-cultural Usability Issues of Bilingual (Hindi & English) Mobile Phones"

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ABSTRACT

Variety of information services like Short Message Service (SMS), e-mail, news, market reports, educational applications and other reading materials are now available on mobile phones. The size of mobile phone and its display is shrinking day-by-day, whereas the volume of information content and services are growing. More importantly, mobile phones introduced in the Indian market have now become bilingual; they support various services in English and Hindi languages. Mobile manufacturers have consciously or unconsciously resorted to English oriented approaches, and as a result of this, they have diluted the culture specific rules and the original form of Hindi language. Therefore, to restore the original characteristics of Hindi in mobile phones, it has become inevitable to study the cross-cultural usability issues between Hindi and English. This study involves consideration of various aspects like keypad design, mapping of Devanāgari alphabets, text entry techniques, rendering of fonts, paralinguistic features, legibility, layout and pagination, navigation through text, grammatical structure of textual content, translation of user interface and reading comprehension. We have studied the application of Hindi in four bilingual (Hindi and English) mobile phones manufactured by different companies like Nokia / Reliance 3105 CDMA, LG RD5130, Motorola C118 and Samsung / Reliance C200. Ten linguistic usability heuristics have been identified and applied for revealing several linguistic usability problems and cross-cultural issues in mobile phones. Our study provides sufficient reasons for standardization of keypad layout, Devanāgari alphabetical rendering, and Hindi translation of English technical terms used in mobile phones. This position paper provides the basis for enhancing the usability of Hindi application in mobile phones.

KEYWORDS

Bilingual Mobile Phone, Cross-cultural Usability, Linguistic Usability Heuristics, Hindi and English, *Devanāgari* Script, Keypad Design, Fonts Rendering, Reading Comprehension

1. INTRODUCTION

1.1 About Hindi Language

Hindi is the national language of India and it is spoken by at least 402 million Indians as per the Census of India conducted in 2001. Ideally, entire 1 billion population of India is desired to communicate in this language. Furthermore, there are several countries like USA, UK, Mauritius, South Africa, Yemen, Uganda, Singapore, Nepal, New Zealand, Germany, Pakistan, etc. which have significant Hindi speaking population. The number of people communicating in Hindi is enormous and hence it is necessary to study the uniqueness and culture specific requirements of Hindi, especially when it is introduced in mobile phones. Hindi originates from *Sanskrit*[1] and it is written in *Devanāgari*[2] script. It has been influenced and enriched by many other languages such as Dravidian, Turkish, Farsi, Arabic, Portugese and English. Unlike other languages enlisted here, English has continued to impact Hindi through modern technologies and media even today.

1.2 Impact of English

One could consider any two languages, in case of bilingual mobile phones. However, English has been specifically mentioned considering that it is the most popular international language available on most mobile phones. Word-processing and document publishing tools, printing technology and other media of communication are highly influenced by English. This is mainly due to natural tendency of western scientists to design technologies suiting the requirements of English as their first priority. English style of typing, text rendering, formatting, layout design, and presentation techniques are getting forced on other world languages including Hindi, due to worldwide proliferation of modern technologies and media. Technology developers have consciously or unconsciously resorted to English oriented approaches, and consequentially, they have diluted the culture specific requirements and the original form of Hindi. Therefore the usability of Hindi application in mobile phones has become questionable.

It is inevitable to study the cross-cultural usability issues between Hindi and English for restoring the original characteristics of Hindi in mobile phones. It is an accepted fact that Hindi and English will require to co-exist together. **We conduct this cross-cultural study with the objective of making them co-exist without imposing on each other, and without sacrificing their originalities, and in the most usable fashion. It is necessary to resolve the cross-cultural usability issues in bilingual mobile phones first, which will eventually pave the right path for multi-lingual mobile applications.**

1.3 Our Approach

Many cross-cultural issues between Hindi and English languages are applicable to wide range of media. However, we have focused on the application of Hindi in mobile phones only. These are highly constrained communication devices in

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[1] The ancient and sacred language of the Hindus in India.
[2] The script in which Sanskrit and several dialects of India are written.

terms of small size of handset, limited display resolution and storage capacity. The cross-cultural usability issues tend to become more sever due to such limitation of resources. We have studied the application of Hindi in four bilingual (Hindi and English) mobile handsets manufactured by different companies.

These are namely-

- **Nokia / Reliance[3] 3105 CDMA**
- **LG RD5130**
- **Motorola C118**
- **Samsung / Reliance C200**

We have focused on script-based application of Hindi and English in Mobile phones. Our evaluation of Hindi and English is from the perspective of 'reading comprehension' because it is the ultimate objective of any written communication through mobile phones. It allows us to consider the entire set of linguistic aspects like text entry, script, word formation, grammatical structure, legibility, readability and navigation through text. Proposed cross-cultural usability study of mobile phones is intended to help in design and development of more usable mobile phones for Hindi users. This has paramount importance; as the total number of mobile users in India is likely hit 100 million by 2007, as per the report published on W2FORUM.

1.4 Definition of Cross-cultural Issues

Due to unavailability of a comprehensive and specific definition of 'Cross-cultural Issues in HCI', it is defined as under-

> **"Cross-cultural issues are basically the unique requirements of different civilizations or societies or communities of people causing change in the design of product or technology or system or service to make it more usable and acceptable.**
>
> **The cross-cultural issues can be studied in terms of racial characteristics, life-style, traditional practices, geographical and political contexts, social rules and values, histories, religions, languages and mental models of people."**

In the light of this definition, we have tried to identify the requirements of Hindi mobile users and evaluated the usability of bilingual mobile phones introduced in the Indian market.

1.5 'Linguistic Usability Heuristics' for Bilingual Mobile Phones

Following 'linguistic usability heuristics' are identified and applied during our evaluation of bilingual mobile phones. The heuristics will be useful for qualitative

[3] Reliance Infocomm Ltd. is one of the major mobile service providers in India. Nokia and Samsung have exclusively provided the mobile handsets to Reliance.

evaluation of any other languages introduced in mobile phones and also serve as design guidelines.

1. **Represent the language in its authentic / original form**
2. **Maintain the original form and structure of script**
3. **Uniform representation of the language**
4. **Avoid influence of English or any other language**
5. **Maximum 4 alphabets / characters per key**
6. **Least typing effort**
7. **One-to-one correspondence between keys and alphabets typed**
8. **Avoid uncontrolled mixture and trade-offs between languages**
9. **100% legibility of text**
10. **Readability / comprehensibility of text**

The cross-cultural issues between Hindi and English documented in this paper are discovered through application of aforementioned 'linguistic usability heuristics'. We have referred them by their serial numbers in our deliberations henceforth. We also observed many subjects while performing certain tasks with the help of bilingual mobile phones.

1.5 Basic Differences Between English and *Devanāgari* Scripts

As per the heuristic nos. 1, 2, and 4, we have identified the basic differences between Devanāgari and English scripts. These heuristics are applicable for most of issues documented in the paper.

Devanāgari script has 14 vowels and 36 consonants. Each consonant has 14 variations through integration of 14 vowels. This produces about 504 different alphabetical characters. It has 10 numerals similar to English. Whereas, English has only 26 alphabets. The alphabetical complexity of *Devanāgari* is quite obvious.

Devanāgari script does not have separate Capital and Small alphabets as in English. Also, *Devanāgari* has adopted many punctuation marks and paralinguistic features such as italic, bold, underlined lettering styles from English.

Also, Hindi or Sanskrit originated languages do not have the tradition of making acronyms and short forms as practiced in English.

English alphabets do not alter their basic shapes. On the contrary, a *Devanāgari* alphabet alters itself drastically with addition of *Mātrā*[4] and conjuncts (merging of two or more consonants).

[4] The vowel mark in *Devanāgari* script.

English script does not encode the conjuncts but they are pronounced in speech. But *Devanāgari* script encodes the conjuncts exactly the way one would pronounce it.

English alphabets are designed with basic geometric shapes like vertical, horizontal, diagonal and circular lines. It also uses a lot of symmetric shapes. The designs of alphabetical shapes are grid based and highly optimized. They became more simplified through the evolution of block printing and now the digital media. In a given font, the shape of an English alphabet is frozen and is not subjected to any dynamic change. These qualities make English script more suitable for low-resolution bitmap rendering in mobile phones.

On the contrary, *Devanāgari* alphabets have asymmetric, free flowing and highly intricate shapes. Most importantly, the shape of an alphabet is subjected to lot of modification and dynamic changes due to addition of *Mātrā* and conjuncts. These qualities make *Devanāgari* script very complex and challenging for low-resolution bitmap rendering in mobile phones.

Such script level differences between *Devanāgari* and English are primarily due to influence of oral traditions in India and dominance of print culture in Western countries. So far we have discussed general observations of *Devanāgari* and English scripts.

2. *DEVANĀGARI* KEYPAD USABILITY

Devanāgari keypad layouts of various mobile phones are compared in the light of heuristic no. 3. This heuristic is also applied to study many other aspects of mobile phones in this paper.

2.1 Bilingual Alphanumeric Keypad Layout

The keypad layout of all mobile phones is exclusively designed for English script. The main problem is that designers have to forcefully fit *Devanāgari* script on this keypad. This approach has disturbed the original structure of *Devanāgari* script. It is worthwhile to design exclusive keypads for bilingual mobile phones. Special mobile phones with *Devanāgari* and English support can be a lucrative proposition if you consider the large number of users in India. But it is important to do proper justice to a language and its users.

As seen in Figure 1, English alphanumeric keypad mapping is standardized for all mobile phones. English numbers and alphabets are printed in the same manner on all keypads. On the contrary, as seen in Figure 1, *Devanāgari* alphanumeric keypad mapping is non-standardized and follows different approaches. The printing of alphabets on keys also varies in terms of the sets of alphabets and their locations on keypad.

LG RD5130 Nokia 3105 Samsung/Reliance C200

Figure 1. English and *Devanāgari* keypad of mobile phones

Let us observe and compare the keypads of bilingual mobile phones shown in Figure 1.

2.1.2 Location and Printing of *Devanāgari* Keys

Heuristic nos. 2, 3, and 7 are applied to reveal the usability problems in mapping and printing of Devanāgari Keys.

Traditionally, *Devanāgari* alphabets are grouped in smaller sets for ease of memory recall. These groups are represented and mapped in different fashions on all keypads. Figure 2 shows a group of *Devanāgari* alphabets त थ द ध न, which is mapped on different keys and printed in different styles.

Figure 2. Different approaches to *Devanāgari* keys

The printing of alphabets on a key is meant to expose the alphabets mapped on it. It is expected to assist users while typing. **As the alphabets mapped on keys are too many, and the key size being very small, the mobile manufacturers have not printed all *Devanāgari* alphabets on keys.**

The keypad of LG RD5130 handset displays only the first alphabet from each group, whereas the keypad of Nokia 3105 handset displays the first and last alphabets from each group on every key. The keypad of Samsung C200 shows first two alphabets of the group on each key.

The keypad design of LG RD5130 handset assumes that you would know the remaining alphabet starting from the one that is printed on every key. The keypad design of Nokia 3105 handset assumes that you would know all alphabets between the first and last alphabets that are printed on keys. The keypad design of Samsung C200 assumes that you would exactly select the desired group of alphabets.

LG RD5130 and Samsung C200 handsets display the remaining alphabets of the selected group on screen after pressing the key. But for selecting the key, user has to rely on prior knowledge. Otherwise, user will have to press all keys one-by-one to identify the correct group of alphabets.

Also *Devanāgari* numbers are not printed and supported on any of the mobile handsets. One has to rely on English numbers only.

On the contrary, same mobile phones have all English numbers and alphabets properly printed on their keypads. You are not expected to depend on memory or prior knowledge.

In fact, *Devanāgari* script has greater number of alphabets than English and hence expecting the users to remember them is quite unfair. Ideally, all alphabets mapped on a key must be printed on that key.

Some mobile phones have dropped out the alphabets like **अः, क्ष** and **ज्ञ** considering that they are less frequently used. By the same logic they should have dropped **ङ, ञ** as well but these alphabets are supported. From the pure linguistic perspective it is an unpardonable mistake to drop even one alphabet.

2.1.3 Treatment to *Devanāgari Mātrās*

Devanāgari Mātrās are grouped, located and treated differently on all mobile phones. The choice of keys for *Mātrās* is also different. For example, on LG RD5130 handset *Mātrās* are mapped on key number 9, on Nokia 3105 handset they are mapped on key number 1,2 and 3; on Samsung handset they are mapped on 8,9, and 0 keys.

LG RD5130 and Samsung C200 handsets have provided exclusive *Mātrās.* Whereas, Nokia 3105 handset treats them as vowels fusing with consonants. Basically all approaches are grossly different.

It is extremely challenging to distribute 14 vowels and 36 consonants of *Devanāgari* along with numbers and punctuation marks on just 12 keys. This turns out to be a very tricky problem, as the keypad of mobile phone does not provide the luxury of multiple key combinations using Caps Lock or Shift buttons as in computer keyboard.

2.1.4 Treatment to *Devanāgari* Conjuncts

LG RD5130 provides exclusive half alphabets (म् स् क्) for formation of conjuncts. This makes it more complex as LG hanset has tried to map half alphabets on keys. As a result, they have missed out some half alphabets. Nokia 3105 and Samsung C200 use *halant*[5] to form conjunction between two consonants.

Application of *halant* is as shown in brackets (प + ् + त = प्त).

Use of *Halant* is the authentic way to form conjuncts.

2.1.5 Conflicting Keypad Mappings

So far we have established that the keypad mapping of *Devanāgari* alphabets and treatment to *Mātrās and* conjuncts is very different in all handsets. As a result, if you exchange Hindi SMS between the mobile phones manufactured by different companies, it gets displayed with some undesirable characters. It is no more readable. You can smoothly exchange Hindi SMS between similar mobile phones only.

There is no accepted standard for mapping *Devanāgari* script on mobile keypads. An optimal and usable solution to this problem is still to be evolved. The designers and mobile manufacturers need to give up English oriented thinking and concentrate on the requirements of *Devanāgari* script.

2.2 Comparative Study of Typing Effort

In addition to the heuristics applied so far, we used heuristic no. 6 and 9 for the comparative study of typing efforts and legibility of text in various mobile phones.

As too many alphabets are mapped on every key, one has to keep pressing it several times to arrive at the desired alphabet. Such higher frequency of keystrokes can reduce the life of keypad. For example, Nokia 3105 mobile handset has minimum 6 and maximum 9 *Devanāgari* alphabets assigned to each

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[5] *Halant* is a sign used to indicate the point of conjunction between two consonants.

key. Despite such overloading, *Devanāgari* numbers are still not supported. If you add *Devanāgari* numbers, it will be about 7 to 11 characters per key.

It is very strenuous to type even one word using *Devanāgari* script. For example, we typed a *Marathi*[6] word महाराष्ट्र in *Devanāgari* as well as in English (*Maharashtra*) for comparing the typing efforts on various mobile phones. Table 1 shows the typing results.

Table 1. Typing Efforts					
Nokia 3105					
Devanāgari	म	हा	रा	ष्ट्र	**Total number of key-strokes**
Key-strokes	5	10	3	18	**36**
LG RD 5130					
Key-strokes	5	9	3	38	**55**
SAMSUNG					
Key-strokes	2	4	4	8	**18**
English spelling of *Maharashtra* typed using all mobile phones					
Key-strokes	20				**20**

LG RD 5130
After pressing a key, this handset displays the particular group of alphabets on its screen. One has to keep pressing the key to arrive at the desired alphabet. It makes you press the keys too many times as it provides exclusive half alphabets for conjuncts. For typing ष्ट्र we required 38 keystrokes. Though the final output was erroneous as shown in Figure 3. What was typed by this mobile phone can be read out as *'Maharash**tta**'*. It does not provide half 'r' for conjunction. This handset supports the feature of predictive typing and hence simplifies the typing effort if the word is available in its dictionary.

Nokia 3105
In this handset, typing in *Devanāgari* follows a pretty simple approach. One has to just go on pressing a key to arrive at the desired alphabet. *Halant* can be used for conjuncts. The *Devanāgari* font supported by this handset is too tiny and not legible enough.

SAMSUNG C200
This handset provides the most optimized technique for typing in *Devanāgari* and it is more efficient than English. But it is based on some new rules and makes it quite technical for the users to understand. As shown in Figure 1., this handset converts each alphabet to a number. For example, while typing ग, one would require to press key number **3** but if you see this key, it represents the group of alphabets starting from ट. This approach makes it confusing and less intuitive,

[6] The regional language used in *Maharashtra* state of India. It uses *Devanāgari* script similar to Hindi.

as one has to rely on the displayed reference of alphabets to find out the associated numbers. It is not desired by the users to remember the numbers associated with alphabets. It is quite unnatural to reduce an alphabet to a number.

This approach is an impediment in the human tendency to build *micro-cognitive maps*[7], which are developed through practice of using remote controls and mobile phones. They are helpful in intuitively locating and pressing of buttons / keys on a device.

LG RD 5130 **Nokia 3105** **Samsung/ Reliance C200**

Figure 3. The word 'Maharashtra' typed using different mobile phones

Correct depiction of the conjunct ष्ट्र (*shtra*) appearing towards the end of *Maharashtra* may be compared with the screenshots shown in Figure 3. The problems are easily noticeable. Unlike other mobile phones, Samsung C200 mobile phone renders this conjunct quite accurately.

2.3 Attention Span and Visual Recognition

Another problem that we spotted has to do with the attention span of users and visual recognition of *Devanāgari* alphabets. In mobile phones, while typing the text, if you keep pressing a key without pausing even for one moment, it changes to the next alphabet. This is a standard technique. But if you pause for a moment, it accepts the alphabet typed by you as final input and the text cursor moves ahead.

This behavior forces one to repeatedly press a key to arrive at the desired alphabet. In case of *Devanāgari*, it amounts to pressing a key for 6 to 9 times. For English, it is only 3 to 4 times.

While frantically pressing a key again and again, one ends up skipping the desired alphabet. One fails to quickly recognize it due to its small size and ambiguous shape. It is also quite tiring to keep gazing at the location where alphabets are speedily changing. Naturally you cannot recognize them quickly, and then you have start typing all over again.

We must appreciate and accept that the attention span of mobile users is very short unlike the computer users. We observed during our experiments that the subjects are unable to track the number of keystrokes when they

[7] Mental images encoded with relationships and relative positions to help in navigation through spatial layout of keys or buttons

were more than 4 times. This observation provides vital justification for coining the heuristic no. 5.

3. LANGUAGE SETTINGS OF MOBILE PHONE

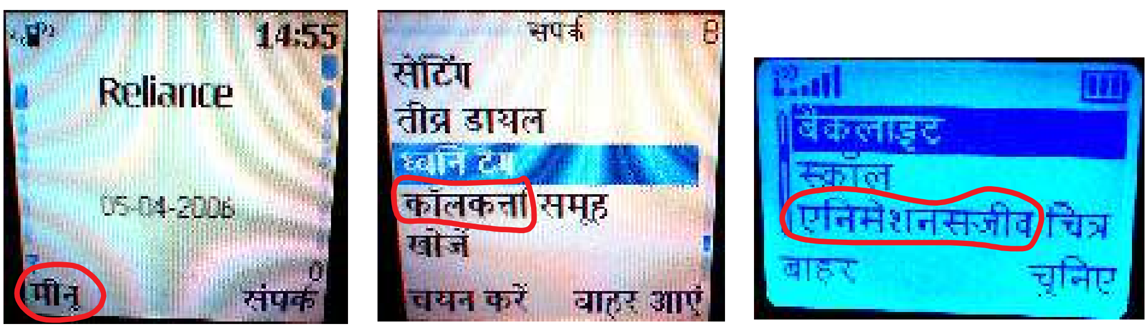
When you set Hindi as the language in your Mobile phone, it is reasonable to expect the entire user interface to be presented in Hindi. In this setting, you come across two types of problems, which are namely- 1. Language dropouts and 2. Use of non-translated English terms.

We applied heuristic no. 8 to identify the uncontrolled mixture between languages.

3.1 Language Dropouts

You always find some features continuing to display the English user interface. The contact list and telephone numbers continue to appear in English only. Presently, most mobile phones are capable of switching over to hard coded Hindi user interface. Apparently, the mobile application developers have been forgetting to translate some parts of user interface while converting to Hindi.

The automatic transliteration of names and numbers from English to Hindi is a demanding task but a necessary one. But it is yet to be attended by the developers. The keypads of mobile phones supporting Hindi language continue to carry English numbers. Also while dialing a phone number, it gets entered in English.



A B C

Figure 4. Use of English Terms in Hindi

It is safe to assume that users who switch their mobile phones to Hindi language may not understand English. There is a strong reason to believe so, as most vegetable sellers, labor workers, villagers, and people who come from the lower strata of society in India do not know English. From the point of view of 'quality', the mobile companies are not fulfilling the commitment of supporting Hindi language, though they claim it. The language dropouts can cause reading problems to many mobile users. They may not understand English user interface or face difficulty in entering and reading contact details in English.

3.2 Add-hoc Use of English Terms in Hindi

Figure 4/A and B are the screenshots from Nokia 3105 handset and Figure 4/C is a screenshot of Motorola C118 handset. As shown in Figure 4, translation of many English technical terms into Hindi is a common problem. Many times it amounts to coining new Hindi terms.

Figure 4/A at bottom of its left corner shows that the term ‘menu’ is written in *Devanāgari* without translation.

Figure 4/B shows a new term for Caller Group (*Callerkartā Samuhā,* as pronounced in Hindi), which is half English (Caller) and half Hindi (*Kartā Samuhā*). The same figure also shows ‘Setting’ written in Hindi and ‘Speed Dial’ written in half Hindi (*Tivra*) and half English (Dial). The translation of ‘speed’ as *‘Drutagati’* is more appropriate. So there are translation errors as well.

Figure 4/B also shows another term wherein ‘Tag’ is written in Hindi. This figure also shows two functions at the bottom of the screen, written as ‘*chayan kare’* (select) and *‘bāhar āye’* (exit). Figure 1/C shows more optimized translation of these functionalities. But their positions have been swapped.

Figure 4/C shows a weird term, which is a mix of half English (Animation) and half Hindi (*Sajeev*). It does not make any sense.

Also one finds the plural of ‘call’ written in Hindi as ‘*callen*’. We found about 42 English terms (about 30-40% of total instructions in user interface) written in *Devanāgari* script in Nokia 3105 handset. These are enlisted in Table 2. Nobody has attempted to translate them in proper Hindi language. One can infer that 30-40% of English instructions written in *Devanāgari* are incomprehensible to those who do not understand English.

It is worth constituting a national committee of linguists and mobile technology developers to standardize Hindi terms for use in mobile phones. This is very much feasible as the English vocabulary used in common mobile applications is very limited. In our study of Nokia 3105 handset, we found out around 42 English terms written in *Devanāgari*, these are enlisted in Table 2. Also the English technical terms acceptable in Hindi may be formally decided and declared. The mobile companies should be persuaded to comply with such standard unless they introduce new terms for new features and applications. The standard of Hindi terms for mobile phones may be updated and enriched periodically.

This will maintain the purity of Hindi language used in mobile applications. It will also enrich Hindi language with new terms. It will improve the usability of mobile phones for Hindi users. It will also promote Hindi and boost the propagation of mobile phones in Hindi speaking world.

Table 2 English terms written in Hindi in Nokia 3105			
मीनू	Menu	प्रोफाईल	Profile
नंबर	Number	मीटिंग	Meeting
सेटींग	Setting	पेजर	Pager
डायल	Dial	फोन	Phone
टैग	Tag	नेटवर्क	Network
कॉलकर्ता	Caller	कोड	Code
स्क्रॉल	Scroll	पुनर्डायल	Redial
वी आई पी	VIP	डीटीएमएफ	DTMF
बिजनेस	Busyness	बैनर	Banner
इनबॉक्स	In Box	गैलरी	Gallery
आइटम	Item	फोल्डर	Folder
इ-मेल	e-mail	ग्राफिक्स	Graphics
स्क्रीन	Screen	मेल बॉक्स	Mailbox
टेम्प्लेट	Template	रिकॉर्डर	Recorder
स्माइलि	Smiley	कॉललॉग	Call Log
छूटी कॉले	Missed Calls	अलार्म घडी	Alarm Watch
कॉलों की सूची	Call List	कॅलेंडर	Calendar
ॲनिमेशन	Animation	कैलक्यूलेटर	Calculator
अनलॉक	Unlock	स्टॉपवाच	Stopwatch
कॉलींग कार्ड	Calling Card	कैलोरी गणक	Calorie Counter
डाटा कॉल	Data Call	डाटा दर	Data Rate

3.3 Bitmap Fonts and Rendering of *Devanāgari* Alphabets

Heuristic nos. 2 and 9 are used to study the rendering of Devanāgari Alphabets in mobile phones.

The mobile phones chosen for study support 128 x 128 pixels display resolution. Drawing of *Devanāgari* alphabets using limited number of pixels is extremely challenging. Such fonts are generally created using 12 to 18 pixels height, which includes the ascending and descending margins required for *Mātrās*.

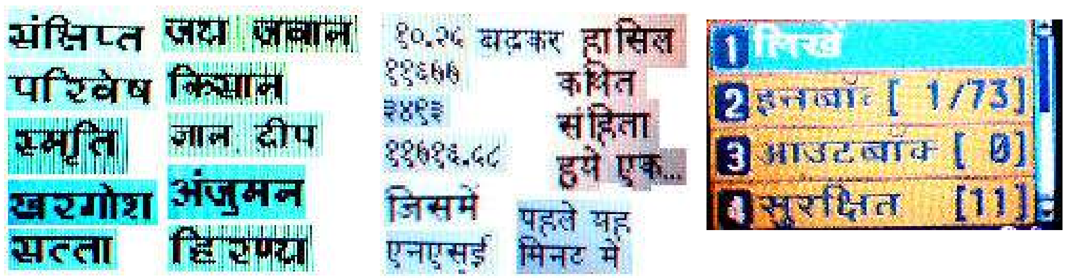
The mobile companies have created bitmap fonts for *Devanāgari* but they require major improvements. Most common problems found in these bitmap fonts are-

- **Uneven spacing of alphabets**
- **Distorted shapes of alphabets**
- **Uneven height and width of alphabets**
- **Intersecting or overlapping alphabets**
- **Insufficient leading between two lines**
- **Ambiguous and non-recognizable shapes**
- **Dislocated *Mātrās and* disjointed conjuncts**

Devanāgari numbers shown in Nokia 3105 (Refer Figure 5.) are of varied heights and some of them are unrecognizable. Some examples of correct alphabets and their erroneous shapes in mobile phones are shown below.

ज्ञ is looking like ज. य looks like टा. ७ looks like 0. ५ looks like ८.

With such poor legibility, how will business transactions succeed through mobile phones? If numbers are not displayed accurately then the financial decisions can result in blunders.



LG RD 5130 **Nokia 3105** **Samsung/ Reliance C200**

Figure 5. Rendering of *Devanāgari* Alphabets in Mobile Phones

3.3.1 Legibility Versus Space Limitations

Nokia 3105 allows you to view 7 lines of *Devanāgari* text on its screen but it is very eye straining to read. Samsung C200 uses auto-scrolling text as part of menus to maintain legibility of text and to manage the long length of text.

Introducing paralinguistic features like italic, bold, normal, underlined fonts and other font styles for *Devanāgari* script in mobile phones is a much harder task. But they will be necessary if large amount of information is to be presented in readable manner.

3.3.2 Matching Height of English and *Devanāgari* Fonts

Matching height of English and *Devanāgari* fonts is also a major problem. In the example shown here "C-DAC सी-डैक", English lettering is using 14-point height whereas *Devanāgari* lettering of same word is using 18-point height. Though visually they both appear matching in height. If you keep both in 14-point size then *Devanāgari* lettering appears much smaller e.g., "C-DAC सी-डैक ". This problem is faced where one has to use English and *Devanāgari* together. **You have to choose between 'point accuracy' and 'optical judgment' while deciding the matching height for both the scripts.**

4. READING COMPREHENSION

Heuristic no. 10 has been used to identify the problems dealing with readability and comprehensibility of text in mobile phones.

Nowadays, mobile service providers are providing variety of services in which they offer daily news reports, stock market updates, horoscopes, banking services, SMS, e-mail, etc. These are mainly text based. One is expected to browse through and read large amount text. Let us look at the issues of reading comprehension in mobile phones.

4.1 Sentence Level Readability Problems

The size of mobile display screen is shrinking day-by-day, whereas the volume of information content is growing. The display screens provide very tiny space for showing this information content. This space is very limited both in its height and width. It is possible to accommodate around 3 to 4 words in a line, which is also a matter of concern. In a typical newspaper column one can fit 6 to 7 words and a book can accommodate 8 to 10 words in a line. It is obvious that one cant read even a simple sentence properly without having to scroll it.

4.1.1 Compound Sentences

One has to keep scrolling down to view the remaining part of a compound sentence. The user has to scroll up again to see the earlier part of sentence and to recollect the context.

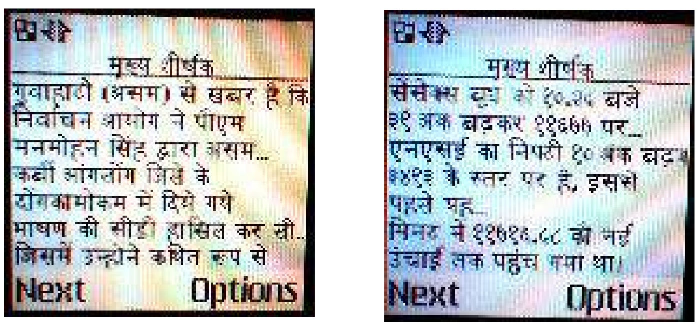


Figure 6. News reports offered by Reliance World mobile service

We found that readers tend to forget the portion of text that goes out of display area. They have to take conscious efforts to memorize it. In a compound sentence, the initial parts of a sentence describe its context. Many mobile users fail to comprehend the overall meaning of sentence due to forgetting the context. This problem is applicable to both Hindi and English languages.

Semantic Unit 1. प्रगत संगणन विकास केंद्र (सी-डैक) की स्थापना
Semantic Unit 2. अपने ही देश में स्वदेशी स्त्रोतों से
Semantic Unit 3. अद्यतन स्केलेबल उच्च निष्पादन सुपर कंप्यूटर
Semantic Unit 4. विकसित करने के उद्देश्य से
Semantic Unit 5. १९८८ में की गई थी
Semantic Unit 6. जो आज अपनी कार्यसीमा को पारकर
Semantic Unit 7. सूचना प्रौद्योगिकी की एक सुस्थापित शक्ति के रूप में उभर चुका है।

Figure 7. Non-linearity in reading comprehension

We never read in completely linear fashion. We always need to glance at earlier sentences or the parts of a sentence for better comprehension. In mobile phones one is not able to do this very effectively. As shown in Figure 7, every sentence is made up of many semantic units[8]. In a compound sentence there are greater number of semantic units and they are connected to each other. Though reading is a linear activity, the need of comprehension forces you to scan the sentence back and forth.

4.2 Grammatical Sentence Structure

Grammatical construction of sentences in English and Hindi is also quite different. Figure 8 shows how the semantic units of a sentence written in English and Hindi are placed in different order. These structural differences are due to the respective grammatical rules of languages. Let us look at some examples.

Hindi uses *postpositions* (मुंबई शेयर बाजार **में**) and English uses *prepositions* (**In** Mumbai stock market).

In Hindi, *verb* follows the *noun* (**निवेशकों** द्वारा भारी **बिकवाली**) and in English, the *noun* follows the *verb* (**selling** by the **investors**).

Similarly, the *subject* and *predicate* in Hindi and English can appear in different order.

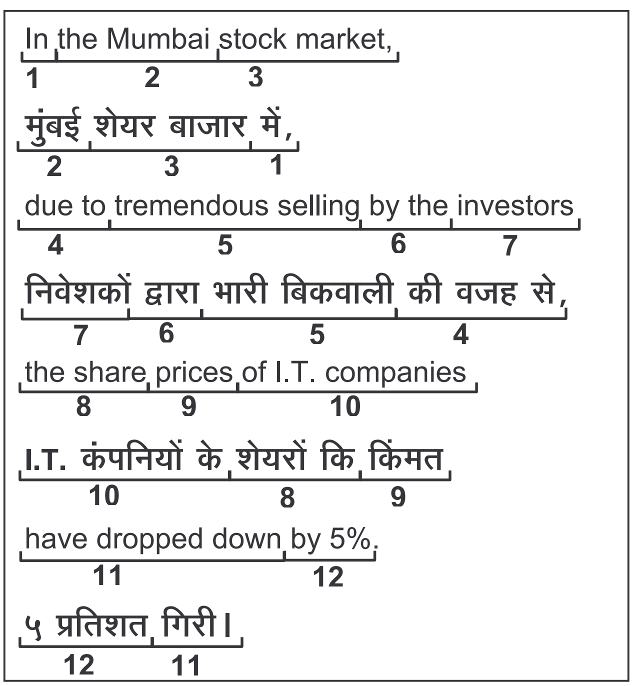


Figure 8. Grammatical construction in English and Hindi sentences

Figure 9. The advantage of spatial cues in printed text

[8] The portion of a sentence contributing significant meaning

These grammatical aspects are worth considering while studying the reading comprehension issues of Hindi and English text presented through mobile phones. While scrolling down the Hindi text, the *noun* is likely to go out of display area first. On the contrary, in an English sentence, the *verb* is likely to go out of sight first. These differences can have impact on the comprehension of text. This type of study should be helpful in identifying the dropouts of comprehension. The observations stated here should be helpful to those who create textual content for mobile phones.

4.3 Disorientation While Reading Large Amount of Text

After reading a column of information from a printed sheet, most readers are able recollect the location of particular information. As shown in Figure 9, they could place dots on a rectangular representation of the column to suggest the location of specific information. On a printed sheet, one gets the advantage of remembering the text layout and certain spatial cues. The paralinguistic features also make it simpler to remember the textual content. It helps readers in constructing the *mental schemata*[9] of text.

In case of mobile phones, major part of text remains out of sight while reading long news reports. In our experiments, we found that readers get disoriented while reading and navigating through the text. It is because they are unable to build the *mental schemata* of overall page layout.

We found that readers are unable get spatial cues while reading scrollable text in mobile phones. They are unable to recognize their position in the overall text. And hence they forget some part of the content after reading. Also, you see them scrolling up and down, back and forth as they do not remember the location of particular information.

Margins, paragraphs, pagination, indexing and navigation are the other unattended aspects of text in mobile phones. Sooner or later, they will have to be addressed, as mobile phones are becoming the most effective medium for communication, business, learning and entertainment.

Mobile phones supported with other world languages are bound to face similar usability, compatibility and readability problems as discussed in this paper. The real challenge is to make these languages coexist in mobile phones, without diluting their original form.

5. BENEFITS

Next 100 million potential users of mobile phones in India are bound to operate mobile phones in Hindi or other Indian languages. Various text based mobile applications dealing with trade, agriculture, education, tourism, health and entertainment will require to be designed. This is quite possible in near future due to rapid enhancements in storage capacity, display technology, and connectivity

[9] Mental image of the layout or structure of content.

of mobile phones, and more importantly the dropping prices of handsets and services.

The market of next 100 million mobile users can be created only through usable and effective mobile applications. Any informative application or service is largely dependent on text-based communication and user interface design. Concentrating on linguistic usability in mobile phones can make this happen. Therefore, various design issues and linguistic usability problems discussed in this position paper need to be addressed on priority.

6. CONCLUSION

Our heuristic study has revealed several linguistic usability problems in mobile phones and the cross-cultural issues between Hindi and English. It provides sufficient reasons for standardization of keypad layout, *Devanāgari* alphabetical rendering and Hindi translation of English technical terms used in mobile phones. The findings of this paper can provide basis for enhancing the usability of Hindi application in mobile phones. The general findings are summarized as under.

- It is necessary to study the culture specific requirements of languages for their application in mobile phones. Keypad design, mapping of alphabets, text entry technique, rendering of fonts, paralinguistic features, legibility, layout and pagination, navigation through text, grammatical structure of textual content, translation of user interface and reading comprehension are the most fundamental aspects for identification of cross-cultural issues involved in bilingual mobile phones.

- The keypad layout should be designed as per the original structure of language without bending the rules or sacrificing the details. The existing linguistic habits and preferences of users may be considered rather than introducing new rules and techniques. The keypad design should not expect from users the prerequisite knowledge or expertise of a language. The keypad should be usable for even unskilled users. Various human factors involved in text entry process may be considered while designing the keypad layout and the input mechanism. The keypad layout for *Devanāgari* script should be standardized.

- Hindi translation of most common English terms may be standardized for mobile phones. Also the English technical terms acceptable in Hindi may be formally decided and declared. The mobile companies should be persuaded to comply with such standards unless they introduce new terms for new features and applications. The standard of Hindi terms for mobile phones may be updated and enriched periodically.

- Rendering of *Devanāgari* alphabetical shapes needs to be standardized for quick visual recognition and to avoid the distortions of alphabetical shapes in mobile phones. Similarly, the paralinguistic features for *Devanāgari* bitmap fonts need to be designed for mobile phones.

- Content creators and mobile application developers need to understand the grammatical differences between Hindi and English to design the content and display techniques. It can help in making the textual content more readable and understandable.

- Such linguistic usability evaluation is imperative for all world languages and their applications in mobile phones. It can help in retaining the original form of language and making it more usable.

7. FUTURE SCOPE

It is necessary to study the use of Hindi SMS or regional language SMS by semi-skilled workers, those coming from rural background, housewives, middle aged and old people in India. It is necessary to explore the possibility of creating short forms for Hindi words similar to English short forms used in SMS communication. The usability and readability problems faced by them need to be identified for enhancement of the keypad user interface and the actual language components in mobile phones. A special study needs to be carried out in India, for identifying the culture specific interpretations of iconic interfaces in mobile phones. It will also be interesting to study the usability issues dealing with the scripts of Urdu, Arabic, Japanese, Chinese, etc.

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Culture Vs Usability in Enterprise Applications

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Abstract
This paper explores how cultural issues are address in current Oracle Web Applications. Oracle web applications are translated in 32 languages and sold in many countries. Interaction issues related to Color, images, text and organization of design elements are addressed carefully in Oracle Applications in terms of Internationalization and localization.

Culture-
Different definition & theories of culture have been proposed by ethnographers & anthropologists which defines Culture in terms of knowledge, belief, art, morals, law, custom, and habits acquired by humans as a member of society
Different Cultures create different expectations in the humans which require designing systems that satisfy different cultures. Consumer products such as mobile phone are highly affected by culture compared to business applications like Oracle.
Generally, culture differs not only in language, symbol, image, color, and format of date and time, but also emotion, personality, perception, cognition, and thinking style.

Hofstede's [1] mode is used commonly to evaluate cultural. It consists of several variables, by which groups of people can be evaluated and classified. Such a model of culture allows for a more empirically view on culture as variables can be present in any given culture in various strength and therefore can be measured and used to distinguish one culture from another. His cultural model includes the following variables:

> **Uncertainty avoidance**: It measures a nation's preference for strict laws and regulations over ambiguity and risk. Greece is the most risk-averse culture, and Singapore the least. Protestant and Chinese culture countries rank relatively low; Catholic, Buddhist, and Arabic countries tend to score high in uncertainty avoidance. Ironically, high uncertainty avoidance

cultures tend to have a less efficient infrastructure than low uncertainty avoidance cultures.

Power distance: It measures how much a culture has respect for authority. The Arabic-speaking nations, Latin America, Russia, and nearly all of Asia (especially India and China) are high in power distance. Most of Europe, Canada, Australia and Israel are low in power distance. Japan and Mediterranean-Europe fall in the middle range.

Masculine and feminine cultures: it describes the degree to which masculine values like competitiveness and the aquisition of wealth are valued over feminine values like relationship building and quality of life. Japan is the world's most masculine society, with a rating of 95, while Sweden is the most feminine society, with a rating of 5. Other "masculine" cultures are USA, the German-speaking world, Ireland, United Kingdom, Mexico and Italy. "Feminine" cultures are the Netherlands, Spain, Thailand, Korea, Portugal, the Middle East, and West Africa.

Collectivist and individualist: Individualist cultures, such as those of the United States and Western Europe, emphasize personal achievement at the expense of group goals, resulting in a strong sense of competition. Collectivist cultures, such as those of China, Korea, and Japan, emphasize family and work group goals.

Enterprise applications

Enterprise applications are those which are accessed simultaneously by many users and are hosted on servers. They mostly have multiple user roles, security access and integration with other applications. They help companies to maintain and access enterprise data like finance, employee, sales, production, etc. Major Enterprise applications fall under Enterprise resource planning (ERP), customer relationship management(CRM), Human Resource Management (HRMS) & supply chain management(SCM). These are mostly horizontal applications used in any industry. But there are Industry vertical Enterprise applications too. Like Banking, Insurance, Universities, Hospitals, Government applications, etc targeted for specific industries. These vertical applications may access some of the horizontal applications to complete their tasks.

Cultural issues for Enterprise applications

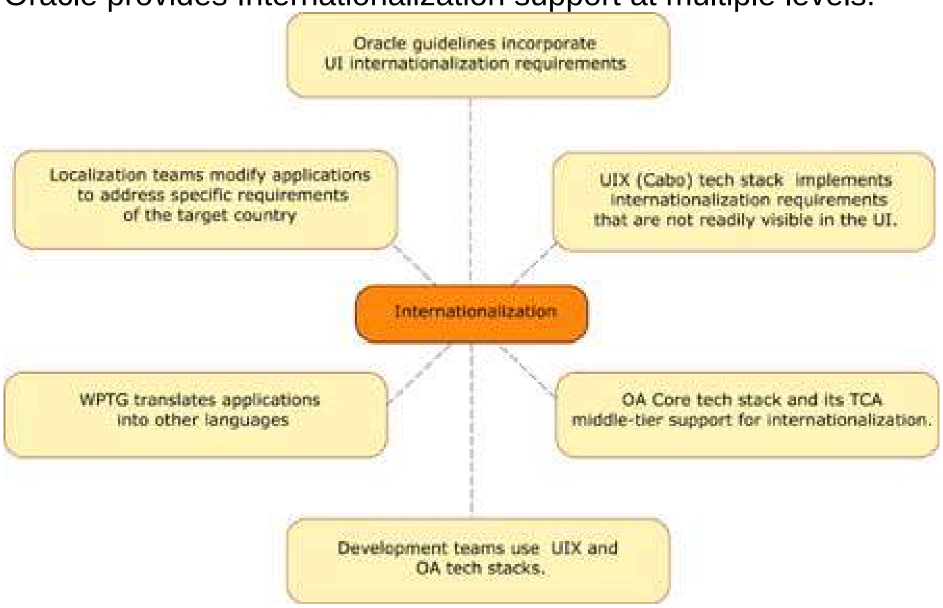
Enterprise applications does have to consider cultural issues in interfaces design like color, images and text which may affect people with particular religion or country or class. But there are more broader issues in terms of internationalizations and localizations that need be address in Enterprise applications. I18n and L10N indirectly addresses issues arising due to different cultures.

In software development, after a product has been internationalized, "localization" refers to the process of making it ready for a specific market. So you can refer to a product as being "internationalized" if it has been developed to meet most of the needs of an international community, but not yet customized to a specific region. The customization to a specific region is called "localization

Internationalization for oracle applications.
Internationalization is the process of adapting Oracle products for global use. Internationalization requirements vary from one country to another, depending on language, formatting conventions, and cultural values.
If an application is not compliant with Internationalization requirements, it will be much more expensive to translate it into some languages, and prohibitively expensive or impossible to translate into others. The net result is that the application may have an extremely limited market outside the USA, and thus hinder the overall marketing effort for Oracle Applications worldwide.

Overall Approach
Support for national language and corresponding character set, such as Japanese and Arabic.
Internationally acceptable use of images and colors. Some images, such as a hand with different fingers extended, may be interpreted differently depending on culture.
Support for national format conventions for dates, time, decimals, currency, names, and addresses. Formats may include or omit certain fields, and require different separators.

Oracle provides Internationalization support at multiple levels:



Translation and Localization Issues
A single language may vary from one country to another. For example, English spelling and certain terms vary between the US and Great Britain, with many former British Commonwealth countries, such as Australia, following British standards.
A single country may have more than one language. For example, Canada has both English and French as national languages, with legal requirements for communications in both languages.

Page layouts must allow translated text to expand by an average of 100 percent, and up to 150 percent for short words (less than 5 characters long) and narrow columns.
Words in some languages, such as German and Finnish, are typically longer than their English equivalents. When placed in narrow columns, such as Content Containers, these longer terms cause additional line breaks, leading to major increases in vertical space, and added horizontal space, which causes extra scrolling.
Some languages may not have equivalent terms to those used in the original English version, so those terms need to be translated as multiple words. For example, there is no single word for "privacy" in Indonesian.
Some countries, such as Sweden, regard the active voice as impolite, and use longer passive voice constructions.

Readiness of Text for Translation

- Help text is also more readily translated if it conforms to Oracle style standards, which promote clarity, brevity, and consistency. If translators have difficulty understanding content, they will have even more difficulty translating it.
- Longer does not mean better. In most cases, longer means "more expensive to translate" and "less likely to be read". High word counts can result in a document not being translated, which is a disservice to users worldwide.
- Label text and instructions may be translated by different people even though they appear on the same page. As a result, any instructions that reference label text may be translated differently. To avoid such errors, do not reference label text in Instruction Text, Tips, and Hints unless absolutely necessary to explain a complex range of options to new users.

<u>To avoid problems in translation of UI text:</u>

- Verify that all use of terms conforms to modern English usage.
- Avoid references in Help text to national organizations, telephone numbers, and addresses, unless specifically required, because these must be localized.
- A single term should only have one meaning within an application. For example, the English word "job" can have multiple meanings depending on context, such as a position in a company or a database management task. Those two meanings would be translated differently in most other languages, but translators have no way to know that separate translations are required.
- Write complete sentences, with proper capitalization and delimiters such as periods and colons, to make the meaning clear to the translator.
- Do not use Latinate abbreviations. For example, use "that is" not "i.e.", and use "example: 15-Dec-2004" not "e.g. 15-Dec-2004".
- For compound actions, use "or" instead of a slash, and "and" instead of an ampersand, unless constrained by space. Both translators and users may fail to understand the difference. For example, "View or Update" is preferred over "View/Update", and "Create and Add Another" is preferred

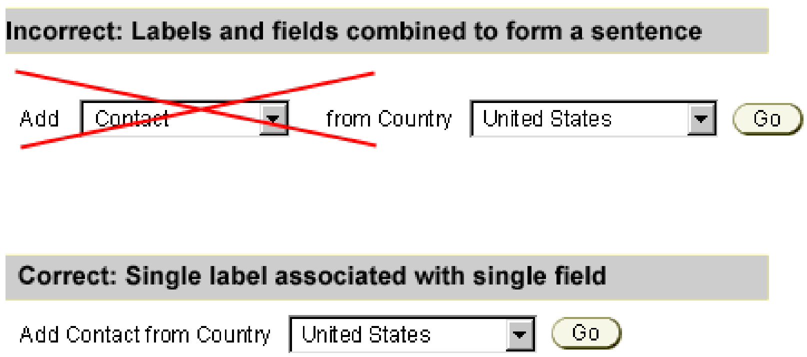
over "Create & Add Another". Also, do not use the construction "and/or": "and" and "or" are mutually exclusive.
- Use complete phrases in labels. For example, use "Replacement Text" instead of "Replace with."
- Do not rely on capitalization to indicate semantic differences; some languages do not have capital letters.
- Product names may also need to be translated, depending on the market.

Character Set Support
Applications must be able to display different character sets to support languages such as:
Japanese
Chinese
Arabic
Russian (Cyrillic)
Greek

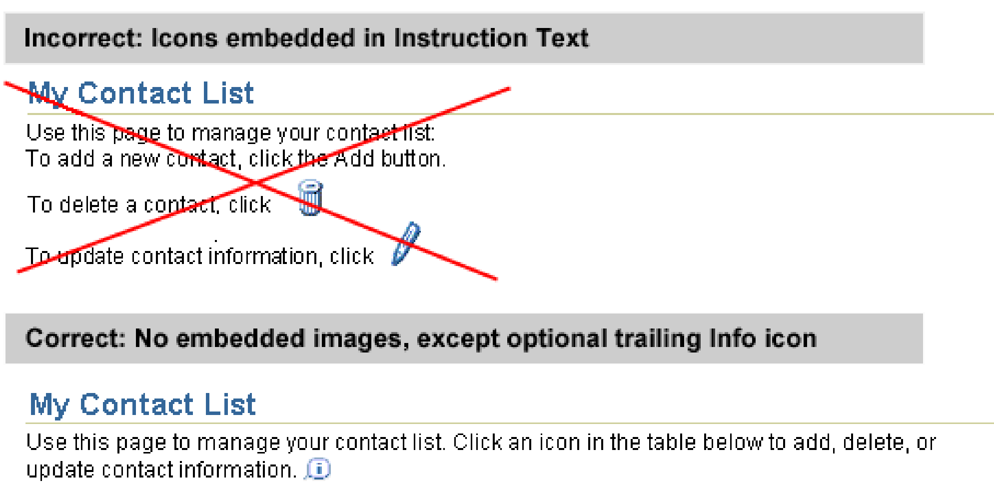
Bi-Directional (BiDi) Language Support
Applications should support bi-directional (BiDi) languages, such as Arabic and Hebrew, which read text right to left, but read numbers left to right (within the same body of information). This support is provided through style sheet settings, so it is essential not to hard code any element that must be translated into a BiDi language.
BiDi languages require that all horizontal directional UI images, such as arrows, be flipped to match the reading direction.

Layout and Style Issues
- Font Families: Developers can avoid using hard-coded fonts, but use CSS style classes instead, so that style sheet can then be customized by locale.
- Font Sizes: Certain font sizes are not available or legible in all languages. For instance, Asian fonts must be rendered in larger point sizes.
- Alignment: When aligning textual content, applications can use 'Start' alignment instead of 'Left' alignment, and 'End' alignment instead of 'Right' alignment. This ensures proper translation to all languages, including bi-directional languages. 'Right' alignment is generally reserved for numeric content.
- Horizontal and Vertical Space: Horizontal and vertical spacing can dramatically change when an application is translated to a different language, especially when that language is character-based or bi-directional.
- Embedded Images and Fields: Applications may not embed images or fields for variables within sentences, or concatenate fields and labels in a sentence-like structure, such as "Add {AddressObject} From {Country}"
    - Languages have different grammars, which cause major rearrangements of translated sentences, thus making it impossible to predict where to place the images or fields in relation to the labels.

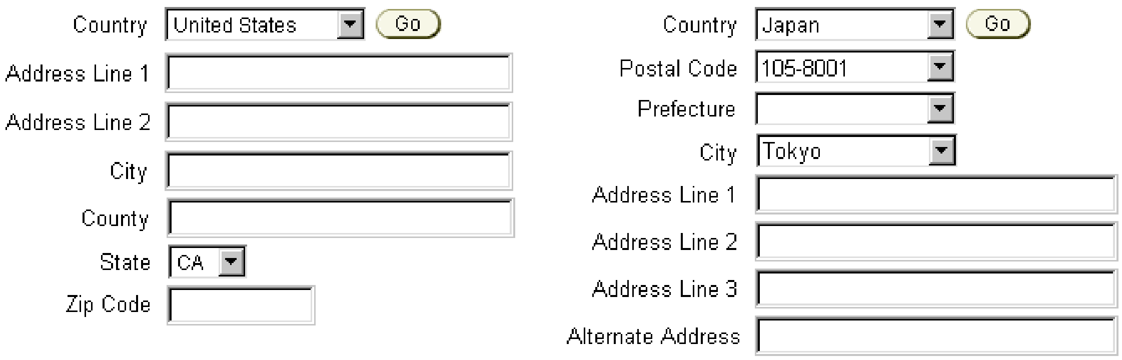
    - Some languages, especially Romance languages such as French and Spanish, have both masculine and feminine forms of articles, adjectives, and pronouns, and these parts of speech must agree with the gender of related nouns. If a field displays a word, it is impossible to predict its gender when translating associated label text.
- Fields and Field Order: Depending on locale settings or country selection, some fields in forms and tables may be added, omitted, or change order:
- Name and address fields may change fields and field order to match national requirements.
- Some languages, such as Japanese, include additional phonetic fields (a.k.a. "Alternate" fields as aids to pronunciation).
- These changes should be implemented by individual development teams based on the localization needs of their customers.



Untranslatable Sentence Formed from Fields and Labels



Untranslatable Instruction Text with Embedded Images



Contrast of Generic US and Japanese Address Forms

Cultural Values
Some colors, symbols, and images may be interpreted differently in different cultures
Problems with Colors
- Oracle limits extensive color usage to avoid culturally sensitive colors. In general, blue is the most acceptable color across all cultures:
- Black: Signifies death or evil in many European cultures.
- White: Signifies mourning in Chinese culture.
- Red: Signifies blood in some cultures, and is generally used for warnings. Some cultures may still associate red with Communism. Depending on the country, this could be perceived either favorably or unfavorably.

Problems with Images
When creating images and icons for use in applications there are three key rules to enable internationalization:
- Avoid placing text in images, as Oracle Applications will not translate the text.
- Verify that the image is not culture-specific. For example, an image from American football may have no meaning or even negative associations in some cultures.
- Avoid using images as metaphors, unless you can verify that the metaphor works internationally, across different languages (this is uncommon).

The following types of images should be avoided or used with caution in applications that target multicultural users:
- Hands: Hand and finger gestures have a wide range of interpretations across cultures.
- Faces: Vary in shape and color from race to race. If faces must be shown, they should include a group of mixed races, consisting of at least one Caucasian, one Negroid, and one Asian.
- National: Including flags and recognizable coins or currency, unless the application shows multiple flags or currencies.

- Religious: Including crucifixes or elongated crosses, crescent moons or sickles, six or five-pointed stars, figures seated in cross-legged positions or with hands forming gestures, and so on.
- Gender: Avoid showing only male or female images. American and European users may react negatively to male-only images; users from some other countries may react negatively to female-only images. If images of people are required, provide a mix of genders.

Formatting Conventions

Many format conventions vary from one country to another. Some of these, such as date, time, currency, decimal separator, and other numeric formats, are controlled by user preference and locale settings. Locale settings modify the display of data to match language, and national and regional requirements.
For example, many European locale settings substitute commas and periods as decimal separators in numeric formats. User preferences include choices between a minus sign and angle brackets to display negative numbers, choices between 24-hour and 12-hour time formats, and comma or period for numeric formats.

Common Formats

Common formats like label/data and tabular elements, such as names; addresses and telephone numbers should have a common layout and common formatting from application to application, as well as meeting internationalization requirements. Applications may deviate from standard formats where they have documented business or functional needs to do so, but such variations should not extend beyond that required by customers, and should adhere to internationalization requirements.
For instance, in an HR application users may need to enter their personal addresses; in a CRM application users may need to enter customers' addresses. The formatting of this information should both be similar between these applications, and be ready for translation without modifying the page.

Name Format Preferences

Formats for concatenated names are governed by the Name Format preference of the user viewing the name. The two name format options are Global or Local.

- The Global setting displays all concatenated names in an internationally viewable character set and sequence. The resulting concatenated name formats are identical to U.S. English formats, though a customer may choose to mandate another country's name formats for its global operations.
- The Local setting displays all concatenated names in the formats from the country in which they were created. This setting is expected to be used mainly by users who deal mainly with staff in their own country, and are in countries where the local names are different from the global names. For example, if a user in the U.S.A. sets the name format preference to Local, any names that were created in China would appear in Chinese characters, using the sequence in which those names are normally

displayed in China. However, if a name created in the U.S. appears on the same page, it would be displayed with the international character set, using English language syntax.

Concatenated Formats in Different Locales

Greeting, Display, and List formats may vary considerably depending on locale. The English language syntaxes may be used for other languages, especially Western European, but this is a locale-specific decision.

- When concatenating names in greeting format, such as "Welcome Mary Stuart," a sequence that is welcoming in one country may be strange or impolite in another. For the U.S.A., the standard sequence is "Welcome {Known As|FirstName} {LastName}"; other countries/cultures may require the sequence "Welcome {LastName}" instead.
- When concatenating name attributes in Display and List formats, different locales may require both different attribute order and different separators. For example, in the U.S.A. a name may be concatenated in List format with a comma as "LastName, FirstName", whereas in Japan the sequence is "LastName FirstName" without a comma.

When concatenating name attributes in legal Display and List formats, one locale may need to include name components not required in another. For example, a U.S. English application needs to include suffixes if they exist to meet national statutory requirements, whereas in France, suffixes are not required.

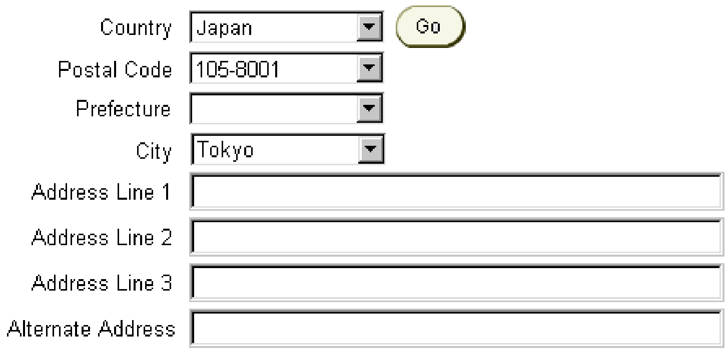
The following examples illustrate the variations in Greeting, Display, and List format syntaxes for certain locales (not a complete list):

- Japan
  - Greeting Format
    - Syntax: [Greeting] {LastName}{Esquire}
    - Note: The term "Esquire" refers to the word added to the end of the Last name, usually "san" in Japanese.
    - Examples: "*Welcome* Suzukisan"; "*Welcome* Miyamotosan"
  - Display and List Formats
    - Syntax: {LastName} {FirstName}
    - Note: No middle initial or delimiter between names
    - Examples: Suzuki Ryoji; Miyamoto Mushashi
- China: All three formats are identical
  - Syntax: [Greeting] {LastName} {First Name}
  - Note: The First Name (Given Name) usually consists of more than one Chinese character. When translated phonetically, the two words are often concatenated together. In China, the two words are concatenated without space. In Taiwan, the two words are hyphenated. In other locales, sometimes the two words are not concatenated but are still be treated as one name rather than First Name and Middle Name.
  - Examples: "*Welcome* Dong Guohong"; "*Welcome* Kwan Sai-Hung"; "Welcome Leung Chau Ha"

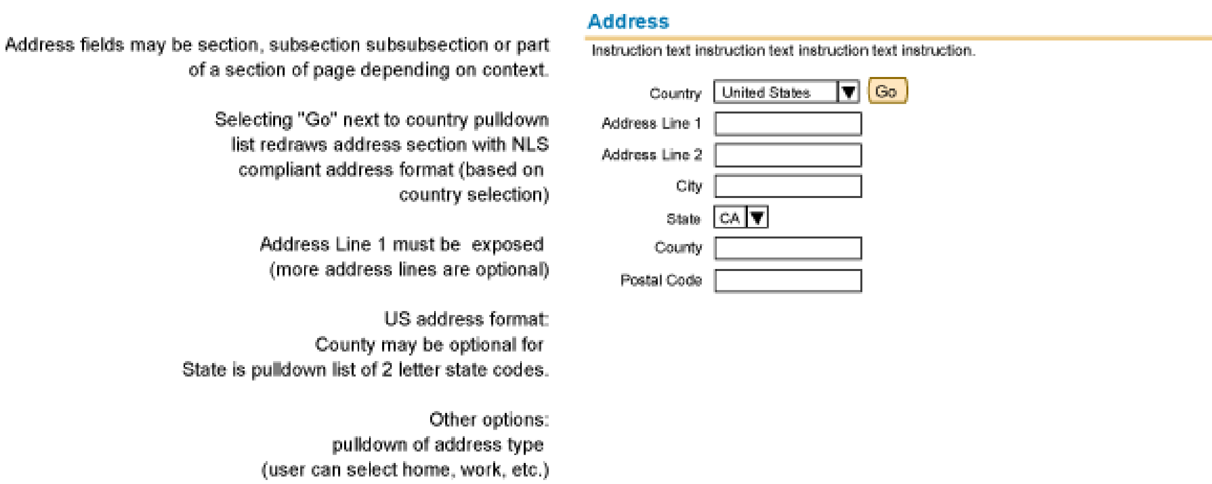
- Korea
    - Greeting Format
        - Syntax: [Greeting] {LastName}{FirstName}[Esquire]
        - Note: No space between Last name, first name, and Esquire. The Esquire varies depending on age and gender.
        - Example: "*Welcome* KimKyae-Youngnim" (for); "*Welcome* KimBogennim" (for)
    - Display and List Formats
        - Syntax: {LastName}{FirstName}
        - Note: No space between Last and First name.
        - Example: "KimKyae-Youngnim"; "KimBogennim"
- Arabic
    - Greeting Format
        - Syntax: [Greeting] {FirstName} {LastName}
        - Example: "*Welcome* Ahmed Ali"; "*Welcome* Maher Al-Nubani"
    - Display and List Formats
        - Syntax: {FirstName} {LastName} OR {LastName}{FirstName}
        - Note: Both syntaxes are supported -- some countries that use Arabic script, such as Egypt, sort phone books by first name; others sort by last name.
        - Example 1: "Ahmed Ali"; "Maher Al-Nubani"
        - Example 2: "Ali Ahmed"; "Al-Nubani Maher"
        -

Locale-Specific Address Format Issues
Depending on locale or country selection, both form and tabular layouts can change considerably:

- Number of Attributes: Some address attributes are country-specific. For example, five and nine digit zip codes are used in the U.S. whereas four-digit postal codes are used in Australia; some countries are divided into states, whereas others, such as Japan, are divided into prefectures. Some countries, such as France, omit the region name (department) because the first two letters of the postal code specify it.
- Order of Attributes: The order of address attributes may also change depending on the country. For example, in France, postal codes are placed before the city name.
- Required Fields: Fields may be mandatory in some countries and not in others. For example, in the U.S.A. if an address is required, then a zip code is a required field, whereas it may be optional in other countries.
- Phonetic Field: Some ideographic character-based languages, such as Japanese, require a phonetic field to help interpret character-based addresses.



Generic Updateable Japanese Address Form



Telephone Number Formats

- Each country may have multiple valid phone formats, with varying numbers of digits, and different delimiters. Consequently, the phone format field is dependent on the selection made in the "Country Code" choice list. For example, many European countries use periods to delimit sections of phone numbers, whereas dashes are more common in the U.S.A..
- The "Country Code" choice list is the first label/choice pair. A "Go" button follows the choice of country codes, unless PPR is used. When selected, the items in the phone format label/choice pair redraws based on the selected country code standard (NLS standard).
- The "Extension" field is optional.

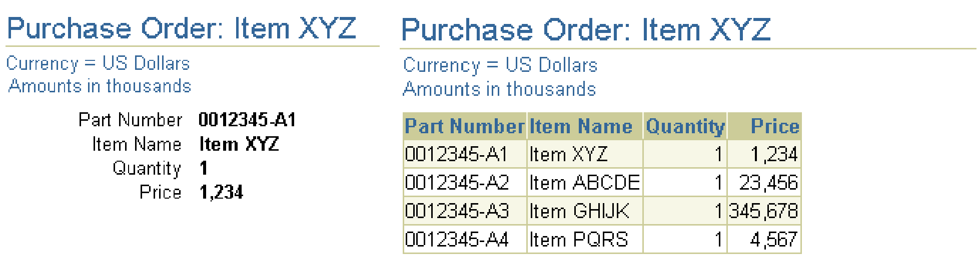
Phone Format

Currency Formats

- Depending on context, monetary information may appear standalone on a page, in a section of a page, in a subsection, or within a table cell.
- Monetary formats follow the numeric formats specified in user preference and locale settings. For example, in the U.S.A., dollars and cents are

separated by a period; in many European countries they are separated by a comma. Conventions for thousands separators also vary with locale (U.S.A. uses a comma).

- o Do not use the U.S. abbreviations "K" and "M" as these are not translatable.
- o Do not use currency symbols such as "$". Instead use full currency designators, such as "US Dollars", or currency abbreviations, such as "USD", together with Key Notation, for the following reasons:
  - o Lack of 1-to-1 parity of a currency symbol to the currency of a particular country. For instance, the dollar symbol "$" is not unique to the United States, but is also used by other countries such as Canada and Brazil.
  - o Performance issues using GIFs to display the currency symbols.
  - o Translatability problems, as not every currency symbol character is available in certain language's font set.
  - o Code overhead to keep choice list of currency code in synch via PPR with the symbol.

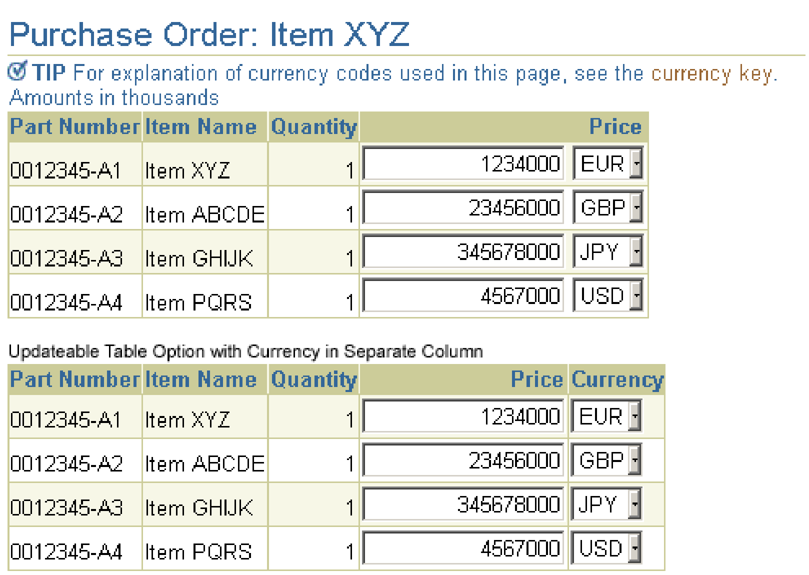

Purchase Order: Item XYZ
Currency = US Dollars
Amounts in thousands

Part Number	**0012345-A1**
Item Name	**Item XYZ**
Quantity	**1**
Price	**1,234**

Purchase Order: Item XYZ
Currency = US Dollars
Amounts in thousands

Part Number	Item Name	Quantity	Price
0012345-A1	Item XYZ	1	1,234
0012345-A2	Item ABCDE	1	23,456
0012345-A3	Item GHIJK	1	345,678
0012345-A4	Item PQRS	1	4,567

Currency in View-Only Format in Form and Table Layouts with Key Notation and Scaling


Purchase Order: Item XYZ
TIP For explanation of currency codes used in this page, see the currency key.
Amounts in thousands

Part Number	Item Name	Quantity	Price	
0012345-A1	Item XYZ	1	1234000	EUR
0012345-A2	Item ABCDE	1	23456000	GBP
0012345-A3	Item GHIJK	1	345678000	JPY
0012345-A4	Item PQRS	1	4567000	USD

Updateable Table Option with Currency in Separate Column

Part Number	Item Name	Quantity	Price	Currency
0012345-A1	Item XYZ	1	1234000	EUR
0012345-A2	Item ABCDE	1	23456000	GBP
0012345-A3	Item GHIJK	1	345678000	JPY
0012345-A4	Item PQRS	1	4567000	USD

Multiple Currencies in Updateable Table Layout with Tip and Scaling

References:

1. Hofstede, G. : *Culture's consequences : Internatioonal differences in Work-related values;* Sage Publications, Beverely Hills, CA, 1980
2. Oracle projects & reports.

Designing eLearning that Bridges the Digital Divide:

A Case Study of Training Automotive Service Personnel Through eLearning

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Abstract: *Established definitions of Human Computer Interaction get challenged when it comes to using information and communication technologies to reach people situated on the other side of the digital divide. As an example, while eLearning is a powerful new way to teach people who are computer literate, can it be effectively leveraged to scale up training and teach people who are not yet computer literate?*

A large Indian automotive conglomerate was faced with the challenge of rapidly upgrading the service skills of its vast workforce across different geographies. To facilitate this, eLearning was proposed as a solution. However, to enable the transition from the traditional modes of learning to eLearning, it was necessary to:

1. *Build interactive courseware that was easy to use even for the computer illiterate*
2. *Design learning that fitted seamlessly with the complex and ever changing performance needs of the workplace*

To achieve these objectives, extensive user testing and contextual analysis was conducted to arrive at a solution definition. Enabling learning also involved planning the changes required in the contexts of use and models of learning besides developing courseware.

The results of this user testing and contextual analysis validated many assumptions while providing new insights on the nature of Human Computer Interaction design that will work in such scenarios. The validated assumptions and insights led to:

1. *Design of an instructional method*
2. *Design of the Human Computer Interaction patterns*
3. *Defining the eLearning technology framework*

The courseware was field tested (after design and development) to elicit learner feedback and enable further refinement.

This paper shares our experiences and the methodology adopted in designing a product that is sensitive to the culture and contexts in which individuals work, learn, share, think and behave, thus bridging the digital divide. It also shares insights on the potential of technology mediated learning to empower access to information and knowledge across hierarchies.

Increasingly, training is becoming an important business factor in effective change management even as a rapidly changing economy threatens to change the ways of working quite frequently. Standard approaches to employee learning fail to address the problems of scale and geographical dispersion for today's large corporations:

- Existing human learning patterns cannot easily adapt to the rapid learning required for pushing up corporate performance, which is nowadays measured in terms of revenue per employee.
- The desire to improve profit margins is leading corporations to explore new ways of optimizing performance that reduce heavy investment in instructor-led training (ILT).

In such a scenario, eLearning becomes an effective tool to meet various conflicting business demands for efficient financial management, training, process engineering and change management. While this requires an initial investment in infrastructure like computers, computer rooms, servers etc., eLearning brings down the average training cost per employee, in the long run. Many organizations around the world are increasingly switching over to eLearning as a mode of rapid and cost-effective training.

However the road ahead for eLearning is not smooth in every situation. In developed countries, although degrees of digital literacy vary, basic digital literacy is more or less assured. In developing countries, however, eLearning faces the challenge of a wide Digital Divide. Except for corporate executives and a few government personnel, digital literacy is not widespread. Farmers, service station personnel, etc., in these countries, are outside the pale of the digital horizon. At the same time eLearning offers the most viable option for extending learning reach to a large number of geographically distributed learners. Therefore, the biggest challenge of training and education in the developing countries is that of reaching the billions who are not digitally literate yet, rather than the few millions who are already digitally literate.

It is not simply a matter of making computers affordable or available. The gulf that separates digital natives (digital literates) and digital immigrants (digital non-literates or neo-literates) also structures their ability to use the medium for learning (*Prensky, 2001*). According to the knowledge gap hypothesis (*Tichenor, Olien and Donohue, 1970*), media always accrue their best benefits to those who are already media-savvy, while those who have limited access to media or limited exposure to learning are finally left out of the knowledge advantage. It is not simply a question of access to media. It is also a question of the competence to leverage media for self-development and professional growth. And then, it is a question of a whole range of cognitive, affective and behavioral differences that separate the socio-cultural milieu of digital immigrants from that of digital natives.

Can eLearning really be used to enable digital immigrants improve their performance through learning or will the complexities of digital technology bog them down? eLearning developed for digital immigrants faces two challenges that it must meet in one sweep – *delivering learning through digital means* and *making the learners digitally literate*.

The Case

The case that we are presenting today is a representative example of an eLearning solution developed to meet the two-faced challenge of building eLearning bridges across the digital divide within the constraints of the culture and economics of the solution. The solution was tested in a field context after development to validate assumptions. The approach to design and its validation followed makes the case for research-driven eLearning. In presenting this case, we bring an industry perspective to learning solutions that address considerations of scale, economics and performance-driven improvement.

The Business Background

Tata Motors, a leading automotive company, wanted to improve the aftermarket service of its commercial vehicles. Towards this end, Tata Motors envisioned an integrated eLearning initiative to upgrade the competency levels of its aftermarket service workforce.

The key objective was to find a scalable solution to rapidly upgrade the skill level of its service personnel as close to expert level as possible. The benchmark for measuring the success of this learning initiative was defined as a discernible and substantial improvement of the Post-Sales Service Satisfaction Index.

Trina Systems proposed eLearning as a strategic tool to develop and manage the competencies of Tata Motor's service personnel globally. Trina's proposition was that even if the service personnel of Tata Motors may have limited or no exposure to computers, eLearning can be designed and developed to circumvent the digital divide and deliver learning interventions that can be accessed anytime and by anyone based on a need-based pull.

Contextual Inquiry

As the starting point for design, contextual Inquiry and user testing were used to define problem scenarios and end-user behaviors. Contextual inquiry is a useful method for understanding the environmental context of use. The objective of contextual inquiry was to elicit a pragmatic design solution based on an understanding of learning patterns among the service personnel.

Apart from the learning context and its end objectives, a delimitation of the learning environment and learner groups served as the contour for design. Some of the factors studied include user behaviors in workplaces; specific work based learning needs; aspects of the physical environment in which the users learn; learning dynamics between different age groups; and the flow of knowledge in workplace hierarchies.

This inquiry yielded interesting insights into the nature of interpersonal, environmental, technological and temporal constraints to learning, which govern the everyday life of these service personnel.

The contextual inquiry aimed to understand how and to what extent a 'learning space' can be structured into their environments and how courseware needs to be designed to enable learning in the constraints of the learners' environment – space, time, place, relationships, etc.

Studying the contexts of work and performance to structure the learning space

Studying end-user behavior for inputs into design

Knowledge Flows and The Mentorship Model

Our study found that technical skill sets like automobile servicing are practiced with a great deal of respect for work. Seniority, experience and attentiveness count more than educational qualification as factors of influence. An *ustad (expert)*, usually a senior mechanic, owns up the responsibility for mentoring junior mechanics. *Ustads* are treated with a lot of respect by their colleagues. They serve as formal and informal knowledge resource centers.

However, the age-old mentorship model has its own set of demerits in managing the time and human resources available on the work floor. On an average, it takes three to four years for a junior mechanic to reach a level where he can work on servicing activities without any guidance. Access to knowledge is restricted to and controlled by managers and senior technicians.

Technological Resource Support

The workshops of Tata Motors generally have about 30-50 mechanics working in two to three shifts a day. Analysis showed that the resources available on the work floor to perform the servicing tasks on the vehicles are inadequate in most cases. Most of the personnel devise their own convenient methods of performing tasks and use non-standard substitute tools, which impact work quality.

Time and Other Work Conditions

Workloads are heavy. Usually a service person performs servicing tasks under severe time constraints and does not have the time or the mental space for traditional classroom training. Managements cannot afford sending their service personnel to distant Training Centers for many days for specialized training.

Further, a mechanic gets a maximum of one or two hours a day off from his regular work and service tasks for learning, drinking tea or smoking, or casual conversations. Very few service centers have a dedicated training room. The work environment is also characterized by high ambient noise from servicing activities and less-than ambient lighting conditions.

The Linguistic Barriers to Learning

One of the factors which caused discomfort of the service personnel with class room training and technical manuals was the unfriendly, jargon-heavy and pedantic language of manuals and training sessions. These use English as the language of instruction, which most service personnel do not understand. Even when vernacular was used, the language was far removed from the vocabulary levels of the service personnel.

User Testing

User testing is performed to ascertain if a given product is 'fit-to-use'. In a HCI context, user testing helps design software that works for the group of users for whom it is meant.

User testing with variants of automotive training courseware and digital media samples of varying levels of complexity was conducted on a select group of service personnel. Special care was taken to ensure variance maximization in the test group by including service personnel of various age groups, education levels and experience levels. Care was also taken to make the exercise non-intrusive.

Parameters for User Testing

The users were invited to participate for about 30 minutes and carefully observed as they worked their way through the digital media. The learners were observed on the following aspects:

1. Perception of Digital Advantage
2. Encounter with The Digital
3. Visual Literacy
4. Predisposition to Group Vs. Individual Learning

This exercise yielded additional interesting insights.

Learners tried out variants of automotive training courseware and digital media samples

Learners tried to manipulate VRML models on screen

Perception of Digital Advantage

The use of computers for learning was greeted with enthusiasm as it helped them become aware of the essential tools for servicing. Users also felt that learning computers will help them service the new Euro range of TATA vehicles which have computer-controlled engines and require the use of a diagnostic laptop computer to download and interpret the vehicle malfunction codes stored in the engine's embedded system.

The Encounter with The Digital

Quite understandably, many of the service personnel experienced an initial inhibition in using computers -- getting used to IT vocabulary, devices, and actions. Visual elements of the graphical user interface, navigational prompts etc. were found confusing for the learners. For many of the learners, the logical connection between mouse, cursors, digital actions and digital events was not very apparent and had difficulty in recalling actions to be performed. They could not structure random guided actions into an integral whole and get the picture of how to use computers. A large number of learners tended to navigate randomly rather than logically.

Visual Literacy

The personnel could relate best to realistic or photographic representation in service procedure demonstrations. We did not expect service personnel to be visually literate enough to understand evolved graphical representation techniques. However, the visual literacy levels displayed were higher than expected. Demonstrative visuals went very well with the audience. Wide appreciation was also received for isometric drawings for their ability to explain automotive assemblies.

3D representations of procedures and assemblies using VRML and real time 3D rendering tools generated excitement and were found useful in representing fitments from every possible angle, although learners found it difficult to manipulate the view angles and zoom-pan levels.

Predisposition to Group vs. Individual Learning

The personnel displayed group learning over individual learning during the contextual inquiry process. However, this cannot be generalized as their normal pattern of learning. It is quite possible that group learning will finally lead to individual learning as service personnel get better used to computers. Based on the results of the contextual inquiry, user testing, business objectives, and secondary information obtained from Tata Motors, its service managers and service personnel, an instructional framework was developed to meet learner needs. The product design was made keeping in view the detailed observations of user behavior and learning environment.

Assumptions Guiding Instruction and Product Design

Based on the learner profile, business objectives, learning and performance objectives, contextual inquiry and user testing, we derived a set of assumptions to guide instructional method and product design. These were:

1. Layering of content can confuse learners
2. Navigation should be linear
3. The learning content should be organized by service tasks
4. The learning path should be structured by components, parts, sub-parts, tasks and sub-tasks
5. 3D visuals allow learners to relate better
6. Demonstrative method of explaining procedures will work better
7. Audio is a key element to instruct low literacy users and allow users to feel as if they are listening to an *ustad*
8. The language should be as close to spoken language as possible

The Instructional Framework

The instructional framework for the course was designed based on business objectives, learning and performance objectives, learner profile, contextual inquiry and user testing. We discuss the instructional framework beginning with the instructional objectives.

Instructional Objectives

The instructional objectives for the eLearning courseware were governed by the learning elements that the courseware was to capture. The following were the main elements of that constituted the learning framework for the courseware.

1. Concepts (Definitions, Ideas)
2. Procedures (Sequence of Steps)
3. Practice (Virtually Perform Tasks)
4. Inference (Troubleshooting)

The objective was to provide quick, easy and transferable instruction for knowledge, concepts and procedural tasks required by the technicians and to enable the technicians to independently handle service situations that lack precedents. This required that apart from procedural training, concepts, inference techniques and tacit knowledge would cement the learning into an integrated whole.

The Cognitive Apprenticeship Model

The instructional model was based on the Cognitive Apprenticeship model (*Collins, Brown and Newman*, *1989*). This model stresses situated learning and aims at a culture of expert practice. The model uses a scaffolding method that introduces users to increasing levels of complexity, diversity and specificity as the learner master simpler and global level skills. There are five key elements of the Cognitive Apprenticeship model.

1. **Modeling:** The expert carries out a task to enable learners to build a conceptual model of the processes required; models instruction based on real life processes and provides explanations: and models false starts, dead ends, and backup strategies to transfer tacit knowledge.
2. **Coaching:** The expert observes learners while they carry out tasks and offers hints, feedback, modeling, or reminders.
3. **Articulation:** The learners articulate their knowledge, reasoning, or problem-solving processes.
4. **Reflection:** The learners compare their problem-solving processes with those of the expert.
5. **Exploration:** The learners perform problem solving on their own and frame interesting questions or problems that can be solved in the process of exploration.

The Human Connection

The mode of learning was designed to complement the traditional mentorship model of learning that fosters confidence and trust. The focus of the framework was on delivering accurate and sufficient information with optimum engagement time. This translated into an instructional approach that would give learners the feel that an *ustad* or *guru* is explaining things in a methodical, step-by-step manner.

The underlying aim was to go beyond the approach of technical training manuals and capture the tacit knowledge that resides in the heads of expert trainers and mechanics. In other words, the relationship between computers and learners was pegged at the *ustad-shagird (expert-novice)* or *guru-shishya (teacher-student)* relationship, rather than at the level of man-machine dynamics. Accordingly, audio played a key role in establishing the human connection of an expert guiding the apprentice. The language of audio was kept colloquial to address the language barrier caused by jargon and literary Hindi or Urdu.

Considerations of Literacy

The specific tasks and procedures have been explained predominantly through an audio and visual focus with very limited textual information, keeping in mind the low literacy levels and predominantly oral culture of service personnel and the need for accurate visual representations of service procedures. However, trainers and learners with higher literacy levels can access the text transcripts of all the tasks and procedures at the click of a button.

Procedural Learning

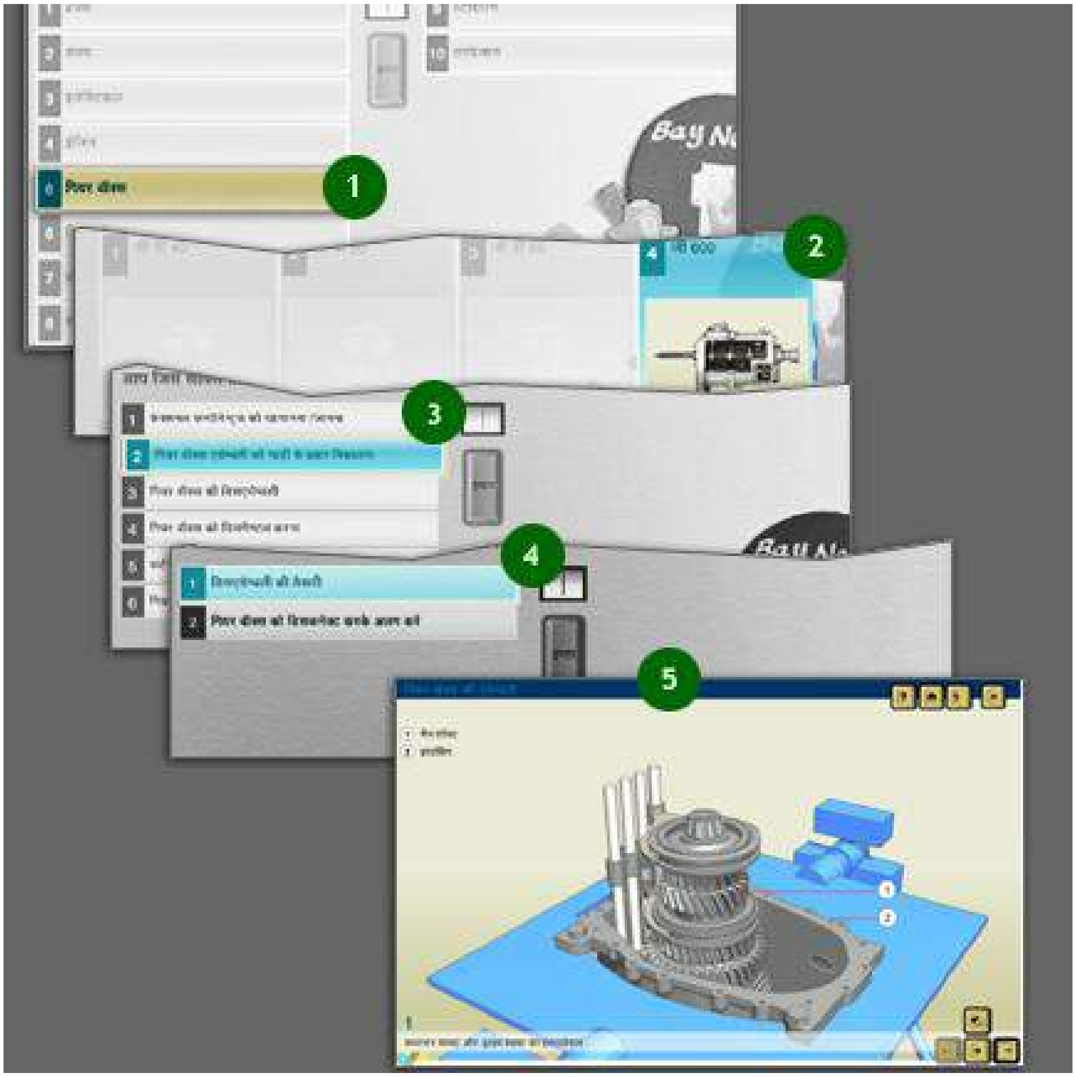
To align learning as closely as possible to the context in which the service personnel use information, a task-centric organization (of learning) was chosen against an abstract classification of content. Access to information was procedurally organized. In the model, the user proceeds along the path: a particular aggregate (or component); relevant variant; list of major service tasks; list of sub-tasks for each service task; an audiovisual walkthrough of the procedure to perform the sub-task. This categorization is done according to the logical set of activities to be performed during servicing. The user thus follows the same order for finding relevant information that he would in his day-to-day servicing scenario. This helps even entry-level mechanics get the process flow of servicing activity, very clearly.

Managing Learning Chunks

Based on our observation of the workplace behavior of service personnel and elicited feedback on the amount of time a service person can devote to learning in one sitting, seat times were calculated for different content chunks. An affirmative conceptual model was used to structure information into small, logical and quickly accessible chunks (around 10 to 12 minutes per chunk).

Learning Path Customization

To address various levels of learning, progressive and custom learning paths were planned out. This path takes the learner through basic, middle and higher level servicing tasks in a systematic manner. The content was structured in a way as to facilitate customization to suit the needs of a particular service center. This allows service centers to assign basics to beginners and advanced learning content to experienced users who have already demonstrated a good knowledge of basics.



Task-centric organization of learning: User selects an **aggregate** (*Gearbox*), then a **variant** (*G-600 Gearbox*), a **service task** (*Removing the Gearbox from the vehicle*), **sub-task** (*Preparing for disassembly*) and an **audio-visual walkthrough** of the procedure to perform the sub-task.

Competency Measurement

Assessments were tied to a progressive learning path. Learners who attain a cut-off score for assessments at one level get certified and are qualified to proceed to advanced levels. This allows tracking of performance patterns and technical competency at the level of the individual user. The data can also be used to measure performance and competency at the level of a service station or a region, to monitor business competitiveness.

Product Design

Based on the insights of contextual inquiry and user testing and the broad product requirements as defined by the customer, a multi-tier hypothesis was framed to guide the design and development considerations of the product including technology, interface, instructional media and product placement. The following were the key considerations guiding design.

1. Scalability
2. Usability
3. Workplace Ecology
4. Translatability, Customization and Content Kaizen
5. Mode of Delivery

Scalability

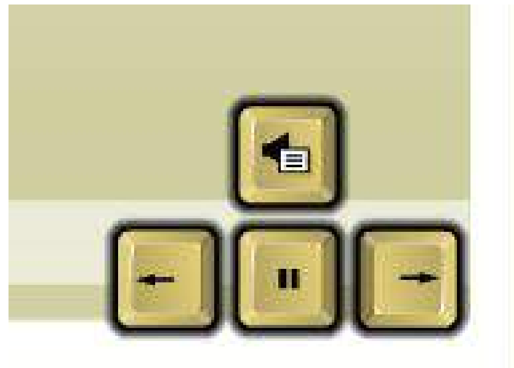
The scalability challenge consisted of delivering 50 hours of learning, at 500 service locations to 5000 technicians and tracking the performance of the learners over an extended period of time to measure learning and performance. Currently, a pilot courseware of 3 ½ hours has been successfully rolled-out at 5 locations to 70 learners and we are in the phase of scaling up to deliver additional hours of learning. Both scalability and economic considerations demanded that design should progressively cut down on costs incurred. And yet, the quality of learning delivered and performance affectivity should not in any way be compromised.

Usability

A well-articulated design for human computer interaction should focus on establishing a good mind map of the application in the minds of the end-users. The architecture developed for the courseware is based on an evaluation of the user's level of familiarity with similar applications and leverages upon this to define the various access points of information/data across the application. In terms of usability considerations, the main challenge in this case was to design the courseware for learners with minimal or no computer skills.

The role of graphical interface is to give tangible forms and semantic connections to various tacit conceptual models of interaction that are normally established in the user's mind. The visual design of GUI was developed to provide instantaneous feedback on actions performed by users. Rollover effects and rollover audio guide user on the menu items. Clear visual clues (forward/backward arrows) with styling similar to the corresponding keys on the keyboard, aid navigation. The navigation allows multiple modes of access for keyboard-friendly and mouse-savvy users. The navigation system can potentially be customized for learning kiosks, although this was not explored for this project – most service stations had computers, but kiosks would have required separate infrastructure.

The graphical interface allowed for both keyboard and mouse navigation



The visual navigation clues in the interface mirrored their corresponding keys on the keyboard

As most servicing activities are performed in a sequential manner, there was a greater design emphasis on sequential rather than random navigation. The navigation itself was designed to suggest the mental model of course structure and intuitively guide the learners to the logical sequence of content.

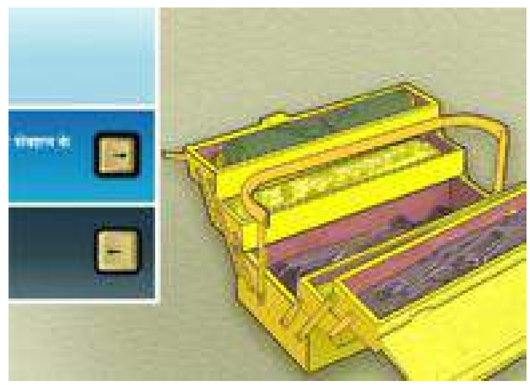
We also had to keep in mind that informed learners or evolved users should be in a position to seek specific information they are looking for. In other ways, the courseware was designed to be read both like a manual and an encyclopedia. The design avoided the use of evolved user interface elements to layer information keeping in mind the computer literacy constraints and user discomfort with layers.

Workplace Ecology

Another consideration in design was to ensure a seamless transition from the work environment to the learning environment. The learning system was designed to facilitate a comfortable transition for the digital immigrant. For example, it was easier for the service personnel to connect to the concept of button pressing than mouse clicking. It achieves this by establishing quick and easy access to a topic of interest and multiple-point control options for various comfort levels like keyboard and mouse-enabled navigations. The interface was also designed to permit various levels of familiarity over the peripherals and interface elements. There was a clear physical, visual, and instructional differentiation of learning space in the courseware context.

There is a great need to understand the actual contexts of use and the interaction patterns to facilitate eLearning for people on the wrong side of the digital divide. Apart from addressing the technological barrier, there are other barriers that call for attention. The learning space needs to be physically and psychologically differentiated from the entertainment space, the leisure space, or the workspace. Learners inhabit multiple simultaneous and contemporaneous worlds. Many of these spaces clash with each other. Effective structuring of learning space goes beyond the design of courseware. It includes the management of the physical space for learning like computer rooms, computer desks etc., and mental space in terms of time, motivation and energy to learn, learning space vs. human space, relevance, usability, and human learning abilities.

The *Digital Migrant* bridges the divide, click by click



Transitioning the learner from the context of performance to the context of learning

Trina Systems is working in close collaboration with Tata Motors to go beyond delivering courseware by making recommendations for infrastructure, learning calendars etc.

Translatability, Customization and Content Kaizen

To favor geographically specific language needs of the learner, every aspect of the courseware and product have been made translatable. This enables easy customization of the courseware to that of the primary language speakers in a region. It also allows easy customization for new parts or vehicle types.

The design had to keep in mind constant updates for newer vehicles that hit the road and changing vehicle parts and designs, every six months. A web-based content repository was developed to deliver the courseware to geographically dispersed locations. The courseware has a modular media architecture, which takes care of content modifications, additions and change requests without involving long development and deployment cycles. The architecture handles audio, visual and textual data in separate packets allowing for easy translatability into multiple Indian languages and easy customization. The architecture allows easy replacement of audio, media and text.

To ensure continuous learning and constant performance measurement, a Content Kaizen has been proposed to capture best practices from the shop floors, form active discussion forums and nourish a proactive community of learners. Monitoring the performance of learners and assessing the effectiveness of courseware is also required for a progressive effectiveness of the system.

Mode of Delivery

Another constraint for design was the limitation on byte size due to bandwidth and infrastructure constraints at remote service locations. To address this, media were optimized for enhanced, hassle-free, internet delivery: The content has been structured into optimal data packets, to enable progressive loading of content in a manner that ensures uninterrupted end-user experience even under low bandwidth conditions.

Validation of Design – Rollout Research

It is one thing to interpret the results of contextual inquiry and user testing for insights that lead to good HCI design. But there is a great deal of space for *interpretation* to diverge significantly from *insight*. It is here that *design validation* becomes of paramount importance. We rolled-out the first set of learning modules at five locations across India to validate the soundness of our design decisions in the actual contexts of use and obtain feedback from users for improving design.

Field Testing Methodology

A joint team comprising of the representatives of Tata Motors and the Trina design team presented the benefits of eLearning and the idea behind the initiative to management/owners at five locations: Pune, Mumbai, Delhi, Jalandhar, and Kolkata. The Trina team deployed the product on the system(s) at these locations and conducted a hands-on, interactive session for the learners to get them started on eLearning. This session included:

1. Explaining the benefits of eLearning
2. An overview on how to learn from an eLearning product
3. Teaching the learners the use of mouse and keyboard and product navigation

The Trina team performed a heuristic formative evaluation by observing the behavior of users with the courseware to study patterns of interaction with the medium and identify potential areas for further improvement of design. We based our method of evaluation on Donald Kirkpatrick's four levels of evaluation – reaction, learning, performance and results (Kirkpatrick, 1994). The last three levels are measured in the long-term and have not been implemented yet. The users were administered a customized variant of Kirkpatrick's Level 1 training evaluation form (in Hindi) that measured the product on 13 individual parameters for validating instructional design and also elicited an overall rating of the learning experience. Apart from obtaining quantitative ratings, qualitative feedback was obtained for five parameters – topics to be included, topics to be excluded, most liked aspect, suggestions for improvement, and topics/areas where instructor-led training is required.


The Tata Motors and Trina team explains the benefits of eLearning


The Trina Learning Designer provides an overview on how to learn from an eLearning product

Quantitative Analysis of Responses to Scale

The respondents were asked to rate the course on 13 dimensions on a three-point scale of satisfaction where 1 indicates dissatisfaction and 3 indicates complete satisfaction. Refer List A for the 13 dimensions. Apart from these individual dimensions an overall rating was also elicited. The responses obtained from a total of 56 respondents across 5 cities were statistically analyzed. On all the 13 dimensions taken together, the statistical computed average is 2.62, which means that most respondents have rated the course high. The objectively estimated or statistically computed average rating of 13 dimensions corresponds perfectly with subjectively elicited overall rating of 2.62. The specific details for the five cities are shown in Chart A and Table A.

Specifically, 9 of the 13 dimensions were rated highly satisfactory by the users, but 4 dimensions were rated moderately satisfactory. These were:

1. Description of course objectives
2. Coverage of procedures
3. Sufficiency of practice feedback
4. Application at work

No dimension was rated unsatisfactory.

Qualitative Analysis of Open-Ended Responses

Five open-ended questions were posed in the feedback questionnaire. These pertained to, topics to be excluded or included, most-liked aspect of the product, suggestions for improvement, and topics where instructor-led training may be required.

An observable trend with good implications for designing courseware for automotive service personnel is the stress on practical knowledge, correct knowledge, troubleshooting, parts information, dimensions etc., in the North (Delhi and Jalandhar). Skepticism seems to have been higher in Delhi, especially in responses from a group of affiliated service dealers. The respondents did not feel that anything covered in the courseware needed to be excluded, but they expressed desire for the inclusion of more information. Some of this was specific. Some users stated that the actual physical effort involved in doing a task was oversimplified at some places.

To the question as to what was most liked by respondents, 10 respondents out of 33 who answered (25.64%) liked the step-by-step method of explanation, which figured as the major benefit perceived. This validates the instructional framework used by us. Six people (15.38%) liked the idea of learning from a computer medium. Five respondents (12.82%) liked the presentation visuals and four respondents (10.25%) felt that the key benefit was that you could learn in your own time and in much lesser time with this method. Other respondents mentioned the use of Hindi, procedure-lookup, replicability at workplace, simplicity of the software and an auto-reverse provision as the key benefits.

Most suggestions for improvement pertained to additional information. Other suggestions included a more practical instruction approach that accounts for troubleshooting and not just servicing of vehicle components; inclusion of more practical and comprehension exercises; and translation into vernaculars other than Hindi.

12 respondents out of 27 (42.85%) felt that classroom training is not required, while 16 out of 27 (57.14%) felt that it was required for some topics. Of these, five respondents (17.85%) felt that measurement procedures require classroom training while 3 respondents each mentioned specific service topics. Other respondents mentioned troubleshooting procedures; information for new models and parts etc.

Results of Observation and Discussion with Stakeholders

Apart from the results obtained through the feedback form, discussions were held with service personnel and station managers. The service locations were evaluated for suitability as learning spaces. The actual behavior of service personnel while using the courseware was also observed and video-recorded for analysis. Some interesting insights obtained were:

1. Absence of dedicated PCs for learning
2. Lack of supervision/guidance for night shift learners
3. Unwillingness or inability of dealers to allocate time for learning during the workday
4. Restricted or indirect access to learning space when located in the manager's offices
5. Lack of documented data on hardware requirements and bandwidth and varying hardware and bandwidth specifications

Some areas of improvement in the GUI and product experience were identified based on the heuristic evaluation process and the observed behavior of the learners in interaction with the system:

1. Introduction of intelligent-intuitive navigation guidance for slow learners through more relevant prompts to guide users around dead ends
2. Stronger reinforcement of the linear navigation logic through cascading actions that take users from one level to another

3. Restriction of the number of keyboard controls to be used or development of customized keyboards or input hardware

Validation of Product Design and Instructional Framework

The results of the rollout exercise validated product design and architecture and the instructional framework used to deliver learning through the courseware. While some users required initial guidance on how to use a mouse or keyboard, these initial difficulties were quickly overcome and the final feedback focused more on information needs rather than HCI design.

The assumptions that got validated were:

1. Layering of content can confuse learners
2. Navigation should be linear
3. The learning content should be organized by service tasks
4. The learning path should be structured by components, parts, sub-parts, tasks and sub-tasks
5. 3D visuals allow learners to relate better
6. Demonstrative method of explaining procedures will work better
7. Audio is a key element to instruct low literacy users and allow users to feel as if they are listening to an *ustad*
8. The language should be as close to spoken language as possible

Of these assumptions, one was partly challenged – part of the feedback was that content should be structured according to troubleshooting scenarios rather than servicing tasks, as troubleshooting rather than servicing is what service personnel require more guidance on.

However, beyond courseware, enablement of learning requires attention to investment in infrastructure and structuring of learning space and time. There is a far more need to acknowledge the human aspects of learning situations to gain, than suggesting just the right information. The Trina team is working with Tata Motors to ensure that these issues are addressed.

Implications – Bridging the Digital Divide

We return to the question we asked in the beginning. So how does one design eLearning that bridges the digital divide? Let’s consider the results of our case against the backdrop of psychological, social, cultural, technological, economic and design considerations.

Factors Governing Mastery of Technology

Human beings have an innate ability to learn and master technology provided it is relevant to their world, and they know, understand and are convinced of its relevance. Ordinary people manage to pick up the skills necessary to harness complex mechanical technology from cranes to tanks to tractors to lathe machines with remarkable ease. But there are a few points that drive this learning:

1. **Relevance.** Users learn technology if it is relevant – it helps them get a job, it helps them reduce the effort involved in household chores, it saves them money or brings them profits. Innovations are adopted when they are perceived as relevant and skepticism is overcome. Mobile communications has had a faster rate of diffusion than computers because its value benefit is more easily comprehensible.
2. **Simple to Complex.** Users learn technology by starting with survival skills and move towards expertise skills after mastering these survival skills. As an example, a computer game developed for avid gaming freaks may appear too complex to digital immigrants.
3. **Intrapersonal and Interpersonal Resources.** Users learn by leveraging intrapersonal and interpersonal resources like guidance, imitation, cautious approach to experimentation, etc.

The degree of ease with which technology is mastered depends on whether it was developed keeping its users in mind or keeping in mind the developer's level of expertise and preferences. The lessons of usability are clear. What is designed for *someone who reaches out* to use software is not the same as what needs to be designed for *someone who needs to be reached*. Any digital technology to enable learning among digital immigrants can succeed or fail based on how much it takes these factors into consideration. By establishing relevance, scaffolding learning and drawing on the contextual resources, HCI design can meet the challenge of enabling digital immigrants to master computers.

Cognitive Assumptions of Computers

One key concept in building an effective instructional model is to bring the learning contents and learning paths of the courseware in alignment with tacit methods of content structuring and tacit behavioral patterns in technology use displayed by the learners.

Porting print content structuring and learning path-structuring conventions to eLearning has its drawbacks because eLearning is very unlike print-based learning materials in many respects. eLearning structured like a book does not give a sense of 'cover' (breadth) or 'volume' (completeness). It also fails to create digital equivalents for aspects of reading experience like flipping pages, knowing the extent of content read and yet to be read, intuitive book marking as indexed by thickness of the book versus thickness of pages covered, etc. The computer also forces a learning mode that requires seating and sitting. Insofar as courseware interaction patterns are similar to other e-engagement patterns of software and websites, proficient computer users find eLearning comfortable, but this might not apply to users who have had little or no experience with computers.

With computers there is also the issue of user-friendliness from the perspective of a digital immigrant. The idea of mechanical control, which is dominant for other technologies, is marginalized by computers, which place greater emphasis on higher order and complex cognitive styles of control. The mouse drives digital immigrants mad. Saving, file naming, directories, repository, searching, viewing, editing, zooming, writing – the list of concepts that a person needs to understand to be able to use computers is very high. A highly literate person can easily grasp the significance of these things, but a less literate person can't grasp the cognitive style of the computer. It's the machine that 'thinks', it's a mind that needs to be grasped and it is not human in its way of thinking. Literacy therefore defines the contours of digital literacy. This confirms McLuhan's dictum that media alter the way we think and feel irrespective of the content (*McLuhan, 1964*).

Coupled with its ambiguous (not ambivalent) utility proposition, the computer disincentivizes those who are not culturally prepared to leverage its benefits. Added to this is the fact that computers have not adapted well to the languages of non-Western users. For example, non-standardized Hindi fonts with their own different keyboard commands create a layer of difficulty for Hindi users that English savvy users do not find.

Thus, one of the key areas that HCI design must address to bridge the digital divide is to work from the foundations and challenge the cognitive assumptions. This implies going the other way round to study real life cognitive patterns of user groups and re-design software, and possibly hardware, to work for these patterns.

Computers and The Ambiguity of Relevance

Computers, which have been around for about sixty years, have had a very slow rate of diffusion. We still find a massive 'digital divide' that prevents the benefits of information technology from accruing to masses. There are a number of possible reasons why computers don't click with the common man as other technologies such as mobile phones, refrigerators, motorcycles etc., do. Till recently the cost of computer hardware and software affected its affordability for a person of very limited disposable income.

However cost is not a primary consideration. Many people show a greater proclivity for buying cars, motorcycles, and houses, than a computer. A key consideration in determining the diffusion of technology is relevance. A refrigerator costs roughly the same as a washing machine or an AC but has a much higher diffusion rate, because the perceived advantage of preserving food by cooling, for longer periods of use, is clear. Refrigerators save milk, fruits, vegetables and other items of consumption from decay. Cold water under hot weather conditions is another clear advantage that people can perceive.

A washing machine on the other hand only saves the labor of washing clothes and may not really distinguish between 'cuffs' and 'collars' as areas of attention while washing. An AC on the other hand has a very strong competition from fans and coolers.

The situation of computers is similar. It is very difficult for a layman to perceive the benefits of computer technology clearly. Is it a typewriter? Or is it a calculator? Or a mailbox? Or a photocopying machine? The ambiguities of a computer make its value proposition enticing but not clear enough for non-users of computers to facilitate decisions on relevance. Even if its relevant were apparent, many of the dominant uses of computer proscribe their relevance to a white-collar context, which people like automotive service personnel, farmers etc., might not perceive easily.

One of the key imperatives for bridging the digital divide, therefore, has a campaign tinge to it – that of establishing relevance of computers and computer-based courseware to digital immigrants. This implies re-positioning computers in a way that their white-collar associations are stripped away.

Evolution of User-Friendly Computers

Let's pause here and consider how over the years as users struggled with computers, developers worked to make computers more user-friendly. From the time of mainframe computers --before the modern-day interface originated, when users required elaborate and specialized training to use computers-- through the time of GUIs to guide the user, to the dawn of the personal and mobile computing era, computer software design has increasingly moved in the direction of user-friendliness. The intrusion of personal devices, mobile devices, entertainment devices etc., has familiarized us with the patterns of engagement. We need to build more technology bridges to make computers friendly to digital immigrants. The history of computers, as of any technology, has had one clear direction among others – an increasing user-friendliness. Further advancement is not a deviation or an anomaly in the turn of events but a natural progression of an existing trend. And the direction is shown by the same research driven human-computer interaction (HCI) design that made computers a mass phenomenon.

The Interplay of Research, Creativity and Constraint in HCI Design

There is a great need to consider an entire range of expectations and constraints, especially in a business context. The question of design takes a different angle against the backdrop of constraints like scalability, usability, relevance, client expectations, timelines, budget, economic viability, infrastructural limitations etc. In a business context, good design is always viable design. The interplay of various factors needs to be considered to evolve a workable balance.

All media offer limitless opportunities for human creativity. Design can take two basic routes: a) experimentation and innovation b) production and reproduction. Both these routes taken are skewed to one extreme. Innovation that does not work out as economically viable and culturally adoptable peters out in short product life cycles. And yet production and reproduction does not automatically lead to continuous improvement of design. Research is therefore the essential bridge that helps align design decisions to lingual, regional, cultural, individual, contexts that determine design viability and sustainability. Our intervention showed that researching human behavior in the context of use HCI design could align design more closely to actual user needs.

Not all solutions that are user-friendly are good solutions. Many solutions developed in specialized laboratories or workshops by scientists who spend years researching ideal solutions fail to be economically viable at the level of scale. Individual human beings for example, would never have brought a mainframe computer except in an institutional context. When technology enters the world of commerce, its ultimate fate is determined not by its brilliance as a technological solution but by its brilliance as an economic solution. And each solution is threatened by obsolescence as the market researches more viable alternatives. Laser discs, for example, appeared on the scene only to create the market for an enhanced alternative – compact discs. Herein lies the crux of the problem for design and development of commercial solutions – that of coming up with design solutions that are scalable and not likely to be rendered obsolescent too soon.

The results of research need to be considered against the economic consideration of scale, which is of paramount importance in the industry. HCI design must therefore strike a balance between user needs and economic conditions of production such that the solution maximizes user-friendliness of design and at the same time maximizes the economic friendliness of design. This requires an approach to design that balances usability and scalability.

Our solution for Tata Motors validates that it is possible to deliver simple, effective and highly usable and scalable design solutions without extensive capital outlays. Such a balanced approach to design also offers greater possibility of making HCI design work not for a small group of users but with extensive reach.

Contextualizing Design Through Culture

Beyond technological innovation, user friendliness and economic viability lie yet another set of constraints – cultural, political, individual, and environmental. The economic viability of washing machines in a country may depend on cost of electricity per wash vis-à-vis per capita income of various market segments. Or take culture for example. To continue the example of washing machines, many US, Latin American and European washing machine designs have side loaders, which work well for Western attire like jeans, pants, trousers, shirts, frocks and skirts. However, side loading can be cumbersome for Oriental attire like turbans, saris, dhotis, lungis, burkhas, gamchas, kimonos etc.

Various technological innovations permeate the lives of people at a fast pace. Mobile telecommunications has had a faster diffusion rate than television, radio and telephone. If we look into the technologies with faster rates of diffusion, we often find that these technologies build upon earlier media/technology forms that have been assimilated into culture. Taking the forms of interaction of older cultural forms, these technologies smoothly weave themselves into the society's cultural fabric.

HCI design can greatly benefit by understanding that solutions need to adapt to cognitive and behavioral patterns of a user group when they are ported from one user culture to another.

Conclusion

The question of which technology will work to address a problem is different from the question of which technology will work to address a problem within the economic constraints. Culture adds another layer of constraints to the economic viability considerations. Individual differences add yet another layer. Finally, there are whole ranges of interacting influences that shape the destiny of technology vis-à-vis its objectives. How can design, therefore, strike the right balance? How do you discern patterns in a complex mesh of interacting factors?

To succeed in reaching out to digital immigrants, HCI design should move in a direction where the cognitive styles of these users are addressed in HCI design and the ambiguity of relevance is removed to deliver direct and perceivable value advantage.

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Appendices

List A: The 13 Dimensions for Evaluating Instructional Design

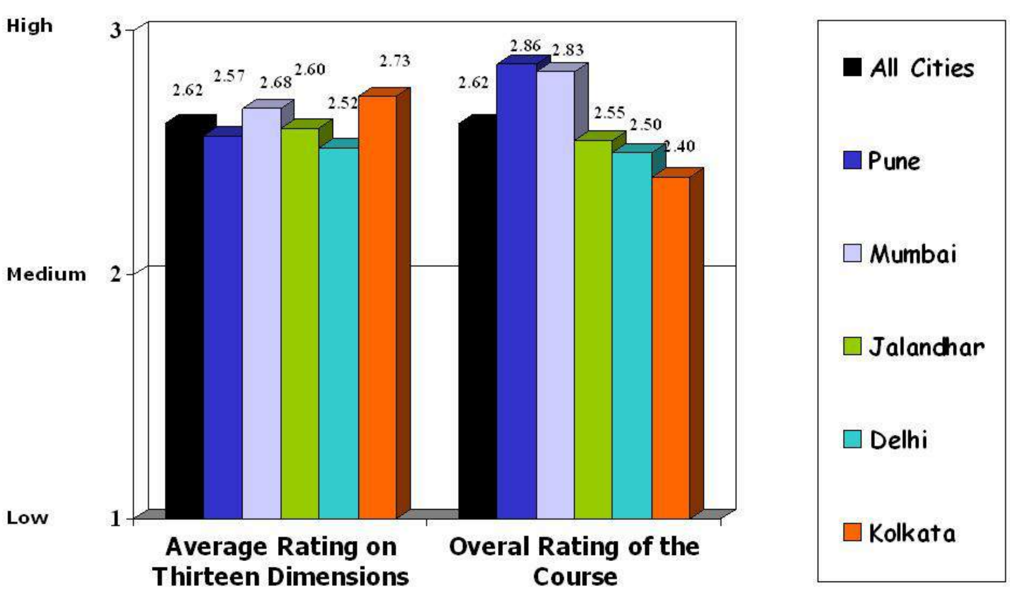
The 13 dimensions were:

- Description of course objectives
- Usefulness to job
- Coverage of procedures
- Practice questions
- Relevance of practice feedback
- Sufficiency of practice feedback
- Application at work
- Method of selecting topics
- At-your-pace learning
- Method of explaining procedures
- Usefulness of explanation of procedures for application in work
- Narration of procedures by the expert
- Instructional method

Table A: Summary of Descriptive Statistics by Parameter and City

	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10	Q11	Q12	Q13	Q14	Combined
Mean (All Cities)	2.20	2.85	2.27	2.64	2.60	2.29	2.36	2.81	2.90	2.81	2.90	2.79	2.57	2.62	2.62
Mean (Pune)	2.13	2.88	2.50	2.29	2.50	2.50	2.75	2.50	2.86	2.50	2.88	2.63	2.57	2.86	2.57
Mean (Mumbai)	2.42	2.92	2.25	2.67	2.50	2.25	2.42	2.92	3.00	2.75	3.00	2.90	2.83	2.83	2.68
Mean (Jalandhar)	2.08	2.73	2.25	2.64	2.70	2.30	2.33	2.90	2.90	2.82	2.78	3.00	2.42	2.55	2.60
Mean (Delhi)	2.08	2.75	2.29	2.57	2.50	2.07	2.23	2.71	2.79	2.93	2.86	2.58	2.46	2.50	2.52
Mean (Kolkata)	2.33	3.00	2.11	3.00	2.88	2.50	2.13	3.00	3.00	3.00	3.00	2.90	2.60	2.40	2.73
Median (All Cities)	2.00	3.00	2.00	3.00	3.00	2.00	2.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	
Median (Pune)	2.00	3.00	3.00	2.00	2.50	2.50	3.00	2.50	3.00	2.50	3.00	3.00	3.00	3.00	
Median (Mumbai)	2.00	3.00	2.00	3.00	2.50	2.00	2.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	
Median (Jalandhar)	2.00	3.00	2.00	3.00	3.00	2.00	2.00	3.00	3.00	3.00	3.00	3.00	2.00	3.00	
Median (Delhi)	2.00	3.00	2.00	3.00	2.50	2.00	2.00	3.00	3.00	3.00	3.00	3.00	2.00	2.50	
Median (Kolkata)	2.00	3.00	2.00	3.00	3.00	2.50	2.00	3.00	3.00	3.00	3.00	3.00	3.00	2.00	
Mode (All Cities)	2.00	3.00	2.00	3.00	3.00	2.00	2.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	
Mode (Pune)	2.00	3.00	3.00	2.00	3.00	3.00	3.00	2.00	3.00	2.00	3.00	3.00	3.00	3.00	
Mode (Mumbai)	2.00	3.00	2.00	3.00	3.00	2.00	2.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	
Mode (Jalandhar)	2.00	3.00	2.00	3.00	3.00	2.00	2.00	3.00	3.00	3.00	3.00	3.00	2.00	3.00	
Mode (Delhi)	2.00	3.00	2.00	3.00	2.00	2.00	2.00	3.00	3.00	3.00	3.00	3.00	2.00	3.00	
Mode (Kolkata)	2.00	3.00	2.00	3.00	3.00	3.00	2.00	3.00	3.00	3.00	3.00	3.00	3.00	2.00	
Standard Deviation (All Cities)	0.41	0.36	0.53	0.48	0.49	0.50	0.48	0.39	0.30	0.39	0.30	0.46	0.50	0.49	
Standard Deviation (Pune)	0.35	0.35	0.76	0.49	0.53	0.53	0.46	0.53	0.38	0.53	0.35	0.52	0.53	0.38	
Standard Deviation (Mumbai)	0.51	0.29	0.45	0.49	0.52	0.45	0.51	0.29	0.00	0.45	0.00	0.32	0.39	0.39	
Standard Deviation (Jalandhar)	0.29	0.47	0.45	0.50	0.48	0.48	0.49	0.32	0.32	0.40	0.44	0.00	0.51	0.52	
Standard Deviation (Delhi)	0.28	0.45	0.47	0.51	0.52	0.47	0.44	0.47	0.43	0.27	0.36	0.67	0.52	0.52	
Standard Deviation (Kolkata)	0.50	0.00	0.60	0.00	0.35	0.53	0.35	0.00	0.00	0.00	0.00	0.32	0.52	0.52	

Chart A: Average Rating on 13 Dimensions and Overall Rating



Validity of Usability Evaluation Methods in a Cultural Perspective

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1. ABSTRACT

This paper presents the problem that widely used usability evaluation methods are not necessarily valid and that the degree of their validity may differ dependent on culture. Furthermore, the paper proposes a way to investigate the validity of usability evaluation methods in a cultural perspective. The investigation method suggested is meant as a framework to be discussed and elaborated.

2. INTRODUCTION

UEM (Usability Evaluation Method) reliability and validity need to be considered, scrutinized and understood. Aspects of reliability have been studied by Hertzum & Jacobsen (2001). However, UEM validity remains to be investigated, especially in context of cultural diversity. This paper discusses the problems of validity of UEMs and proposes a methodological framework for studying this topic.

2.1 Background

Research papers in the field of Human Computer Interaction (HCI) reporting about experiences in using UEMs indicate that only few UEMs are used widely in industry. According to a recent survey; usability testing, expert evaluation and interview-type investigations are among the most used UEMs (Troost et al., 2006). In practice, these UEMs are in fact generic terms for an endless variation of implementations. For example, the way to run a usability test may vary in terms of number of users, type and number of tasks, type of measures, environment in which the test takes place, observation techniques employed, type of analysis, form of presenting the results, etc. Similar or even greater variation will be found when comparing UEM procedures for expert evaluation and Interview-type investigations across investigators, companies and countries.

In industry the results of UEMs typically lead to decision making related to the system that has been tested. An investigation early in the concept phase may lead to rejecting the concept or approving the concept with modifications or as it is. Later in the development life cycle formative UEM results may lead to changes to the system. Post-launch investigations with UEM techniques may lead to decisions with regard to developing next generation or simple updates of the system being investigated. Independent of when in the development life cycle an UEM has been used the results and derived decisions are what matters to organizations.

2.2 Problem statement

Lack of UEM validation continues to be a main problem in industry and research. In essence investigators and organizations using UEMs may trust them as good indicators for investigating a system's usability although the UEMs may not in fact be trustworthy. Reliability issues of selected UEMs have been investigated earlier (Hertzum & Jacobsen, 2001), but investigations of validity of UEMs are rare. A reliable UEM is expected to produce the same result if repeated under the same conditions, but reliability does not ensure validity. For example, if a usability test was repeated under the same conditions and they produced the same list of usability problems the test can be argued to be reliable, but the problem list may not necessarily represent problems in real usage. The usability test may miss critical problems (misses) or predict problems that are in fact not problems in real usage (false alarms). In addition, some UEMs may be culture-skewed in the sense that they are more valid in some regions or countries than others.

Table 1. Evaluators may identify a usability problem that is a real problem or they may miss identifying a problem that presents a real-life problem. Similarly evaluators may identify a problem that is in fact not a problem in real life (false alarm) or they may not judge an incident a problem, which is not a problem in real life (correct rejection).

	Problem	No Problem
Identified	Hit	False Alarm
Not identified	Miss	Correct rejection

3. AIM OF STUDY

The proposed study aims at investigation the validity of three widely used UEMs in a cultural perspective. The motive is firstly to understand the term *usability* cross-culturally, secondary to measure the validity of selected UEMs.

Since a given UEM measures some aspects of usability (Hornbæk, 2006), the underlying measures are the once that are particularly interesting to investigate in a cross-cultural study. Investigating UEMs rather than the underlying measures is convenient in order to disguise what is in fact under investigation. Underlying measures of an UEM can possibly match up with characteristics of usability perceived by users in different cultures. The interesting point here is whether some underlying usability measures match better with the perception of usability in some countries, while they are found less relevant in other countries.

If some UEMs are more successfully matching some cultures than others, this can have profound effect on the application of UEMs in industry. Independent on the culture effect of UEMs a validation of popular UEMs is very important both for HCI research and for industry.

4. METHOD

This method section aims at outlining a framework for investigating validity of selected UEMs in a cultural perspective. The framework is not a detailed investigation plan, but merely a high-level proposal for a possible set-up with rationales to explain why this framework may succeed to answer the research questions.

4.1 Methodological challenges

The main challenge in a validity study of UEMs is to determine *real usage problems* – those problems that we assume we can predict through usage of valid UEMs. This challenge may be the core reason why we see so few papers about validity of UEMs. There are at least three potential contradictions in determining *real usage problems*, they are:

1) By pre-defining the term usability prior to investigating *real usage problems* we may not precisely match users' or experts' perception of usability. We could make use of the ISO 9241-11 (1998) definition (effectiveness, efficiency and satisfaction), but that would leave out factors like *fun* and *wow*, which anecdotally have impact on how users and experts rate the usability level of a system. Without pre-defining the term usability the validity study cannot be planned and controlled easily.

2) In the attempt to collect data that fleshes out what *real usage problems* is we will automatically intervene with and potentially bias those users who are part of the investigation. Without involving users in real-life context we cannot collect data about *real usage problems*. This is a paradox of most investigations but when the aim is to investigate validity of a methodology the validity requirements to that investigation is higher than ordinary.

3) Should users or investigators determine what *real usage problems* are? An immediate answer would be that users should know best what pose a problem to them in real-life contexts. However, users may not notice how they solve a task inefficiently before they are presented with an easier path to solve the task. First at that point users will have clarity to see that the system should have guided them to the more efficient task immediately. If investigators are the ones to solely define *real usage problems* we may risk that this validity study copies the exact problems of UEMs – that investigators include so-called "false alarms" on the list of *real usage problems*.

The three contradictions mentioned above should be clarified and solved prior to conducting the validity study in a cultural perspective.

4.2 Proposal for a methodological framework

The core of the validity study is to compare a list of *real usage problems* with those problems detected when using selected UEMs. We suggest that three UEMs are investigated, namely usability test, expert evaluation and user interview (see Table 2). The framework should also work if less, more or different UEMs are investigated.

To cover the cultural perspective it is suggested that four countries are included in the data collection phase. These countries could be China, India, US, and Denmark, but the framework should also work if less, more or different countries are included in the investigation. Each UEM should be applied to a system or selected parts of a system. The system used should be represented in local editions in all countries included in the investigation. Each UEM should be applied to a selected system by different investigators in each country thereby limiting the evaluator/investigator effect.

We propose that four (groups of) investigators apply a given UEM in the four selected countries. The investigator should act as coordinator and use locale resources for the actual investigations to be conducted in native languages. In order to avoid learning effects between UEMs no evaluator is to conduct more than one UEM in each country. Also no users should be included in more than one test session.

Table 2. A framework for investigating the validity of selected UEMs in a cultural perspective. The numbers under "Usability Test", "User Interview" and "Real Usage Problems" refer to number of users. The numbers under "Expert Evaluation" refers to number of evaluators.

	Usability Test				User Interview				Expert Evaluation				Real Usage Problems										
	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	X
China	12	12	12	12	12	12	12	12	4	4	4	4	10	10	10	10	10	10	10	10	10	10	10
India	12	12	12	12	12	12	12	12	4	4	4	4	10	10	10	10	10	10	10	10	10	10	10
US	12	12	12	12	12	12	12	12	4	4	4	4	10	10	10	10	10	10	10	10	10	10	10
Denmark	12	12	12	12	12	12	12	12	4	4	4	4	10	10	10	10	10	10	10	10	10	10	10

It is yet to be defined how Real Usage Problems are collected, but it is suggested to collect multiple sources of evidence through for example diary studies (Rieman, 1993), logs, shadowing, hotline calls, questionnaires, etc. In order to cover the full range of usability aspects it is suggested to use the working model for usability measures defined in Hornbæk (2006). The process for analyzing the *Real Usage Problems* data should be clearly defined before data are collected.

The cultural aspect of the validity investigation is associated to countries. Since this categorization of cultures may apply to a naive understanding of what constitutes *culture* this study should define culture in a more precise and appropriate manner. Countries represent many ethnic groups and citizens in the same country have diverse value systems and represent diverse social groups. It is suggested that a reasonably homogeneous group is defined for each country, rather than attempting to represent the full diversity of users within a given country. We may define a homogeneous group by age, geographically location, education background, and other relevant parameters. These groups should also be comparable across countries, in the sense that we do not wish to compare for example a teenage group in Denmark with a mid-age group in the US.

5. CONCLUDING REMARKS AND NEXT STEPS

This paper has discussed validity problems of UEMs and proposed a framework for investigating validity of selected UEMs in a cultural perspective. The paper intends to spark further discussions of validity of UEMs and ways to investigate this aspect.

Prior to empirically investigations of validity of UEMs in a cultural perspective we need more work on defining central terms like *validity*, *usability problems*, *real usage problems*, and *culture*. After this theoretical work is in place an elaboration of the methodological framework is needed.

A main challenge is to limit the empirical work and yet end up with reliable and valid results that can help generate more mature UEMs and hopefully a more solid understanding of what constitutes a usability problem.

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A culturally sensitive exploration of Icons & symbols in Danish & Indian cultures

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Symbols and icons play a significant role in the formation of Culture. Humans interact with symbols and icons to express, propagate and signify the culture which in turn becomes an identity for that group of people. Designers whether graphic design or in HCI have a tendency to use Symbols and Icons more for their functional and aesthetic roles rather than for any thing else. However Symbols and Icons are emotionally loaded as well as Culture sensitive. In this paper the author intends to explore every day symbols such as National flags, Birds, Anthems for their historical and emotional significance. The author takes the example of the emotions surrounding 'Love' and explores it in the Indian and Danish context to bring out the commonalities and differences. The author argues for greater cultural sensitivity on the part of a Designer with respect to the use of icons and symbols and pleads for cultural icons to be used intelligently and not merely for the limited purpose of hedonistic commerce. If 'culture' stands for the practices of producing meaning, making sense of the world, sharing values and engaging in everyday life, studying these practices might involve questions of representation, identity and power – and lead us to probe the boundaries of society, politics and ontology. If 'usability', on the other hand, is about human perception, memory and cognitive mappings, specifically relating to human-computer interfaces, research into these issues focuses on clearly defined pragmatic and functional considerations of technological design. Understanding Symbols and Icons in their Cultural context will aid there better Usability in HCI.

Social Computing: Experiences from Rural India

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Abstract

Social computing refers to the application of technology as a mediator of social interaction and collaboration. Interplay between the individual social behavior and their interactions with computer technologies are a part of the Social Computing process. Efforts and projects are under way to popularize Social Computing in rural areas because of the belief in the transformative potential of the technologies. This paper is an attempt to explore the possibilities of Social Computing in the rural areas. Do the rural people have the social capital to harness these technologies to serve their development goals? It is argued that while the debate about insertion and enhancing potential of the social computing into rural settings is substantial, its transformative power with respect to the lives of the common people is overestimated.The paper highlights some of the developmental strategies and initiatives to promote e-governance in Belandur Gram Panchayat in Karnataka state of Indian subcontinent. Belandur Gram Panchayat is the first village in the country to introduce computers at village level governance. This paper seeks to explore the theories, practice and the praxis of the social computing by discussing the experiences of Belandur Gram Panchayat.

Key Words: Information and Communication Technology, Social Computing, Belandur Gram Panchayat..

Introduction:

Computing is now becoming a way of life. Computers are becoming increasingly ubiquitous. It is no longer restricted to the domain of technical experts and specialists. It is spreading across to various section of the society and thus gradually encompassing our everyday lives. Its pervasive influence on human social lives is evident with the increasing role, information technologies has on our every day lives. The past few decades have also indicated the rapid changes in their design, structure and technology. Technology becoming obsolete with the arrival of competing tools and trends is indeed a part and parcel of the computer industry. Its short history throws into open several of such stories and examples of obsolete and outdated technologies. The best reference could be the size of the computer itself which has moved from large desk top to small simputers. They are becoming increasingly smaller that they are now wearable. These portable and the mobile computers which are now making a way in the market only confirms that they are becoming more pervasive in human social life. Thus, interaction with the computer is not just confined to work places. Application of computer technologies in our daily routine activities is gradually becoming a habit. For instance large-scale computer mediated communications are taking place for household activity, routine communication, business, entertainment, learning etc. Thus, computer mediated communications have become enjoyable and resulting into full fledged social activity. These rapid changes have an major impact upon the understanding the importance of designing the computers based on the needs of the people thus making it people oriented and community oriented.. As a result of these changes, several disciplines like HCI, Social Informatics, Social engineering have emerged in the academia. Social Computing which enquires into social and cultural aspects of the computerization process finds its place amongst these disciplines although there exist blurred boundaries between them.

'Social Computing'

Social computing springs as a result of the impact of computing (or information and communication) technologies upon the social and cultural processes of society. It refers to dynamics of social behavior of the individuals and their interaction in the society which is a result of these technologies. In other words social computing results due to excessive digitalization and virtualization of everything in the society. The term social computing refers to the interplay between person's social behavior and their interactions with the computing technologies. It involves science, technology and society. As a domain of science, it seeks to describe the relationships among social behaviors and machines so that certain amount of certainty can be reduced between the interaction amongst the humans and the machines. As a domain of technology, it seeks to apply social and behavioral science to the design of information technology systems thus enabling efficient collaboration between them. (Dryer, 1999) Apparently, a domain of society, it seeks to enquire into the social and cultural phenomena which gets dictated by the process of computerization , digitalization and virtualization process.

The new era unfolding does not just need technology for the sake of technology for it is likely to reach its saturation point. It has brought in the fear that more the life becomes technological, it tends to become less human. So, now the emphasis is on how these technologies can be imbibed and integrated into social lives. Thus the success of these new technologies lies in their potential to affect human social behaviors. That's precisely, why social computing becomes important while enquiring the different aspects of technology and society.

Collaboration, communication and community are believed to be the three corner stones of social computing. The detailed analysis of Social capital with in the particular community can provide the examples of integration of technology with the societal network and the consequences of social computing emerging out of it. But the challenge of academia lies in actually determining to what extent computing and social life can coexist. Or in other words, to what degree the assimilation between the two is possible. Social computing should not just limit its enquiry into mundane aspects and activities of life which are largely technology prone. It should also penetrate upon the fundamental practices of social life like religiosity, marriage, child rearing, etc. The production, propagation, struggle and sustenance of social life and the impact of technology upon them needs to be studied to understand the larger canvas of technology's mediation or integration into social life.

Perspectives:

There are different perspectives upon which the social impact of the computing can be examined like Social Interface theory, Computer mediated communications theory or Computer supported cooperative work, (CSCW), Community researcher's theory and theory of Interpersonal psychology. Social interface researchers examine social behavior by studying human responses towards technology while CSCW researchers study social behaviors in computer-mediated communication. Community researchers study community influences on behavior resulting out of these technologies and Interpersonal researchers study social behaviors in face to face interactions arising out of technologies.

Social Interface theory

Social Interface theory has been widely applied while understanding social computing, Social interface theory argues that humans respond socially to artifacts and hence artifacts must be intentionally designed to encourage social responses. Social interface theory is built on the results of various studies demonstrating that humans respond socially in their interactions with machines. Meaning, humans are inclined to treat everything as social and natural. Hence, they subconsciously and automatically depend upon their natural and social experiences to aid their technological experiences. Certain features of artifacts, (for instance, artifacts using natural language) tend to fulfill a social role and they are likely to encourage social responses. Researchers like Reeves and Nass claim that humans respond to machines as social actors while some researchers like Kiesler and Sproull believe that humans can have social responses in interactions with machines. Thus, researchers have proposed social interfaces as a way of using these responses to help make human-computer interaction natural, enjoyable and efficient regardless of the mechanism behind human social responses to machines. (Dryer, 1999). Reference to Social Interface theory is made in the paper since my theoretical position while analyzing Belandur's gram panchayat experience is tilted towards this theory.

Social Capital and Social Computing

The term 'Social Capital' was first used by a French scholar Pierre Bourdieu in his work 'The Forms of Capital (1986). He motions about the different forms of capital existing in the society namely, economic capital, cultural capital, social capital and symbolic capital etc. He defines social capital as "the aggregate of the actual or potential resources which are linked to possessions of a durable network of more or les institutionalized relationships of mutual acquaintance and recognition." Bourdieu (1991: 243) explains capital as representing power. The term was later picked up and popularized by James Coleman and later by Robert Putnam.

The term 'Social capital' largely refers to the social networks which consist of informal values and norms shared among the members resulting that enable certain among of cooperation among themselves. To put it more precisely, Social Capital may be defined as those resources inherent in social relations which facilitate collective action. Thus, it is a informal network of association representing any group aimed towards a common purpose. Social Capital Recourses include natural human behavior like trust, reciprocity, association etc. It also has in its fold traits like compromise, bargaining etc. Such kind of informal network and cooperation or social capital as it is being currently called was always in existence in human societies. What makes it as an emerging concept in the recent years is the anxiety of wanting to exploit the resources of social capital within the communities as extensively as possible.

It is indeed interesting to connect social capital with social computing and Information technology. Information Technology and development are closely interrelated as it is believed to be the harbinger of a new information revolution leading to a new economic and social paradigm. The potential for development due to application of Information Technologies is spectacular and it is reflected in several ways. Internet services, telecommunications, etc are just a e few examples. Information Technology has the ability to connect the actors to resources, relationship and information beyond their immediate environment. Hence, it is believed to possess the rich potential to increase social capital. Social Computing facilitates in exploring such possibilities and benefits by bridging Information technology with social capital.

There are several benefits arising out of the proper interaction with Information Technology and Social Capital. Backward areas like remote villages or geographically isolated regions with limited resources can have the opportunity to access information which is otherwise only the privilege of the urban areas only. But those backward areas need to be equipped with basic infrastructure needed for the information technologies to work like computer and phone line. Education and business opportunities can be doubled in such areas if the right application of IT is made. Selling goods through the internet offers grater access to different markets and can save time and transportation costs for negotiation. Both producers and consumers can reap maximum benefits. Firms and companies can have joint operations and collaborations thus enhancing business opportunities. These activities are normally facilitated by the traditionally available, already existing social capital resources in different societies. But however, these resources of social capital can be enhanced due to the several opportunities offered by the internet and other technologies. It could be a group of farmers from different corners coming together to explore the possibilities of reaping the benefits of IT by modern communication systems. Or it could be a set of craftsman within cooperatives joining hands together for better connectivity with the world markets. Social computing becomes crucial while examining behavior patterns of the individuals in the society during such an interaction with the technology. Hence the importance of the associations between social capital, Information Technology and social computing is increasing each day.

ICT and Development in India

It becomes imperative to examine the debates over the role Information and Communication Technologies have played in the development process in India before one takes upon the discussion of social computing in India. Evidently, social computing both as a theory and practice emerge as a result of increased deliberations made by ICT on the societies.

In India the adoption of ICT as a driver of the economy became visible only since 1990s. Free market economy in India paved the way for gradual growth of ICT technologies and its penetration both in economy and society has resulted in a paradigm shift in the development process. Bill Gates has rightly said in his book “The Road Ahead” that the Information Highways are a mass phenomenon or nothing. For developing countries ICT is having a measurable impact on the socio-economic conditions of the people and it is gradually being accepted. Development economists feel that ICT should not be treated as an isolated sector, but should be used as a lens to re-think development strategies, as a tool to enable all sectors and as a new and powerful means to empower the poor. It is essential to understand that ICT is different from other technologies and technological revolutions. This will enable the effective use of ICT for development.

It is argued that it is critical to understand how information and communication are vital to the lives and livelihoods of the poor and how ICT could enhance their access to markets, institutions, services, education and skills. One major contribution that ICT makes is to break the mutually reinforcing cycle of poverty and lack of information or access to ways of improving the fate of the poor. The poor lack access to information about income, earning opportunities and market prices for the goods they produce. To add to this, most of the time they are unaware of their rights, health and hygiene, public and welfare services. The poverty stricken condition of the poor gets accentuated due to lack of knowledge, education and the skills to improve their livelihood. Unless there is a strong democracy, they may lack even the political leverage necessary to have their voices heard. These observations have been confirmed in several projects where ICT has been applied in breaking the poverty, low productivity cycle and bringing some hope to the poor.

World Telecommunication Development Conference in 1994 at Buenos Aires, which was the first solid international step in promoting IT and communication in rural areas and suggested framework for this revolution. It was out of this conference that a study group was appointed to collect evidence of the impact of ICT on rural development and present it to policy makers, and to make ICT an intrinsic part of the development debate. The report of this study group has been an extensive document and it has added to the growing awareness among the people to make ICT an important nerve of development process. Recent experiences with experiments like Gramdoot in Rajasthan, Bhoomi in Karnataka, 2Mbp universal connectivity in Andhra Pradesh, Gyandoot in Madhya Pradesh and e-Choupal across the country suggest that ICT has been quite useful for the rural masses and has met some of their immediate interest and enhanced the quality of rural life. (Ghosh, 2004).

There are several cases, which articulate the benefits derived from the rural communities out of ICT technologies. For instance, in Andhra Pradesh in one of the villages in Ranga Reddy district, the farming community has learned to use computers to manage their water resources, updating of village records, gained access to vegetable prices etc. In another instance, the National Institute of Agricultural Extension Management and the NIIT has helped train school drop outs to become computer operators. Similarly one of India’s top corporations, ITC that has extensive interest in agri-products has launched the rural internet initiative ‘e-Choupal’. The M.S. Swaminathan Research Foundation has trained local villagers in areas around Pondicherry to monitor information needed for farmers, fisherman, cattle growers and artisans and helped improve their lives. These examples reinforce the perception that ICT is not for the elite only, but equally and perhaps more so, for the poor.

Cases Studies in India Promoting ICT in Rural Areas

Internet and Self-help Groups

Several self-help groups have emerged in rural Andhra Pradesh that are involved in making and selling everything from shirts to pickles. Their markets range from the Middle East to USA and South Asia. Most of these markets are online. There are several projects like CARD, APSWAN and APSCAN, which facilitate rural areas with ICT. The twin-cities project called e-Seva delivers government information and forms even to the rural interiors. Largely the rural administration in some parts of Andhra Pradesh has become online in nature, and has therefore enabled people to pay bills, duties, taxes online and get several other services. There is some amount of certainty that e-governance shall ensure absolute transparency and prevent corruption of any sort which is so widely rampant in Indian politics and administration. In addition, the former Chief Minister of Andhra Pradesh, Chandrababu Naidu was computer savvy and technology minded. His entire administration hence was ICT minded and was well connected though his network. Such an ambience facilitated the promotion of ICTs in some parts of rural Andhra Pradesh.

Internet and Fishermen

The Swaminanthan Research Foundation in some of the villages in Pondicherry is known for promoting the use of information technology and communications through a number of internet centers for getting information across to farmers and fishermen, and from them to urban centers. Dr. Swaminanthan, a top ranking agricultural scientist and administrator, and a winner of Magsaysay award for his accomplishment has been advocating a community-based approach to farm problems. His foundation based in Chennai, has helped open *internet kiosks*, wherein a local person trained by the Foundation helps villagers to gain information on a variety of their needs. In addition, these kiosks also feeds the farmers information on local weather conditions, prices of various agricultural commodities in nearby markets, on healthcare and several other areas. None of this is free and the kiosk operator earns a handsome return on his /her work. The entire project is largely run by the people themselves. It is said that information from the computers in rural areas, where people live in thatched mud huts, has saved the life of a milking cow, prevented an old woman from becoming blind and routinely warned fisherman of stormy whether that can claim lives.

In another experiment in Tamil Nadu, professors from IIT, Chennai formed *"n-Logue"*, an institution to bring low cost communications to the rural and remote areas. The institution has been promoted by this group headed by Professor Ashok Jhunjhunwala whose invention CorDECT enables wireless connectivity to rural populations at an affordable cost. 'n-Logue' is a rural internet service provider dedicated to providing internet access to villages. A case study presented by a dedicated member of the n-Logue team speaks about village Padinettamkudi, just 35 kms from the South Indian city of Madurai, a village of 1000 people that has no public telephone, no proper road, and the only school has classes up to middle-school level only. In this village, n-Logue has incubated an internet kiosk with a PC and a telephone using wireless connectivity on CorDECT platform. The kiosk operator provides a wide range of information to the villagers such as a technical course in Chennai, a birth certificate, an income certificate, a caste certificate, a school admission form, information about railway reservation in the city, complaints regarding non-functioning of water pumps, etc. Thus some of the villages in India stand connected to the world. ICT in future can possibly end the isolation of village communities.

Gyandoot and its Services

Gyandoot (messenger of information) is an experiment conducted in one of the backward districts, Dhar in the state of Madhya Pradesh. The project aimed at setting up the intranet system that connects rural cyber kiosks throughout Dhar district, which has a heavy tribal population and very low literacy. The experiment involved an arrival of a computer and the availability of information on demand to the people. So Gyandoot provides government-related and other information to the public and enables them to get government forms and other papers they need from kiosks for a small fee. This experiment was awarded a Swedish award for community leadership. The project, however, is not an extenuation of the government, but is run as an independent institution by the local registered society called Gyandoot Samiti. The government input comes through the Dhar District Rural Development Agency, which has provided office space for the network server and project team, free of charge. The aim of Gyandoot is to use a district-based intranet to increase facilities available to the public regarding government policies and procedures, training and education, and commerce. The real benefit of the programme has been a heightened awareness of what information technology could give the people and the ease with which this is accessed. The villager finds that he does not have to bow before the officers for such information, which he has right to know, and that right can be exercised by asking the computer operator to give him the information. This improves the feeling of empowerment amongst the people and thereby it waters the grassroots of democracy.

Gramdoot and its Services

While Gyandoot focused on the use of information technology in the backward districts, Gramdoot is a more compact and well-conceived project regarding the use of computers in the district areas. The project was conceived and executed by a young fiber optics company, Akash Optic Fibre Ltd. Through its subsidiary Akash broadband, the project seeks to bypass the high cost of rural telephony by making connectivity available for a number of different services thereby spreading the costs and making these services affordable to the targeted rural communities. Presently, the project is being implemented in one of the districts in Jaipur, and with sufficient backing so that it could spread to whole of Rajasthan. In order to make the project attractive to rural audiences as well as commercially viable it also provides TV viewing along with several other services that Gyandoot provides. Services like copies of certificates and land record are charged a small sum of Rs 20, while cable TV is provided at Rs 105 per month. The menu is prepared in consultation with the intended beneficiaries, so that there is a sense of participation on the part of rural communities. Some of the services are unique such as a web conference with a villager in another village, which costs only Rs 5 for a three –minute interaction. The use of optical fiber ensures that the quality of services is high and that multiple services could be provided.

Computer and Land Records

Land record is the most vital document in any Indian farmer's life. It is the basis of the entire revenue administration, the area where the government pinches the farmer. For instance, buying and selling or pledging of land to get loans and several other interactions in the village depends upon the production of an authenticated land record document from the village officer who looks after the official matters. He is a powerful man who can make or break the lives of farmers in India. He can play around with the lives of farmer as he has control over the small piece of paper, which documents the details of the land, which is actually the lifeline for most farmers. The government is aware that it is quite difficult for the poor and illiterate farmer to protect his land record against land sharks and powerful local leaders. On the other hand, these governments cannot wish away this system because the entire land revenue system has been built on this basis from time immemorial.

It is only recently in the state of Karnataka that bold empowerment is launched to computerize all the land records and give computer outputs for these records a legal status and to make them available at specified centers at a nominal cost. It is popularly known as '*Bhoomi Project*', which has won international awards like the recognition from the Commonwealth Association for Public Administration and Management and the Stockholm Challenge Award. Leading chipmaker Intel has made a film on this project to show how information technology is benefiting grass-root people like farmers. The project in simple terms digitized some two million-land records in 27 districts. In practice this was a mammoth effort of transferring to the computer the handwritten records, many of them decades or even centuries old and in local languages. Data entry operations alone cost Rs.80 million and private sector capacity was utilized for this purpose. The cost of the software developed for local languages by the National Informatics Center of the Central Government is not included in this cost. To be on the safe side, the government implemented the scheme taluk by taluk so that each farmer has switched from handwritten records to computerized ones. Gradually, the handwritten ones were declared as illegal from the date of implementation in each taluk. The government also devised a system of supervisory checks and roped in NGOs and people's representative to oversee the project. The most important outcome of the project so far as the farmer is concerned is that now he could walk into a kiosk and ask for a copy of his record for as low as charge of Rs 15 per copy within 30 minutes of applying, which is a record in e-governance in the country where delays in responding to such applications is the rule. Therefore there is no need to wait on the village officer for getting a copy. It is indeed interesting to note that farmers want these kiosks to operate at sub-taluk level also.

The state government now plans to extend this experiment to disseminate other types of information about villages such as keeping a list of destitute families, handicapped people, pensioners, families living below the poverty line, concessional food grain card holders, regular updates on market rates for village produce, weather information, etc. What is most interesting about this project is that the government foresaw stiff resistance from its own staff and prepared plans to overcome it. Such planning helped a lot in the success of the project says Rajiv Chawla, the Indian Administrative Officer responsible for its implementation. The strategy was to involve these officials in the success of the project by first taking them on board and making them supporters of the project. As a result of which a number of seminars, workshops etc., were organized for all the stages at various levels. Consultants at district levels interacted with officers at district, sub-district and even sub-taluk level to persuade them to come around and be the supporters of the project. What would be their benefit in a computerized environment was explained to them like freedom from drudgery of elaborate work involved in keeping and maintaining the handwritten records. For the operation of the kiosks, people fresh from college were recruited and trained so that the benefits of computerization are evident to one and all. The elaborate training and positioning was a crucial element in the success of the project. Each consultant appointed for the project in each district also ensured that he interacted with both the officials and the public. More than five million farmers have already availed the Bhoomi service from various kiosks. This shows the immense faith and support the farmers have expressed for the new Bhoomi system.

Information is indeed power and it stands to reason that if this power is shared equitably, all will benefit. Bringing internet-based technologies to the villages makes possible a number of applications like health care, extension services, weather updates, education, banking, messaging, etc., to be accessible to lay men. The PC, as Alvin Toffler has rightly pointed out in his book ‘Power Shift’, is the most important invention in promoting decentralization. All the above cases demonstrate that the Information

Technology and Communication revolution is touching the interior of India. The success of ICT in disadvantaged communities will depend upon several factors, such as support, availability of services, motivation to use technology, people's awareness of the potential and capability of the technologies, mastery of technologies and level of empowerment of civil society. Besides, the importance of ICT as an economic opportunity should not be underestimated in presenting the project for approval and involvement of the community.

Bellandur: An Electronic Village

Bellandur is a village situated 25 kilometers away from Bangalore, Karnataka and it comes under the Bellandur Gram Panchayat. The Bellandur Gram Panchayat is the first Panchayat in the country to introduce computers at village level governance making e-governance a big success. In addition, this gram panchayat is the first in Karnataka to computerize its administration and aspects of governance. More than 10,000 people in 2,500 households across five villages come under Bellandur Panchayat. What makes this project unique is that it is an independent initiative funded by the Village Development Committee (VDC). Bellandur is a comparatively well off panchayat, which is assured of year-round irrigation from the Bellandur lake with rice cultivation and vegetable farming being the mainstay of the village. The main industry in Bellandur, which is garment manufacture, employs a large section of women from middle-class households. There are also a large number of government employees living here, who commute to the city of Bangalore. Finally, Bellandur has around 95 per cent literacy. Literacy perhaps has facilitated in the successful launching of the e-governance project by persuading the people to cooperate and to get involved in the mainstream project activities.

Bellandur's e-governance project started with a single computer that was brought to the village in 1998 to replace the Panchayat's old typewriter. This brought Bellandur to the notice of Compusol, an IBM and Microsoft joint venture company, which is currently involved in research and development of e-governance software packages to suit the Indian context. At present the panchayat office has three computers, one for each of the bill collectors. Working closely with the panchayat members and village residents, Compusol managed to devise software packages to suit the needs of panchayat administration, handling the recording of property details, tax collection, data management and so on. Since this was the company's maiden venture, the packages were provided free of cost. The only investment made by the panchayat was towards the purchase of hardware, a total of around Rs.70,000. Such an initiative has completely changed the way the panchayat function. It is cutting the costs and removing corruption in the process. Property-related records such as land revenue details and land dimensions are now stored in the computer. Records of bills paid are made available to members of the public. Since the software uses the local language, ordinary residents have experienced no problem in getting involved in the project. In addition to speeding up processes such as tax collection, property transfer and reducing the workload of the three bill collectors, the e-governance project has set off other developments. Following the computerization of tax collection, the panchayat has recovered a huge outstanding. It has recorded a steady increase in collections and managed to mop up Rs.1 crore in 2001 compared to around Rs.14 lakhs that was collected in 1999. This has allowed the panchayat to channel funds for development projects such as macadamizing roads and digging bore wells. Now every household has daily water supply and pays Rs.25 a month as water tax. Bellandur is also perhaps now the first village in India to have an underground drainage system: it cost the VDC around Rs.5 lakhs. The system has solved problems of clogged drains and slushy roads. Thus Bellandur Gram Panchayat in Bangalore rural district, which has taken its first steps in e-governance, has been an eye opener for the rest of the world in this information era.

It is interesting to note that in Bellandur, digital knowledge and economy is definitely making way beyond the urban clusters. For instance, Bellandur village has enjoyed the fruits of these new technologies. There are scarce glimpses of ordinary village situations in Bellandur with cattle moving in a herd, tiled homes with cow dung cakes all over the walls. Instead, there were small structures and buildings everywhere giving a look of perfect mini-satellite town. It would not be an exaggeration if it were mistaken for a city with shops, restaurants, business enterprises everywhere and facilities of every kind available.

Further the project is not being funded by the government, but it is entirely and exclusively the result of a private initiative and the villagers themselves largely known as

Village Development Committee (VDC). In this regard mention has to be made of Jaganath Reddy, the man behind this entire story of success of the Bellandur Gram Panchayat. Mr Jaganath Reddy, although a politician seem to be more of an entrepreneur given his skills in mooting this project single-handedly without the help of the government. It looks as though he belongs to the new generation of young politicians of India who seems to have a vision of their own. If not for his vision in wanting to make Bellandur a wired village, these accomplishments in the village would not have been possible. Besides, it is also crucial to mention that the residents of the village and their collective support has made Jaganath's dream come true in computerizing the gram panchayat activities. As he himself says that if not for the cooperation and the enthusiasm of the villagers this project would not have materialized. Jaganath was the former Panchayat President and presently Mrs. Nirmala holds the post of President. This speaks of gender dynamics, which is also quite powerful in this place. Women have worked towards making a place for themselves outside their homes and that reflects in the activities of the villages including the panchayat official work. In addition, the village needs to be glorified as it has 95% literacy. Hence the literacy rate is one of the prime reasons for the success of the project as education facilitates implementation and launching of such ICT related e-governance projects smoothly and more effectively. High levels of literacy rates, dynamism and innovations of village leaders turned politicians and cooperation of the villagers have together been responsible for mooting the e-governance project in the village successfully.

It will be rather difficult to term Bellandur as village or gram any more as it has a appearance of a full fledged happening city full of commercial activity. There are several reasons for this village to attain the stature of a 'satellite town like a look'. Primarily, there seem to be developmental activities being undertaken under the initiative of both panchayat and VDC (Village development Committee). Roads are being repaired and macadamized which give a new look to the village. The basic need of the people of the villagers namely drinking water facility is being taken care of with the construction of bore wells. Moreover the water facility system has been properly channelised with water supply reaching every household and the residents in turn have to pay some minor amount as tax every month. Finally, drainage facility has also been improvised with the construction of underground drainage, which cost around 5 lakhs, which was borne by the VDC.

Generally as we enter an average village in India, we witness the scene of clogged water, slushy and muddy roads especially in the rainy season, and absolutely no healthy toilet and sanitation facility. However, Bellandur surprises most visitors with its underground drainage system and sanitation facility. Besides, household appliances, articles, fancy shops and facilities for photocopying, studios, and shops with computer appliances etc., are available, as is so in the city. All these luxuries have made this place a heaven for hundreds of employees who reside in this village because it is expensive for them to reside in the city of Bangalore. There are a number of government employees who commute everyday to the city for their employment and come back to their homes in this village. Similarly, there are a number of young software professionals who are employed in various firms in Bangalore who reside in this village, as it is difficult and expensive to do so in the city. Since schools are also being established, Bellandur is likely to have its own demand in the near future as it is being used as one of the many satellite hubs of Bangalore. It would not be a mistake if one claims that Bellandur is towards making itself as an important 'satellite town' of the city of Bangalore. Thus Bellandur is offering to a large population a life style similar to that of a city that is cost effective and pollution free.

Once a village, this place has been slowly transformed into a township and mini-city like structure thus acquiring a new tag for itself as an 'Electronic Village'. This was largely possible because of the access to Bangalore.

Social Computing in Belandur

Belandur e-governance initiative is unique because of demonstrative interplay and integration of social capital and Information Technology. Both bhoomi and belandur projects primarily aimed at computerization of land records in the rural Karnataka, although the developmental work is now broadened to other aspects besides the land records. Both the projects might have used the infrastructure of Panchayat Raj bodies at village and Taluk levels for their operation. But what makes the difference between them is the fact that Bhhomi project was a part of the Karnataka state government initiative which comes under the broad IT policy of Karnataka state government. However, Belandur project of computerizing land records was completely local people's initiative and cooperation. In academic language, one tends to theorize it as social computing. Social computing in Beklandur can be further conceptualized as interplay of social capital and Inforamtion Technology was evident from the activities in the village.

Interviews with the Panchayat leader, members and village residents revealed several issues quite relevant to the discussion of social capital and social computing in rural areas. Computerization program seemed to have begun in 1996 with the arrival of computer in Belandur Gram Pancyat. The cost of the computer we brought at the time was 67,000 rupees only.

Initially there was lot of opposition from the villagers as some of them confused it for television, which was known for entertainment value. Even those who thought it to be computer were not happy because, computer for them in those days in villages was also popularly known for entertainment purpose like playing cards, chatting, sports, watching CDs etc. The real value of the computer and its advantages were not known to the villagers. They felt that Gram panchayat is spoilt because computer is being installed and all the members will only watch movies and play cards in computers. Alternatively they felt that if the same amount of 67.000 in invested in road construction or other public utility, then it would have been more beneficial to the village community. Hence they were not happy initially and they had mistaken that the Gram panchayat members had got it for their entertainment purpose. Thus confusion prevailed among the villagers with regard the arrival of computer in to the village in the beginning. But gradually they began accepting it and understood it benefits.

Once it arrived, a girl was sent for two months for computer training and she starte4d handling the computer after she returned from the training. She began her work of entering the data on land records, property and on several other matters related to the village and storing it in the computer. Soon the news spread everywhere and Belandur Gram Panchayat became popular for having a computer in its office. Many outsiders were surprised and they came to the village to visit Belandur Gram Panchayat office and they expressed their surprise, excitement and encouraged the villagers. The press made frequent visits to note down the activities of out Village Gram panchayat in detail. During that time, even the state government offices did not have computers. Infact computer education in schools especially in convents were initiated only after few years. Since, Belandus acquired computer at a time when computer education was yet to get a proper footage in Karnataka then, it attracted sufficient attention from local and global spheres.

A single computer at Belandur Gram Panchayat office made the world look at Belandur. Eventually they got help from the software people companies and the proper establishment in the real sense took over one and half years. Once that was done, feeding of the information took place and soon ready data on several matters related to village affairs were available in the computer. It included Gram Sabha Resolutions, property details, expenditure statements, Gram Panchayats meeting resolutions, beneficiary lists etc. Thus there was a facility where all the information could be stored in one place. Also, it was possible to get any information easily in a fraction of second without wasting time as and when required. Information was thus easily available from computers and in the process even the correspondence also is being made easier. It took some time to convince the villagers about the uses of computers and once it was done, explaining them with the help of the past and present condition, there was a sense of realization among them with the situation. There is no agitation or sense of dissatisfaction over arrival of computers into

Actually gram panchayat had no provision to buy the computer since the cheque power is limited to only 10,000. But Belandur had 'village development committee' which contributed for computer purchase. Even then the taluk and district panchayat questioned as to how we got the provision. They also sent a notice seeking exploitations. It was obvious because, in those days, even state government offices did not have computer facilities. Once when they were told that it was got through 'VDC', there ceased to be any technical problems arising out of it. If they had not taken shelter of 'VDC' then it would be very problematic and a big head ache to get clearance at different stages and levels of government. They had to take prior permission from taluk and district head for every single activity connected to computers and in the process might also had to pay bribes. This indeed reflects the collective action among the villagers.

They do not seem to get any special financial support from the government till now. But they are expecting support in technology. They want technology because they want to implement number of new programs and for that they need appropriate soft wares and technological support. For instance, they want to do citizen's ID to keep track of the people coming into Belandur different places. Since the area is getting urbanized, lots of people are moving in and nobody knows their details and whereabouts. They feel the need to keep track of these migrants by making the citizens's ID and place the visitor's names along with the photograph in the website with the other details. For that they need software and support in technology to implement it. Also voters list, birth and death certificate, society duties etc are not given to gram panchayat. It is in the jurisdiction of the village accountant in the revenue department. IF these powers are given to gram panchayat then it will really facilitate their future plans for further development. The voters list has lot of mistakes and needs to be updated. The villagers feel that Gram panchaya shall do an efficient job if t is entrusted with that task. But, along with increased gram Panchayat powers, they expect technological support which is their dire need now.

The above were just some reflections derived from the experiences of field work in Belandur village. The filed insights reveal the skillful management of community, communication and collaboration with the technology which are believed to be the corner stones of social computing.

The Belandur GramPanchayat now proudly claim that they get all necessary records whenever they need them without having to wait for weeks. Besides these records are free from human arbitration and hence updating becomes easy. Computerized records make farmers free from harassment by the government officials, middlemen and village level leaders, etc and farmers now have direct access to all information about their property which was earlier not possible. Advantages arising out of this system are many. There is increased transparency, avoidance of malpractices and manipulations, increase in the collection of revenue are just some of them which is evident to the villagers.

Disadvantages could be the delays due to power outages and breakdown, delay due to Tashildar's thumbprint, glitches in software etc. Non familiarity an non accessibility to technologies earlier too could make villager feel disconnected and disoriented while internalizing these technologies. It is here where the designers have a crucial role to play in envisaging social computing. Designers need to keep in mind that familiarity, devise satisfaction, social application, accessibility, appeal, relevance, power, pervasiveness, communication are some of the important factors affecting the human computer interaction. Earlier research have indicated that devices can effect the mechanisms that determine when interactions are satisfying and productive. If the device has not been designed to support social interactions, they can appear to users as unattractive. The way devices can be used cannot be determined by their creators alone. Individuals too can influence the usage of devices as they are social creatures. The importance given to social relationships in our lives do indicate that individuals adopt those devices that support rather than inhibit such social relationships. Thus computing technology can be successful, if they are supported by human social lives. Designers need to understand the mechanisms behind interpersonal satisfaction and collaborative productivity. (Dryer, 1999)

Digital knowledge and the impact of ICTs on the rural communities have largely led to the diminishing of the traditional forms and practices of both participation and community organization. But, alternatively, they have opened up new communicational channels among people, which have led to newer forms of participation and organization. The very fact that the success of Bellandur village is due to people's participation ensures that there are newer forms of participation processes emerging among the communities, which is leading towards development. Secondly, the computer education in rural areas is not quite adequate. The efforts made by the government and non-government agencies to spread computer literacy are not sufficient. The current computer educational approach to spread computer literacy is showing some positive results only in the semi-rural areas, as there is some degree of awareness about computer technology among the residents. But a more intense approach is necessary to train those villagers who are completely disconnected with the city and township. Knowledge about computer and other technologies needs to be mediated through proper pedagogy, which connects the illiterate rural masses living in the interiors of rural India.

Information technology holds great promise for creating positive economic growth in rural areas. There is also a need for the development of social capital as well to nurture the developments of IT among the rural communities. Social capital has been the necessary component of information technology investment in rural areas and the integration of the two is very essential. Thus the concept of Social capital (which has in its possession human and social traits like good will, strong social ties, mutual support, shared language, common beliefs, mutual obligation etc) has been lately applied to number of fields including IT. The interplay of social capital, knowledge sharing, technology, community building becomes visible as one explores several experiences of social computing in different parts of the world.

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Conflicts in adopting to E-Services in rural India- A Study of Cultural Issues

Abstaract.

In this paper we address the cultural issues surrounding the use of metaphors that arise due to the implementation of Information and Communication Technology (ICT) in rural India. We argue that there is an emerging need to look into the doctrine behind the metaphors being used based on the Indian village culture and their habits. In other words one needs to identify some of the issues that might be pertinent to the design of better ICT products such as e-governance, e-choupal, e-seva and e-learning programs launched for the villages of India, keeping in mind the cultural integrity and aspects.

We illustrate this point by investigating the different consequences of the current designs introduced via some of the methods in villages, in the existing scenario. We review current theoretical and empirical works that are used in Indian villages and their foreseen effects on village life and culture.

A survey of Indian villages viz *Bellendur, Baramati* which are having an established ICT base was conducted. Along side, pilot study of a local village named Amingaon was done. Analysis of the survey revealed that there is a cultural feedback in the user's behavior and the significance of interface is rooted in local contexts. On the basis of analysis of survey results we propose a structured model describing guidelines that will help design, create and evaluate better output by ICT projects for cultural use.

This demonstrates that interface designers not only need to look into heuristics and translating aesthetically related issues but also deeper cultural understandings, perceptions and beliefs of their target audience. Consideration of regional specific cognitions must be taken so as not to lose customers by alienating them and having adverse effects on the cultural habits. It is hypothised that this paper should enable international designers to understand how metaphors are embedded within cultural and social backgrounds and also partially understand the complexities of local consumer behavior.

Keywords:
Metaphors, Cognition, ICT, Heuristics.

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An interface to aid rural health workers in diagnosing cataracts

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Abstract

This paper describes the design and development of an interface for a handheld device that aids rural health workers in diagnosing and identifying the maturity of a cataract through an external visual inspection and comparison of the eye with stored images on the device. The design of the interface is driven by the geographical, social and cultural contexts that influence the work of the rural health workers in India.

We describe in this paper the challenges associated with such a diagnosis by semi educated rural health workers and illustrate how a consideration of the local culture and design innovations incorporated in the interface can aid them in making an informed decision about the maturity of the cataract and the status of the post operative care required, thus saving the patient – usually senior citizens- precious time, trouble and money by obviating the need to travel from remote villages to far away eye hospitals.

Keywords:

User Interface Design, Cultural and Social cues in User Interfaces, Rural Health, Handheld devices, visual assistance in decision making.

Comments: Very interesting application value. It is understood that the authors will present a total application package with a rural emphasis. The contents of this abstract and full paper are of high value to audience from other countries/ cultures. The abstract doesn't throw light on the methodology of design, experiment s involved, and their validation. The authors are requested to include all relevant methods, data collected, and how the designs were validated. Wondering if such systems are used in China too. No references have been mentioned in the abstract. Assuming that they will be in the final paper , this abstract is recommended for the main session.

Embedding complementarity in HCI methods

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Abstract. Differences in cultural contexts constitute differences in cognition and research has shown that different cultures may use different cognitive tools for perception and reasoning. The cultural embeddings are significant in relation to HCI, because the cultural context is also embedded in the methodological framework, and in the techniques and the tools that we apply. But we lack a framework for discussing what and who we are, when we talk about what and who of a person as a user of an ICT system that has to be designed, developed and implemented. We need complex and rich descriptions. We need to reflect critically upon our own frame for understanding and this requires critical reflections upon the forty years dominated by a rationalistic empirical understanding of the user as expressed in the literature and practice within the HCI paradigm in system development. As an initial step HCI needs to take up the research challenge which lies in conceptualizing and representing complexity and we suggest the theory of complementary positions.

1 Introduction

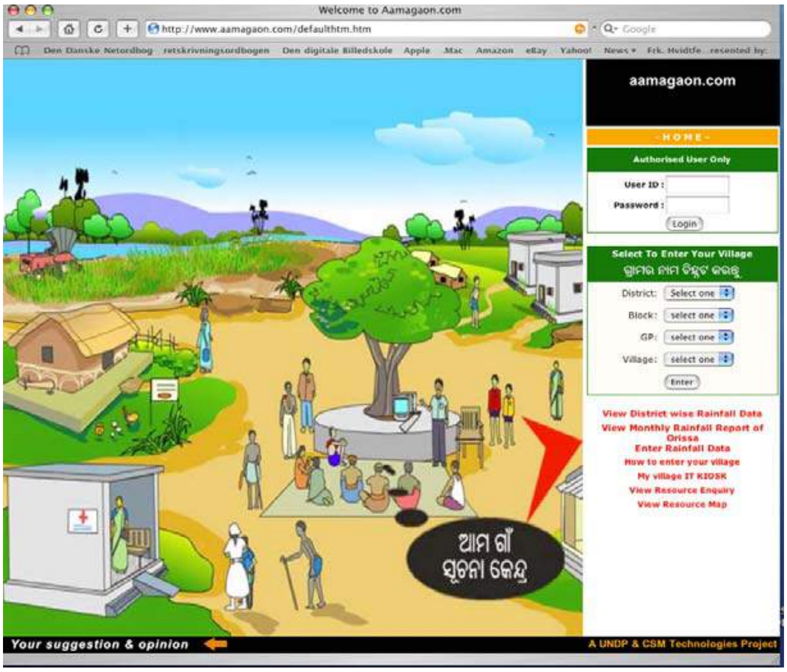
The global digitalization of information and communication processes requires that the world citizens are literate in the use of computers. But the majority of the world populations are illiterates, and not only technical illiterates, but illiterates in the traditional sense of the word: they cannot read and write. However, the global ICT development largely disregards the problem with illiteracy and cultural differences.

India may serve as an example. India has developed an impressive ICT industry and has a very high level of expertise in software engineering. In addition, India has implemented e-government systems that also address the rural populations. But the Indian population is very large, and the potential users include highly diverse groups, many of which are illiterate. Experiments have shown that a gulf exists between the intended use of a technology and the actual use because “neither Development nor Quality Assurance Process consider Usability from the requirement phase or the pre-implementations phase” (Jani R. and Badave V., 2004) (Singh and Agrawal 2004).

2 E-Government and illiterates

The Indian Government has explored design for illiterates by setting up electronic kiosks in remote areas and letting the electronic information process be handled by and through a kiosk operator - who may be a local administrator. India is divided into states, a state is divided into districts and districts are divided into blocks. A block may consist of 40-50 villages and a block administrator may be miles away – geographically and mentally – from the individual farmer in a remote village, who wants to ask experts in Delhi about the black spots on his crop. “In India, language, context, culture change in every few kilometres” (Parmaar et al. 2004). The administrator may not know anything of the knowledge field in question, and the expert in Delhi may never have visited the remote area of the remote state in question. Villagers may have no concept nor understanding of computers and networks – and the technology makes no sense to them. The individual “user” becomes dependent upon the operator (Parmar V. S. and Wani P., 2004), and questions and answers may suffer from having to pass through the administrators. Besides, information is power, and the administrator’s role as the gatekeeper of technology, interpreter and handler of information may undermine the intended technological enhancement of democracy, as gate keeping may develop into a very powerful (and misused) position.

Orissa Government site: Rural Planner. The image interface is designed for illiterates. However if a user moves cursor or clicks a bubble with text in the Oriya language appears – and there is already as can be seen there is a text on the house in both Oriya and English: Enter.



If the user/operator moves the cursor over the tree, several items become visible: people, the health station, a text in a black bubble and a red arrow that points to a menu bar – in English - on the right side. The user/operator is asked to key his user id, password and entry (location), where he can choose between district, block, group or village, and then he may select to see rainfall for given periods.

3 Interfaces for illiterates

There is a digital divide between those who have access to IT and those who do not, those who can read and those who cannot, those who speak English and those who do not (Yajnik, 2004). Different solutions have been suggested and prototypes developed, e.g. "interactive speech interfaces" (Girja, P.N. 2004) and special navigational assistance such as "signboard system, vocal agents or natural language processing dialogue" (Panwas, V. and Pradeep Y., 2004).

Other solutions have been suggested, e.g. personalized e-government services, and experiments have been carried out with "personalized services through touch screen kiosks" to the illiterate villagers. But there are problems with "establishing identity of person and verification" (Katre 2004). In one experiment, potential illiterate users were asked to choose a combination of images, 7 images for their username and another 7 images for their user identity. There was no problem in getting the users to choose among the many different visual images, which also differed greatly in style and size. However, a few days later the users did not remember all the visual images they had chosen, or the sequence in which they were chosen. In another experiment, villagers who were unfamiliar with computers were unable to use the keyboard despite careful instructions. The researchers concluded that the users' perceptual-motor skills were not developed to handle small keys on a board. It raises the question whether one can touch and interact with something in a meaningful way if the object and the actions do not make sense?

4. Culture and cognition

Context is embedded in cultures, and differences in cultural contexts constitute differences in cognition (Barry and Dasen,1974). This understanding has to be taken one step further as research shows that cultures may use different cognitive tools for perception and reasoning and there are culture specific differences in the way that people think and reason (Nisbett R., 2003).

There seems to be a problem in the relation between the culture of Information and Communication Technologies and the cultural cognition of everyday life. The villagers had no problems reflecting on rain, clouds, grey skies, sun, etc. when drawing on concrete experiences from everyday life. But when these objects were transformed and visualised on a computer screen, they did not recognize them and were unable to talk about them when interviewed. They were visualised, but abstract to them - not concrete experiences like seeing the black spots on the crop. " We do not exactly know the information need and information seeking behaviour of the rural populace" (Singh & Agrawal 2004), and we do not know their reasoning on or perception of the ICT applications, to which they are introduced. This may be difficult to understand for academics, because meta reasoning about abstract concepts is fundamental in our professional lives. But the reasoning and thinking drawing on the concrete experiences from everyday life cannot capture the abstract meta-reflections embedded in the world of ICT applications.

The cultural embeddings are significant in relation to HCI, because the cultural context is also embedded in the methodological framework, and in the techniques and the tools we apply. The HCI field fails to consider the role of culture in its methods and techniques (Smith A. & Yetim F., 2004), but they cannot escape a cultural bias. Traditional HCI methods and techniques have developed along with the IT industry and are based in western thinking.

5 Cultural wrapping

But it is not only Indian HCI that is subjected to western thinking. Also Europe is subjected to cultural blindness. One recent example is the representation of humans in

Microsoft OneNote software. Here users are represented by portraits (photos) in usage scenarios know as personas (Mikkelson & Lee, 2000; Nielsen Lene, 2002; Pruitt & Grudin, 2003): On OneNote´s Danish website, Kirsten is a consultant, Søren is an engineer and Kathrine, who takes notes in English although she is a Danish student. On the German site, as on the American sites, she is named differently, but the photos and tasks are the same. The diversity of people's skin colour in the different usage scenarios shows that the company addresses "equity issues". But it applies usage scenarios with an embedded representation of users as mono-cultural and function-oriented ideal types. Thus, only the wrapping is changed, and the signal embeddes in the company message is that the essence of culturability is insignificant. Hence we are all on a global scale exposed to descriptions of a limited number of ideal humans who apply technologies in certain ways and are blind to cultural differences and illiteracy.

6 A challenge to HCI

Not even the representation of the user in the traditional Human-Computer Interaction (HCI) techniques and methods reflects a complex and differentiated understanding of human beings. In most of the Human Factors' representations (Baecker, Grudin, Buxton and Greeenberg, 1995; Dix, Finlay, Abowd and Beale, 2004; Lindegaard, 1995), it is not a person who is represented, but computer applications with a one-dimensional user as an appendix (Card, Moran and Newell 1980, Nielsen Jacob 1992, Nielsen, Clemmensen and Yssing 2002). Despite conscious and explicit attempts to get around the one-dimensional human being, even the new interaction design research (Preece et al., 2002) ends up with a simplified, rational subject, and interaction remains something that takes place in a closed space: within the human head. When Human Factors as well as Interaction design focus on tools, techniques and methods, it seems they cannot frame the use of tools in the embedded world views, maybe because they do not have a clear understanding of the underlying theories,.

The challenge lies in developing more diverse representations of the complex human being in an information and communication technological (ICT) perspective. Inadequate descriptions of humans are decisive for the designer's conception of the user and will eventually govern the development of the user interface (Kumar & Bjørn Andersen 1990). Hence, they also have an impact on the user functions designed as part of the systems, and they influence the human-computer interaction - and the human beings that use the systems (Levinsen, 2003). As such, the designers' user representations influence our conceptions of what humans are and what computers are, and in the end, they will also influence our imaginations about the future society as a whole (Weizenbaum 1976, Winograd & Flores 1988).

The inadequate descriptions of users do not enable or support the design of a future ICT that is oriented towards humans as individual users in other cultures and contexts than the standardised work and mass consumption culture. We need richer and more complex description of who we design for and what they will do with our designs. We need complementary methods and techniques to develop complex descriptions of the future systems' users, and we need methods and techniques to develop complex user centred designs, tests and evaluations (Karat & Karat 2003). Our claim is radical: We need to develop a complementary theory that embeds complexity, and we need to reflect critically upon the forty years of dominance by a rationalistic empirical understanding of the user expressed in most of the literature and practice within the HCI paradigm in system development.

7 Conceptualization and representation of complexity

Users do not identify with – and cannot be identified from a traditional demographic categorizing of sex, age, profession, etc. We are immersed in different cultures and take on *roles and functions depending on which contexts* we enter into and are co-creators of. We can play with our identity in chat rooms; we can cooperate with colleagues via the net and a few minutes later, log in and be a student in a virtual master study programme. However, within ICT the representation of the human has been based on a rational ideal, that is a goal oriented, information seeking and task directed (Ericsson & Simon 1984, Levinsen & Ørngreen 2003, Lewis, Nielsen & Yssing 2003). Quantitative segmentations have played a major role, and because computers were developed for standardised work (e.g. text editing) and mass consumption, the human had to become someone who could adapt to each new generation of software, instead of the other way around. It still characterizes computer use (except for front users) that humans have to adapt. At the same time, however, ICT is spreading into people's everyday life and all other aspects of life, both in specific, personal ways and as general, cross-personal globalization. As a consequence, technologies will have to work in ambient contexts defined by the different ways and areas and the different uses. The *context becomes floating*: I am physically present at my office, in my chair, and, at the same time, I am present on the net, virtually present in Bangalore, walking down the 'MG road' deep into discussion with an Indian colleague, sensing the noise from the traffic, the chaotic street, the multicoloured flower-arrangements in the many small shops – and aware of the two students who enter my office and place a book they want to return on my desk.

The children of today will be the power-users of tomorrow. They are emotionally engaged and develop new cognitive skills (Nielsen, 2003). Without efforts, they navigate deeply into an application, transfer to other applications, and all the time they have an overview and know their way "home". In this development, we find a challenge for research. The *interaction with the computer is mental*. The computer interacts directly with the human cognitive processes: perceptual, emotional, sensual and conceptual. Hence also the sensual, visual and emotional interaction, which relies on tacit processes (Nielsen, Christiansen, Clemmensen, & Yssing 2003) and takes place above, around and below the verbal and written interaction, becomes significant. But how do we create and communicate this knowledge about humans' use of technology? How do we use these creations to design software and interactive products? It is not only the goal directed interaction we need to understand, design and evaluate, interaction also embeds aesthetics and pleasure (Jordan, 2000).

Irrespective of the technological goals, the intentions with ”pervasive, ubiquitous and transparent computing” (Weiser, 1998; Weiser & Gold, 1999) are identical: Technologies should be ”unobtrusive”, i.e. we should not focus on the technology, but on the activity we are currently doing. We suggest that Human-Computer Interaction (HCI) research should contribute to the design of future ICT systems by focussing on (1) the double complexity of complex roles and functions (2) culture and floating contexts and (3) the cognitive basis of the interaction with the computer. The research challenge lies in conceptualizing and representing this complexity. The complexity should be captured through the methods and techniques for analysis, design, test and evaluation of human-computer interaction. The conceptualization of research objects is all framed by culture because of its embeddedness in our understanding of humans, theory and technology. To analyse this complexity, we need to apply a theory of complementary approach.

8 A complementary methodology – future work

The cultural frame, the complex human being, the floating contexts and the mental interaction cannot be described from one single observer position. They may eventually be described and presented in a richer diversity by combining many observations from many observer positions (Levinsen 2005). What we need is a framework for discussing what and who we are, when we talk about what and who of a human as a concrete user of a concrete ICT system that has to be designed, developed and implemented. As a framework, we suggest a theory of complementary positions, which insists on solid accounts and theoretical explanations from all observer positions in relation to perspective, standpoint and focus. This framework will enable us to relate to the observers' influence on the observed aspects (Allen, 1959) and the limitations encountered by culture and language(s), when the subject-object distinction cannot be maintained.

Adopting a theory of complementary positions as a framework necessitates an experimental approach. The complexity of the Indian scenario has shown that highly creative approaches to development from user perspectives are necessary. But coming from a Scandinavian user-oriented tradition it is tempting – looking from outside-in - to see the problems with the Indian applications as the traditional usability problem: the user has not been involved. But just like the Indian approach does not address the fundamental problems with illiteracy, neither do we – from the Scandinavian tradition – address the fundamental problems in our users oriented methods. We have to ask the question: Will they work with technical and functional illiterates from rural villages?

The task for HCI is to reveal cultural biases embedded in IT applications and in HCI methods, and at the same time have an open mind for development of new HCI methods and techniques as well as new applications. But the design and development need to be based on experimental sketches and prototyping, just as techniques and tools for test and evaluation of human interaction with the computer/other ICT artefact have to be developed on an experimental basis because we are entering unknown land. Confronting existing techniques and tools, e.g. contextual enquiry, cultural probes, scenario development, the technique of engaging persona, iterative prototyping, design of icons and graphical (dynamic) interfaces to applications with explorative and experimental approaches may lead to innovation in HCI.

Our design approach attempts to integrate a focus on analysis and design that goes beyond the general reliance on iteration as a way to develop products that fit the user's needs and context. In a period with flexible, mobile technologies used in floating contexts, it is vitally important to maintain a focus on users and the complex user situations. As society and users' work become increasingly complex and global, we believe complementary techniques resulting in multidimensional user descriptions may lead to a focus on a robust and diverse user approach, for example by means of extensive work studies providing multidimensional rich portraits of users.

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Culture specific solutions for dealing with waiting time on computer applications

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Abstract

Time is a precious resource and computer time is an even more expensive resource. Waiting time is like friction which must be overcome to get any process done. Waiting is almost imperative with various computer products and systems and the user is often found to be at the waiting end of a rotating sand clock or a progress bar. Users may get irritated and restless, with repetitive interruption in work due to response times, leading to lowered work efficiency.

On the other end it may also cost potential business to a service provider, with users balking away due to excessive waiting times. For any process, waiting times can be reduced with better and more efficient systems but it would be economically futile to work towards bringing waiting time down to zero. Due consideration to the psyche of the waiting user, can lead to a better user experience and development of more productive applications. It may also provide with a good opportunity to involve the user with desirable activities.

An understanding of how people of different cultural orientations deal with waiting as an activity, and respond to it, can provide solutions to HCI(Human Computer Interface) designers to come up with culture-specific solutions, ensuring that users feel as good as possible while waiting. Cultural conditioning forms the basis for parameters such as attention threshold, Long-term versus short-term orientation, focus on objective and uncertainty avoidance. These further transcend into response time and type, status report type and content, page load methodology.

This paper is aimed at dealing with various aspects of waiting time and its implication in HCI with respect to varying cultures. It is intended to analyze the issue with the help of surveys/ available statistics and Case Studies regarding Culture specific traits and expectations.

CONTENTS

1 Background

1.0 What is Culture?

Out of several definitions of Culture, the most appropriate for the context of this paper is the one by Hofstede: Culture is defined as “the collective programming of the mind which distinguishes the members of one group from people from another.” [12]

1.1 Cross-Cultural Issues

(Culture) has a strong effect on what users look for in a system’s interface and how they interpret such interfaces. Thus it is commonly recognized that elements of a user interface appropriate for one culture may not be appropriate for another.

1.2 Waiting Time:

Waiting time varies across cultural norms for time spent waiting may trigger anger and strain rapport [15]. This necessitates serious consideration on culture-specific solution in order to handle waiting time for various organizations that take help of HCI in their business.

1.3 Waiting time on web applications

Waiting is inevitable. The ways and the places where we wait may have changed; our waiting lines may have moved from provision shops to check-out lines in stores, from bank teller counters to ATMs; but we still wait. It results from the laws of supply and demand that are universal, independent of time and technology.

Technological limitations and the fact that we do not work in isolation also result in waiting time. Almost all our activities are interlinked and interdependent on external events. Complete synchronization is impossible to achieve and hence we have to spend a fraction of our time as waiting time, when undertaking any task. Computer applications, running of the best and the fastest of dedicated systems would also have technological and physical limitations making waiting time, inevitable.

Some of the instances when a common user would encounter the 'waiting experience' would be during computer start up/shut down ,waiting for an application to start up, time taken to complete a process and so on.

Waiting time on the internet is a shade closer to the "real" waiting experience for the following reasons:

- It results, not just from technological limitations but also from user traffic. While using a web application, a user is aware that he/she is competing for information with other users. Some users would intentionally avoid logging on when they know the internet "traffic" would be heavy depending on real life schedules, habits, and situations.
- Users have choices. If users feel they are being made to wait too long they can quit and move to some other website, just as they can decide to quit a queue that is not moving fast enough.
- The internet has become a part of the daily life and lifestyle of people. It provides for many daily needs and dependency is only increasing. It would be useful and fruitful to link it to the aspect cultural preferences.

Waiting time on the internet is important because slow download of web pages and represents one of the most imperative obstacles to growth in online commerce and is thus the main object of this paper. Cross cultural issues result from varying attention spans and response to waiting across cultures and form an important dimension of this study.

1.4 Impact on users

Waiting is unpleasant, occasionally expensive and steadily increasing. Frustration and costs are two of the many aspects of waiting time and may affect the "waiters" in numerous ways. The waiting game may also involve feelings of status, power and self-worth.

In application design, waiting time and user satisfaction are thus closely related, making it a vital factor. A measurement of the relationship between page download times/process run time and the users' emotional reaction to it, is vital for the evaluation of all applications. The frustration due to page download times of web application experienced by users can be safely assumed to rise rapidly with increasing waiting time. An actual plot of time verses user satisfaction/dissatisfaction would reveal the importance of dealing with waiting time as an important design issue and the approach to be adopted.

1.5 Impact on business

Poor website performance can cost companies millions annually in wasted marketing money. Advertising may initiate web site traffic but cannot make users stay. Often IT proffessionals get so caught up in the technical details that they forget that what matters the most is the performance of the site as users perceive it. A technically brilliant site, built on the latest hardware and software at great expense, can still have appalling performance.

1.6 Differences across cultures:

Put your hand on a hot stove for a minute, and it seems like an hour. Sit with a pretty girl for an hour, and it seems like a minute. THAT'S relativity.
- Albert Einstein

The meaning and significance of time may not be consistent across cultures. [3]

The concept of time and hence the concept of ‘Waiting Time’ in particular varies across cultures. The following examples may be noted in this regard:

In Northern Europe people are exact and precise about time, much like Americans on the East coast. The Northern Germans and Swiss are particularly punctual. In South America, most people know no other way of living and never explain or apologize for being late. In Italy clock time schedule is not that important. The second program starts (on TV) only after the previous one completely ends. [15] e.g. for Americans & Europeans, time is an asset which can be spent and saved (They feel insulted when those with a different view of time keep them waiting).

A large research endeavor was taken up into national culture differences across subsidiaries of a multinational corporation (IBM) in 64 countries. The study defined and validated five independent dimensions of national culture differences: Power distance, Individualism, Masculinity: Uncertainty avoidance, Long-term versus short-term orientation. [12]

Edward T. Hall studied the cultural differences to the depths. His concept of polychronic versus monochronic time orientation, deals with the ways in which cultures structure their time. The monochronic time concept follows the notion of “one thing at a time”, while the polychronic concept focuses on multiple tasks being handled at one time, and time is subordinate to interpersonal relations.

As per Hall’s studies [10] Chinese software developers are found to carry high-context cultural backgrounds, where as for American software developers, it is low-context. It is found that [2] Chinese software developers performed better within an iconic or pictorial mode, while their American counterparts were more successful in an alphanumeric mode.

2 Avoiding determinism: towards interface localization

As per Geert Hofstede (1997); in most countries a dominant culture exists and it should be possible to identify the characteristics of such a culture to determine how we should design our technological artifacts to suit the majority of users. But for multicultural organizations (say, Infosys/TCS) having quite cosmopolitan environments within a small locale, such a deterministic generalization of culture may not be appropriate. At the same time, ‘Customized user interfaces may not be necessary for users of same computer based systems due to shared representation'. [4]

Seen from a human factors point of view, traditional designers and most developers of new technology have been making too many assumptions for too long about user prejudices and preferences in the adoption of innovations. We find that they either ignore these perspectives entirely, or they over-compensate. The 'one-size-fits-all' solution is a utopia.

Although 'India' has been considered as a single cultural entity in most of the research endeavors for HCI, the real scenario is different. In fact the user's preference for HCI in Waiting Time/other scenarios is found to be a very complicated issue and needs to be solved at deeper level rather than trying to widely generalize it. This encouraged us to conduct a survey among Indian Web users. The basis of the cultural difference for the survey conducted among 100 odd participants on internet was considered to be the mother tongue of the participant. The survey results gave stunning results portraying the difference of user expectations within various language speaking groups within India.

3 The Survey

Our Survey on Web habits/preferences across cultures:

The results of the online survey conducted for this study, provide some interesting insights on the user patience levels. Participants were requested to take the survey through links mailed to them.

Survey steps:

1. *Welcome page*: informing the participants about the purpose of the survey; Button click to reach the survey
2. *The main survey page;* click to submit
3. *Thank you page*

3.0 Derivatives:

The survey provided us with following information:

1. User priority of websites trends
2. Culture specific priority trends
3. Culture specific profiles regarding polychronicity /monochronicity or individualism/ collectivism.

This information helped us come to the solutions of the Waiting-time problems on web that we shall be discussing towards the end.

The following statistics may be noted.

Details of participation

S.no	**Participant's Home State**	**Visits**	**Partials**	**Completes**
1	Andhra Pradesh	46	0	20
2	Maharashtra	19	0	13
3	Hindi Speaking States (UP, Bihar, etc.)	26	0	15
4	West Bengal	15	0	7

The visitors, who did not complete the survey, apparently found the waiting time for the survey to load too high and abandoned it without viewing the questions or felt they had already spent enough time waiting and did not go further to answer the questions.

The abandonment rate here is close to 50%. That would imply that half the visitors abandoned the site before accomplishing the task at hand. Even some popular websites have high abandonment rates and new upcoming sites must be even more wary of these figures.

3.1 Survey Result Analysis

We defined five increasing level of waiting time involved with a particular kind of a web site and asked the user up to what extent he/she shall be patient with it. The waiting time patience index was calculated by finding the weighted-mean of the percent of users from a particular culture clicking on a website-option.

This helps in mapping the cultural risks that arise out of culture specific traits of users that are otherwise not so easy to map or plot onto graphs. Culture is a strong means of social conditioning. Derivatives of this conditioning are numerous- culture specific expectations, work style, thought patterns and these determine how a user goes about applying himself to a system.

Table1: Waiting Time Patience Index as per website-type

	Hindi	Telugu	Marathi	Kannad	Bangla
1. Your Bank's Website	13.33	16.13	15.4	18.06	17.13
2. E-mail	11.46	12.8	14.66	17.13	15.06
3. Internet shopping	15.73	16.13	17.93	18	15.2
4. Ticket booking	13.86	17.06	17	17.86	13.33
5. Search sites	10.13	10.93	15.13	11.4	10.46
6. On-line Bill payment of daily utilities-like mobile, electricity etc.	15.2	17.66	14.66	14.2	13.33
7. News	14.4	12.53	16.66	14.53	12.2
8. Online Music	17.86	18.26	20.8	17.13	17.8
9. Online Games/Entertainment	17.33	18.6	22.06	19	17.93

It is evident that People across varying cultures have different preferences.

It is important to know what exactly user's do while waiting on internet for some operation to happen. The following survey result is targeted at that:

Table2: What do users do/like to do while waiting on web.

You hit a link; for a few moments you only see a blank white page; what do you do for the 12 seconds that it takes for the entire page to load.	Hindi	Telugu	Marathi	Kannad	Bangla

Watch the process bar at the bottom; that's engaging enough	8%	8%	13%	0%	0%
Don't mind opening up another window for something else; would come back to check some time later.	71%	58%	47%	67%	71%
Would be more comfortable if some part of the website is available for reading on	21%	33%	40%	33%	29%

Though some variations are present, Indian web-users tend to involve in similar activities while waiting on web.

As we have discussed earlier, Assuming too much about user's preferences is not a good idea. This prompted us to survey what the Indian users would like to have while waiting on web. The options given include some of the popular ones and some as proposed by us through this paper:

Table3: What users like to have while waiting:

Waiting time – more than a minute. For example your request for availability of a train ticket.	Hindi	Telugu	Marathi	Kannad	Bangla
Would be satisfied to see a message" your request is being processed, please wait	13%	25%	20%	17%	14%
Would definitely like to see some animated graphic representing the process taking place	17%	29%	27%	17%	14%
Would like to read the latest news flash meanwhile	21%	38%	27%	17%	29%
Would like to view miscellaneous advertisements	0%	0%	0%	0%	0%
Information about other/latest schemes/offers available for that particular site	25%	21%	13%	33%	0%
Time clock, estimated time left for the process to be completed	42%	42%	47%	67%	71%
Play games	13%	4%	13%	0%	0%
View an interesting graphic/pictures etc	8%	8%	20%	0%	0%

Table4:

Waiting time- more than two minutes. How would you like to spend your time while waiting for something to download?	Hindi	Telugu	Marathi	Kannad	Bangla
Information about the document/entity to be down- loaded	26%	42%	20%	17%	14%
Would definitely like to see some animated graphic representing the process taking place	13%	25%	27%	17%	14%
Time clock, estimated time left for the process to be completed	39%	42%	27%	17%	29%
Take a small quiz or a brain teaser	52%	29%	0%	0%	0%

The survey results show that though most of the users preferred what is already available, a good chunk went for non-conventional solutions, and that opens a deluge of innovative options to develop further.

Users in the following questions were asked some questions in order to find out the Polychronic/Monochronic character variation across cultures:

Table5: Polychronic/Monochronic cultures

When you know that some web operation Shall take time to complete, what is your immediate mental response?	Hindi	Telugu	Marathi	Kannad	Bangla
You impatiently wait for the operation to finish **(Monochronic)**	4%	4%	7%	0%	0%
You feel impatient and try to engage in some other work (say, checking your Inbox), but really cannot concentrate on either **(semi-Monochronic)**	25%	33%	0%	33%	29%
You tend to do so something in parallel (say, checking your Inbox) but wish if the web operation had taken less time **(semi-PolyChronic)**	83%	83%	86%	83%	86%
You treat it an opportunity/Break to engage in something else for some time **(PolyChronic)**	4%	17%	14%	0%	29%

It is evident that contrary to common belief, Indians as a part of the sample of our survey, in general are not Monochronic in nature. They rather show mid-way characteristic between two extremes, more towards polychronicity.
In the next survey, users were asked some questions regarding how they would like to spend time while waiting. The questionnaire was designed in a way to measure their Individualistic/Collectivistic characteristics.

Table6: Individualist/Collectivist cultures

What do you like to do when you are made to wait for say, 6 minutes for a download to complete?: (Choose one of the most appropriate option)	Hindi	Telugu	Marathi	Kannad	Bangla
Start Playing Minesweeper **(Individualistic)**	17%	35%	14%	0%	29%
Have a look at the mail forwarded by a college friend (perhaps a week ago) with the pictures of your favorite Bike/Tourist spot **(Semi-Individualistic)**	43%	52%	36%	50%	86%
Forward the same mail as a forward to your family/friends **(Semi-Collectivistic)**	13%	17%	7%	0%	29%
Chat with your online friends **(Collectivistic)**	48%	52%	71%	50%	43%

It is clear that various cultures within India exhibit quite contrasting characteristics.

The survey results suggest us the need for avoiding determinism as far as HCI design is concerned.

4 Solutions

4.0 Culture specific solution

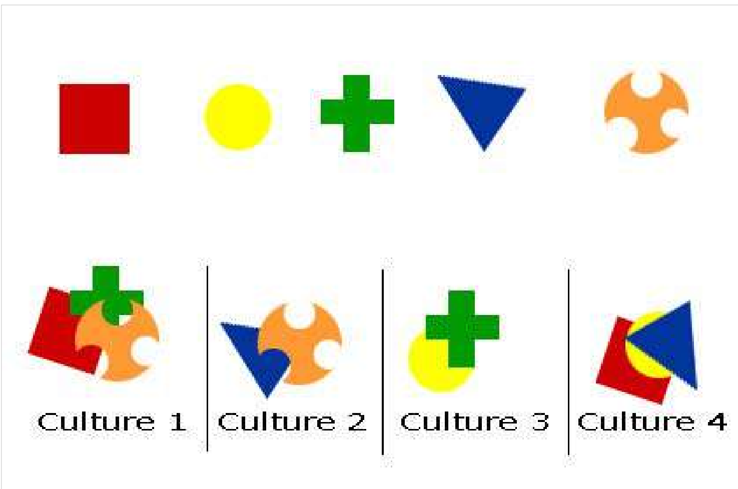
The cultural discussed above and others can used to derive design parameters and content creation. For example, for cultures that polychronic in nature, waiting time may be coupled with some added features of their use which they can keep themselves involved with; like briefly introducing some schemes of commercial benefits offered by the company/website. While the main application/webpage loads, an easily and quickly loadable part of the GUI may have such information displayed as a marquee/scroll/ an animation.

For Indians time does not end with death [3]. Thus they have a more philosophical concept of time. This may be utilized while manipulating the way they are made to wait. They may be served with thought provoking graphics/ texts to ponder upon.

The waiting time in Middle East is controlled by “the will of God”.[3] Thus they are not so aggressively insulted by waiting and are probably passive to it. The HCI designers may very well utilize the fact and serve the user with more elaborate content in a well-planned way.

In Brazil, the waiting time is a function of ‘Importance’. The concept of importance is a subjective issue and may vary with person. It would be wise to take some parameters as inputs from the user to predetermine his priority of importance and manipulate the content during the waiting time accordingly.

Image1: Each cultural trait leads to a design parameter



The solution that is aimed at would look at culture as a blend of some basic human traits. Under this methodology we would like to follow the object oriented approach wherein basic cultural traits would act as determinants for basic classes or categories and a particular permutation/combination would lead us to particular culture. This model allows for more details to be added on and at the same time more varied cultures may find definition. In Fig 1 the basic shapes in top row stand for basic human traits and a combination of these would combine to give a culture they define.

- Ploychronic ‘content’ in culture would lead to wider content in the “Wait time manager” while monochromic nature would necessitate more focused information being provided.
- It is important that users holding high value of time need to be engaged in something they find useful, and not simply something that kills time.
- For Individualistic cultures: It would be a good idea to generate individual user profiles by keeping track of usage history.

Certainly, we are aiming at real-time customization of User interface on internet to minimize the ill-effects of waiting time. There are various ways of collecting parameters for defining user’s cultural profile. To cope with cultural diversity and still ensure optimum performance, a designer needs to know about a wider range of factors that will affect a person’s work and social behavior in a technological environment. This necessitates the concept of ethnographic techniques to be used in content creation.

This may include the IP address tracking of the user and utilizing Client/Server Side dynamic contents, Virtual Documents (Virtual Documents are web documents for which the content, nodes or links, or all three are created as needed) etc. In fact more innovative solutions can be adopted to find out the user's profile and hence produce a suitably customized UI.

4.1 Benefits of dealing with waiting time

The feedback given to the user while he/she is waiting is of utmost importance and can make a lot of difference to the 'apparent' performance of a web site. A number of websites have taken some interesting initiatives which we shall briefly discuss here:

Some of the most common techniques adopted to make waiting time bearable are:

1. Animation in loop to show that process is under way, like document flying from one folder to another or a moving arrow.
2. A "Please wait message".
3. The header, with or without an advertisement may be displayed to engage the user and indicate progress
4. Static part is uploaded first.
5. Images are loaded progressively with slowly increasing resolution
6. Constant update on remaining time/bytes to be downloaded

The next level of more advanced Waiting time management techniques are:

Gmail.com and *Orkut.com* (Google affiliated)

1. Login frame is for 'orkut.com' is different. When the user submits the login and password, only a part of the screen goes blank. The rest of it remains for the user to read. A small red tab in the login frame says- "Loading…"

2. Inbox lists sender and subject of mail and also the first few words of the mail. When the user waits for the mail to open he/she has some idea what the mail is going to be about.

3. All mails in a conversation are linked together. Saves time for searching and opening mails (Pro-active approach)

A gaming site 'cosmos' allows user waiting in queue to join the "battleground" to play time killers such as Connect 4, Tic-Tac-Toe, Othello, Team Minesweeper or Chess.

4.2 waiting time manager

4.2.0 The concept

The Time taken by loading of an application or webpage can be safely predicted. The loading has to be designed to take place in such a way that at the user's end, a parallel GUI is displayed where as the loading takes place in the background. This parallel GUI is critical in terms of its content and time management issues and is the main issues for this paper. In case of WebPages, an easy solution would be to trigger the loading of two WebPages to take place at a single request by the user. One of them being the actual webpage requested by the user and another may be ‘Waiting Time Manager’ webpage, the content for which is the issue in discussion.

For the development of the ‘waiting time manager’ it is assumed that the process of waiting is inevitable and that HCI is a controller of the activities to be carried out by the user during the waiting time:

A better way could be to earmark a portion of the webpage as ‘Waiting Time Manager’ which is automated to estimate the time taken by loading of actually requested content and gets replaced as soon as the actual content loads completely. This could extended to an advanced ‘bottom pane’, universally adopted by websites. **Instead of the usual process bar, a more comprehensive and user specific update or in other words, the ‘waiting time manager’ would deal/engage the waiting user.**

In case of Applications, a more sophisticated solution would be required to manage the waiting time. The content and the containing object in this case would need to be more carefully designed so as to maintain dynamism/change of content so that the user does not get fed up with the same content every time he/she intends to load the application.

4.3 Content control and hazards

While waiting, users are in an impatient state of mind and so they should not have to try hard to understand the content “waiting time manager” presents to them. The waiting time manager content can then be broadly categorized into the text and the graphical mode as per user preference.
We must be careful about relegating users’ perceptual idiosyncrasies and varying cognitive strategies to simple ‘user preferences’ that have no real technical merit. The solution need not present direct connotations or link to a culture but should be able to respond to the psyche of the user.

5 Implementation

It is important to ensure that the time taken to determine the type and content of wait manager is the least possible. Also that it reaches its target users in a fast and efficient manner.

The answer may lie in geographically distributed servers, each server holding data relevant to the region. The geographical location of users can be determined and can be used to broadly derive the cultural background of the user. Geographical location of a computer using a website can be tracked through various technologies. When data is sent or received from a computer on internet, its IP address tells a lot about the geographical location which might be useful to automatically customize the user-interface at first level. Geo-targeting [16] is another significant technology in this regard used to determine the real-world geographic location of a website visitor by tracking its IP address and other factors. A website equipped with Geo-location technology can identify the user’s general location in real-time.

6 Further research:

1. To find out the parameters that defines a specific culture.
2. To develop various ways to enhance the concept of “Waiting Time Manager” by appropriate and optimum technology that does not irritate the user.
3. To develop the relationship between various parameters defining various ‘cultures’ and mapping them to appropriate implications in UI design.
4. Where do we store the culture specific data: sharing ideas that need not be developed by each entity/website.

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HCI in SE Process Literature

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Abstract

The fields of human-computer interaction design (HCI) and software engineering (SE) have evolved independently in the past two decades, apparently almost completely unaware of each other [1]. Over the same period, the importance of the HCI design in software has increased enormously. As software makes its journey from sophisticated scientific equipment of the 1970s to pervasive, almost invisible consumer products of the new millennium that touch the lives of many people, there is a greater need to mingle software engineering with design thinking.

SE literature tends to ignore or give little importance to traditional design methods and techniques in the software development process. There is a tendency to look at the 'user interface design' at only surface and skeletal levels.

This paper reviews and critiques the role of HCI as discussed in two seminal works on SE – Software Engineering – a Practitioner's Approach by Roger Pressman [2] and The Rational Unified Process Made Easy by Per Kroll and Philippe Kruchten [3]. The objective of the critique is to look for opportunities for improving the process and making it integrated across disciplines of HCI and SE so that the overall product quality is improved and the efforts of software development are optimally spent. The paper summarizes areas of concern in the current literature and puts forth ideas for characteristics of a 'truly' unified process.

Introduction

The fields of human-computer interaction design (HCI) and software engineering (SE) have evolved independently in the past two decades, apparently almost completely unaware of each other.

SE evolved largely in the context of the information technology (IT) industry with the objective of developing *'methods and procedures for software development that can scale up for large systems and that can be used to consistently produce high-quality software at low cost and with a small cycle time'* [4].

On the other hand, in the past two decades, the importance of the user interfaces in software has increased enormously. It is estimated that almost half of software in systems being developed today and thirty-seven to fifty percent of efforts throughout the software life cycle are related to the system's user interface [1]. As a result, the importance of user-centred design approaches are gaining ground in the software industry. Practitioners of user-centred design approach argue that the very purpose of developing a software system is to satisfy a human need.

The processes of HCI and SE affect each other deeply. However, there exist major gaps between HCI and SE, both in academic institutions and in the industrial practice.

The standard curricula in reputed universities for either field make little, if any, reference to the other field. Neither field teaches how to work with the other. In the industry, there are significant gaps of communication between the HCI and SE fields: the architectures, processes, methods and vocabulary being used in each community are often foreign to the other [1]. Further, deliverables of one group are not evidently useful to the other and there is an apparent disconnect between the priorities of the two groups. These gaps may lead to communication and coordination problems between team members, duplication of effort, compromises in the process and eventually the output. Somewhere deep down, however, the two fields have a common goal - to deliver high-quality products that have a significant software component.

Here I review of the role of HCI as discussed in two reputed sources of SE literature – the practitioners approach to software engineering by Roger Pressman [2] and the Rational Unified Process by Kruchten and Kroll [3]. The objective is to critique SE process literature from the perspective of HCI design – specifically, HCI design process and its integration with the SE process. The attempt here is to highlight areas of concerns and make some observations on what I consider to be the gaps in the current approach. This paper is based on work done for a PhD seminar [5].

I am mindful that these are not meant to be books on HCI design. In that sense, my review may sound like overly harsh criticism. However, given the popularity and impact of these books on the SE profession and the otherwise excellent, comprehensive coverage of several topics, the gaps result in more harm than good to the cause of well-designed software products.

Areas of Concern in SE Literature

Pressman [2] is a seminal book on software engineering (currently in its sixth edition over two and a half decades) and is valuable, up-to-date reference of current understanding in the field. Though the book reviews several SE processes in vogue, it elaborates much upon the classical ‘waterfall’ model for software development that uses these phases: Communication (initiation, requirements), Planning (estimating, scheduling, tracking), Modelling (analysis, design), Construction (code, test) and Deployment (delivery, support, feedback).

In my opinion, following concerns related to HCI design emerge after a review of Pressman:

1. **Communication with the customer is an unsolved ‘problem’**. Pressman admits this problem upfront: *“Understanding the requirements of a problem is among the most difficult tasks that face a software engineer”* page 174. There is much emphasis of creating unambiguously stated requirements during the Communication phase. The communication with the customer should necessarily be within the limits of the ability of the customer to respond meaningfully. However the language suggested to capture requirements is too difficult for most non-software engineers to follow. Well-documented user study techniques such as contextual inquiry, task analysis, focus groups et al can help multi-disciplinary design teams identify problems and opportunities deeply, in a user-centred manner and within constraints of real-life projects. The main text on ‘Requirements Engineering’ chapter by Pressman makes no reference to such techniques, let alone an attempt at integrating them in the process or demonstrating through case studies. Communication with users

seems to rely solely on questions asked to users in meetings, though it is known that this has problems and is not reliable.

2. Pressman admits that *"some design invariably occurs as part of analysis"* page 209. I would add – **much of HCI design implicitly and unconsciously happens during communication and analysis**. In fact, the use case scenarios and the wire frame UI elements in the chapters on 'Requirements Engineering' and 'Building the Analysis Model' have numerous such examples and a HCI design professional might consider many of them as premature (as user studies were insufficient) and potentially inappropriate. Typically, once something gets written up in a requirements document it gets set in stone and changes, however desirable, become uphill. In my opinion it is appropriate to make HCI design decisions during the Analysis phase as long as they are done explicitly, consciously and after following the appropriate design process and by using the right skills.

3. **Alternatives are not considered before finalizing HCI design.** In design, there can be no absolute 'right' answer and any product can be improved upon. Young designers are encouraged to discard the very first solution that is obvious to them and apply their mind to thinking of alternatives. Envisioning many solutions forces the designer to deliberately think differently. It opens the possibility of combining solutions and coming up with the most appropriate solution. Creating alternatives as a part of the design process is a common practice in almost all design disciplines. Many techniques enable designers to think of multiple solutions before finalizing design. Pressman neither advocates nor demonstrates the importance of considering alternative HCI designs.

4. **HCI is more than skin-deep.** Pressman looks at 'user interface design' at only skeleton and surface planes: *"The blueprint for a house is not complete without a representation of doors, windows and utility connections for water, electricity, and telephone (not to mention cable TV)."* page 356. Pressman seems to ignore the importance and even existence of the structure plane of user experience, and gives much responsibility of the strategy and scope planes to the customer rather than the designer. This surface-led outlook to HCI design is criticised as trying to 'paint lipstick on a bulldog'.

5. **Designers (and not users) need to accept responsibility of design.** Statements by Pressman seem to suggest a tendency to the contrary. For example, *"However other elements of the model may be more volatile, indicating the customer does not yet fully understand the requirements for the system."* page 196 or *"If an organization does not understand how to manage and control software projects internally, it will invariably struggle when it outsources software projects."* page 46. An analogy of the doctor-patient relationship is good to consider while accepting responsibilities of design. The responsibilities of a designer go beyond designing a product that satisfies the customers' needs and should be viewed holistically. The designer should strive to make the product easy to manufacture, easy to use, maintain and discard, and yet safe for all (not just the customers), environmentally sustainable, socially empowering (or at least not disempowering), politically appropriate and other parameters that are relevant. The business / customer may take final calls on these, in the spirit of an 'informed consent' by patients,

but the HCI designer (along with the software architect) needs to ‘make recommendations and give considered opinions’ first.

6. **Pressman largely presents an inward view of design.** Design is a goal-driven, creative, problem-solving process. By this, we don’t mean solving problems of the design process itself. The problem is necessarily external to the design process. Many concerns are related to how can we make sure that we develop software optimally, maintain it well, ensure that it will not crash etc. Few concerns go beyond software development to how we can respond to the external problem at hand. Pressman almost completely ignores cultural, environmental and emotional aspects. Now that interactive artifacts have permeated these aspects have an impact on design of products (including their functional requirements). This inward view probably happens because software engineering is still evolving. As the field matures, it will become important to start looking outward more often than inward.

Rational Unified Process (RUP) is a well-defined, well-structured and widely respected process in the field of software engineering, in addition to being a software development approach and a process product that provides software development teams a customizable process framework. For the purpose of this review, I used Kroll and Kruchten’s book [3] on the RUP.

RUP suggests four phases in software development – Inception, Elaboration, Construction and Transition. Within each phase, there are typically one or more iterations. Key risks are identified and attacked and during an iteration, a working integrated software product is delivered.

I found these aspects of the RUP as positive and potentially amenable towards the integration of HCI design and SE process:

- **RUP stresses on a milestone driven and iterative** approach that builds on successive refinements over iterations. This stresses on rough-before-fair and is a favoured approach among designers – though this approach was not explicitly suggested to consider alternatives (a design approach), but to mitigate risks (a management approach), which may be the same thing in some cases, though not all.
- **RUP advocates flexibility along the ‘ceremony axis’**, which could potentially make it easier for design professionals to contribute to the software development, without the knowledge of complex SE notations that they are not trained to handle and which would not be suitable for HCI design activities.
- RUP has two structures or dimensions. A dynamic structure, or a time-based dimension, and a **competency based structure (the static dimension).** This static dimension recognizes and enables a multi-disciplinary approach to software development and lists nine disciplines along with their expected involvement along the dynamic structure. Unfortunately, at this time the static dimension of the RUP ignores the discipline of HCI design, though it can be easily added.

While some HCI-SE process integration concerns listed in the critique on Pressman's book have been mitigated in the RUP, some remain and a couple of new issues have emerged. In my opinion, following new concerns emerged:

1. **Change management vs. tackling the source of change.** RUP assumes that change in software development is inevitable. By attacking change risks early, the RUP does a good job of managing change. However, there seems little done to understand the cause of change requests in the first place and how to tackle the problem at its root. There is the acknowledgement that understanding what to build is a problem. However, it is not viewed as a creative, design problem but an intra-team communication problem. *"This may sound strange, but the fact is that in many projects there is no common understanding of what needs to be built. Although all team members think they know, often each one has a completely different understanding than the next."* page 96. Here design is not looked upon as an act of 'creating a form from the formless', but essentially an act of bringing everyone on the 'same page'. It is generally assumed that some 'subject matter expert' already knows what needs to be created: *"Typically, the domain and the subject matter experts know what this functionality is from the user perspective."* page 103.
   It seems that RUP underestimates the 'change risk mitigation' afforded by good design practice. In fact, that Kroll and Kruchten seem to warn against the risk of spending too much time on design: *"It should be noted that there is also clear risk that users, UI designers and analysts seek to perfect the UI prototypes, which could lead to analysis-paralysis. Your goal is not to finalize the UI; your goal is to get a reasonably good UI to facilitate effective communication with users on what the system should do, allowing you to finalize the use cases more rapidly."* page 307. Why is 'finalizing use cases rapidly' a better goal, particularly since we know that change is inevitable? And what havoc such 'analysis-paralysis' can cause? These questions are unanswered and there is no hint at the (positive) impact detailed design can have on managing the cause of change.

2. **Usability in Transition – too late.** Kroll and Kruchten note about the Transition phase: *"At this point in the lifecycle, all major structural issues should have been worked out, and user feedback should focus mainly on fine-tuning, configuration, installation, and usability issues."* page 162. Finally, there is a word about user feedback and usability. But why so late in the process? What if usability evaluations throw up issues that impact the software architecture? In fact they do. Experience from the industry suggests that one often runs into deeper-than-skin usability problems that impact all the way up to the project scope and software architecture. John and Bass [6] have identified 27 architecturally sensitive usability issues. Doing usability evaluations early (say during elaboration, perhaps during inception) could certainly mitigate change risks arising out of usability problems that impact software architecture.

In addition, the following continue to be concerns with RUP:

3. Communication with the customer is an unsolved 'problem'

4. HCI design happens during inception and elaboration implicitly, unconsciously

5. Alternatives are not considered before finalizing HCI design

Characteristics of a ‘Truly’ Unified Process

From the review above, the following emerge as characteristics of a process that purports to be ‘truly’ unified. A process should:

- **Integrate and optimize processes of HCI design and SE.** Ensure that HCI design inputs are used early – certainly before designing the user interface, and ideally before freezing on the requirements. Current SE literature seems to call upon HCI inputs quite late in a software project, if at all. Ensure that the integrated process suits the predispositions and working styles of all the professions involved.
- **Communicate with the users in a language that they understand.** Assume that the user can’t completely state requirements explicitly, upfront and in a format suitable for software development. A useful analogy is that of a doctor and a patient – it is OK to ask the patient where it pains and what he ate last night. It is not OK to ask whether he needs appendectomy or colitis treatment. Established user studies techniques such as contextual inquiry, task analysis and focus groups need to be appropriately integrated with gathering requirements for a software product.
- **Recognize that design will happen by default unless worked upon explicitly.** Merely throwing professionals together on a team does not resolve all issues. A multi-disciplinary team comprising of HCI design, business analysis, software architecture and project management skills still needs a common process to work together.
- **Consider alternatives for design elements explicitly.**
- **Consider design as a creative act that solves the external problem**, and not merely a matter of good communication among team members and the user groups.
- **Recognize that client sign-off doesn’t imply that the UI design is acceptable.** This can be revealed only by usability evaluations and iterative improvements. The designed product is largely the responsibility of the designer or the design team from all angles. The role of the client is merely to give his informed consent to the design.
- **Integrate and optimize work products and deliverables across disciplines.** Work products across the disciplines of HCI and SE – personas, actors, scenarios, use cases, affinity, goals, quality attributes, strategy, requirements, wire frames – though interrelated and having significant overlaps don’t, at present, naturally flow from one another leading to duplication of effort and loss of fidelity.

Conclusion

The SE processes have gone through a maturity curve over the past three decades and new approaches are constantly suggested. A ‘truly’ unified process integrating the activities of all disciplines contributing to designing software products is all set to emerge in the next few years. Such an integrated process can not only improve the design quality of the products, it will also optimize on the effort required to build such products. In this paper, I presented some areas of concern in the current SE literature and put forth ideas for characteristics of such a ‘truly’ unified process.

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Why Some People are Addicted to Computer Games

——an analysis of psychological aspects of game players and games

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Abstract

The purpose of this study is to investigate the status of computer game addiction, and the relationship between the addiction and personality. The study also examined, with investigation from game players, what kind of game elements are more important and whether game software usability makes a contribution to game addiction. 471 graduates and undergraduates, who had game experience, from four universities of Beijing were recruited to complete a set of questionnaires. The questionnaires included personal information questionnaire, game addiction disorder questionnaire, 16 personality factor questionnaire, game software elements questionnaire, and game software usability questionnaire. The study found that game addiction score of male students is significantly higher than that of female students. Relationship between game addiction and personality, game elements and game software usability did exist.

1. Introduction

Being a major source of entertainment, computer games have become component of the social lives and leisure activities of young people since 1990 (Chou & Tsai, 2004). Recently, arguments about the positive and negative impacts of computer games have received considerable attention. Some studies found that playing computer games is not as bad as many people thought. Playing games may be associated with positive features of development, since it reflects and contributes to participation in a challenging and stimulating voluntary leisure environment (Durkin & Barber, 2002). If the computers are used correctly, computers can be a positive factor for a child in his physical and social development process. (Hoysniemi et al. 2003). Charlton (2002) stated that computer dependency was pictured in a positive aspect. One of the few negative consequences observed was the negative impact upon educational performance. Leung & Lee (2005) found quality of life can be enhanced if suitable amounts of time are spent on playing games. But they also found heavy use of the Internet and computer, such as playing computer games, may actually degrade quality of life if these technologies were used excessively or used for unhealthy reasons.

Computer game is the result of advanced science and technology. It can bring people to a virtual world. During playing the games, people can get feeling of success and satisfaction. So it is easy for some people to addict into it. Mumtaz (2001) found that children make more use of the computer at home than at school. Playing games was the most popular activity on the home computer, which all children enjoyed. Word processing which pupils considered boring was the most frequent activity on the school computer. Chou & Hsiao (2000) found that internet addicts spent a lot of time on games. Qingxin Shi et al (2005) also found that students who using computers most frequently were for computer games.

With game addiction increased fast, it brings more psychological obstacle. People who play computer games excessively will damage their social and psychological function significantly. Therefore, it is meaningful to conduct research on game addiction.

Griffiths proposed four theoretical accounts adapted from McIlwraith's work on television addiction to expatiate on computer game addiction (Griffiths & Dancaster, 1995). These are:"

1. Computer game addiction is a function of the computer game's effects on imagination and fantasy life, i.e., people who play computer games to excess have poor imaginations;
2. Computer game addiction is a function of the computer game's effects on arousal level, i.e., people who play computer games to excess do so for either its arousing or its tranquilizing effects;
3. Computer game addiction is a manifestation of oral, dependent, or addictive personality, i.e., people who play computer games to excess do so due to their inner personality as opposed to the external source of the addiction;
4. Computer game addiction is a distinct pattern of uses and gratifications associated with the computer game medium, i.e., people who play computer games to excess enjoy the physical act of playing or play only when they are bored, etc."

From the above, we can see that computer game addiction is related to people's state or personality. There are also some researches on game addiction and personality. Yang & Tung (2004) contended that students had a high tendency to become addicted for those who have personalities characterized by dependence, shyness, depression and low self-esteem. Dominick found that it was not necessarily for heavy teenage video game players to be more aggressive, but they did have lower self-esteem (see Clippinger, 2002). Griffiths and Dancaster (1995) found that greater psychological reaction are experienced by individuals with Type A personality when they are response to the psychologically stimulating caused by computer games. The results suggested that in order to feel the psychological stimulation, Type A individuals might be more susceptible to computer-game addiction. Lin & Tsai (2002) argued that while playing computer games, players become aroused and perhaps for seeking this arousal they may be more likely to play games again. Armstrong et al's (2000) findings illustrated that heavier computer users were not so much stimulus seeking, but have a poorer self-esteem. Sanger et al. argued that children, especially boys with low self-esteem and confidence, enjoy playing computer games because playing computer games will allows them to have a sense of control, operate as experts, gain respect from others. (see Chou & Tsai, 2004).

Besides, addiction may be not only related to personality but also related to the characteristic of game software itself. Griffiths lists a number of potential factors that people could be addicted to: the act of typing; the medium of communication; the absence of face-to-face interaction; the information obtainable; the activities available (see Armstrong et al., 2000).

In M.D. Griffiths et al's (2004) research, they investigated players' favorite features of playing an online game. The results showed that the favorite features were: (1) playing for social reasons (e.g. social contact with others, being able to assist others, being a Guild member etc.); (2) enjoyment of violence (e.g. hand-to-hand combat, player versus player options etc.); (3) being able to play alone (i.e. soloing); (4) game-specific features (e.g. character role-play, casting magic, no end to the game etc.); and (5) other features (e.g. exploring, strategic thinking, character building etc.). Results also showed that significantly more adolescents who specifically state that violence are their favorite aspect of game play. Competition is also a foundational element in games (Williams & Clippinger, 2002).

In our study, we worked out a computer game elements questionnaire through interviewing game players and literature and investigated the relationship between it and game addiction in order to see what elements or features of computer games attracted game players.

Moreover, this study also investigated the relationship between game software usability and game addiction to see whether game software usability will have impact on game addiction. Usability is one of the important quality characteristics of software systems and products (Jokela, 2004). Usable systems are easy to learn, efficient to use, not error-prone, and satisfactory in use (Nielsen, 1993). Game software with good usability may be more attractive for game players.

There are some researches about game software usability. User interface is what connects the computer with the user, which is the means of interaction between the two. Locus considered "the design of the interface must provide a representation of clear, consistent and attractive communications, since the quality of the interface contributes towards the ability of the user to reach excellence" (see Passig & Levin, 1999).

The present study addressed the basic demographic information of computer game addiction, and the relationship between the addiction and personality. The study also examined, with investigation from game players, what kind of game features or elements are more important and whether game software usability makes a contribution to game addiction.

2. Methods

Participants 471 students who had game experience were recruited from four universities of Beijing. The reliable questionnaires were 464 copies, among which 267 copies were done by undergraduate students and 187 copies were done by graduate students.

Method We used quasi-structure interview and interviewed two game players and one game designer who was also a game player. From the interview, we got a lot of important information about games and game players. For example, we got information about the brief history of game developments, the types of current games and the characteristic of different kinds of games, and differences between boys' preference games and girls', and so on. Then, based on the interview, we searched some related information from the Internet. According to all the information we got, we worked out some questionnaires. They are personal information questionnaire, game software elements questionnaire, game software usability questionnaire. Besides, we also used game addiction disorder questionnaire and 16 personality factor questionnaire. All the participants should complete all the five questionnaires.

1. Questionnaire of subjects' demographic information

11 items were included in this questionnaire. The items were aiming at getting the information of gender, grade and major of the participants and the information about playing games. For example, the items include whether have their own computer, the frequency of using computer (everyday, three to four times a week, seldom), main use of computer (study, playing games, watching videos, surfing internet and chatting), the frequency of playing computer games (everyday, once in two days, only weekend, hard to say), time spent on games per week (above 20 hours, 10-20 hours, 5-10 hours, 2-5 hours, seldom play), ratio of the time spent on playing games to free time (all the

free time, 4/5 of the free time, 1/2 of the free time, 1/5 of the free time, seldom play), the level of playing computer games (advanced, upper medium, medium, beginner), the most frequency game that the person play.

2. Questionnaire of Game Addiction Disorder

Game addiction questionnaire was made according to the Internet Addiction Test (Kimberly Young). The questionnaire consists of 19 items on which participants rate themselves on a 5- point Likert scale, ranging from *seldom(1)* to *always(5)*. The reliability coefficient-Alpha coefficient is 0.9004. The score of a subject was the sum of the rating of all 19 items. The higher the score of the addiction scale, the more severe addiction the subjects may be. Those whose plus rating range from 19 to 47 were considered as normal game player, from 48 to 76 were slight game addict, and from 77 to 95 were severe game addict. There are some items in the questionnaire, for example, how often do you find that you play games longer than you intended? How often do you neglect household chores to spend more time playing games? How often do others in your life complain to you about the amount of time you spend playing games? How often do your grades or school work suffers because of the amount of time you spend playing games? How often do you become defensive or secretive when anyone asks you what do you do? How often do you find yourself anticipating when you will play games again?……

3. Sixteen Personality Factor Questionnaire

The 16PF Questionnaire is a self-report assessment instrument that measures the sixteen normal adult personality dimensions discovered by Dr. Cattell in his landmark research. In 1949, Raymond Cattell published the first edition of the 16PF Questionnaire - the 16 Personality Factor Questionnaire. It was a revolutionary concept: measuring the whole of human personality using structure discovered through factor analysis. From client responses to the questionnaire, standardized scores are derived for each of the sixteen personality factors. Using dimensions discovered through factor analysis, the 16PF Questionnaire assesses the whole domain of human personality. It measures levels of: Warmth (A), Emotional Stability (C), Liveliness (F), Reasoning (B), Dominance (E), Rule-Consciousness (G), Social Boldness (H), Vigilance (L), Sensitivity (I), Abstractedness (M), Privateness (N), Openness to Change (Q1), Apprehension (O), Self-Reliance

(Q2), Perfectionism (Q3), Tension (Q4) (see the appendix of the explanation of 16 personality factors). A subject's raw score for each of the 16 primary factors is obtained through a weighted procedure where particular responses count as "1" or "2" summated toward the final raw score.

4. Questionnaire of Game Software Elements

The questionnaire consists of 69 items on which participants rate the importance of computer game elements on a 5- point Likert scale, ranging from *not important at all (1)* to *very important(5)*. We used the explore factor analysis (principal component, and direct oblimin) method to analyze the data, and got 19 dimensions. These factors extracted are satisfying with our construct to some extent. According to the content analysis, six items were deleted, some items are distributed to other dimension and others remained in the original dimensions. At last, we got 14 dimensions which are listed in the following table 1. The reliability test of this questionnaire shows, overall alpha coefficient is 0.932. The following table 1 also shows the reliability of each dimension.

Table 1 Game Software Element Dimensions and its Reliability

Element Dimensions	Alpha coefficient	Number of items	Description and Explanation
Theme of games（G1）	.483	3	importance of game's theme, style and task
Fidelity（G2）	.723	4	scene, action weapon and so on like the real world's
Story scenario and background（G3）	.779	2	importance of game's cultural background and story scenario
Beauty and appreciation（G4）	.785	7	it includes the degree of delicacy of music and the pictures, and so on
Interaction and competition（G5）	.807	11	it includes interaction and competition with other players
Feeling and affection（G6）	.683	2	players can get the feeling of love from virtual parents, friends and lovers
Risk and excitement（G7）	.702	2	Players can explore and take a risk in the game
Free creation（G8）	.767	5	players can create the scenes, tools and equipments
Promotion and power（G9）	.758	6	players can get more power and

			promotion when they did well
Skill presentation and use (G10)	.732	5	players can present their ability in these games
Sense of achievement (G11)	.725	2	game can bring players sense of achievement
Interface display (G12)	.815	6	it includes multimedia displays
Physical control (G13)	.744	5	it includes control of mouse, keyboard, and so on
Feedback (G14)	.755	3	the feedback that players got from the game software, and feedback's style

Note: Although there are only two items in G3, G6, G7, G11, considering the four dimensions are all very important factors of game elements, so we kept them.

5 Questionnaire of Game Software Usability

A professional assessment questionnaire was translated, and only some items were selected to form this part of questionnaire. The questionnaire consists of 35 items on which participants rate the importance of computer game software usability items on a 5- point Likert scale, ranging from *not important at all (1)* to *very important(5)*. We used the explore factor analysis (principal component, and direct oblimin) to analyze the data, and got seven dimensions. We got 7 dimensions which are listed in the following table 2. The reliability test of this part shows overall alpha coefficient is 0.928. The following table 2 also shows the reliability of each dimension.

Table 2 Game Software Usability and its Reliability

Usability dimensions	Alpha Coefficients	Number of items	Description and explanation
Expression of Interface and Help information (S1)	.811	6	explanation or expression of the function or menus
Suitable for Individualization (S2)	.779	7	Players can define or set something according to their play habit or their needs by themselves.
Error Tolerance (S3)	.846	7	The system can detect the errors and remind the players to correct them in time
Feedback (S4)	.646	3	Feedback from the game software
Consistent or Conformity to User Expectations (S5)	.744	5	It also includes the consistency in the same game
Easy to Learn (S6)	.625	3	It is easy to see the function's

			meaning and easy to use.
Agility（S7）	.747	3	Players can choose several kinds of manners to complete the game, and they can shift conveniently

All participants answered the questionnaire namelessly. Spss 10.0 was used as the statistics analysis tool.

3. Results

1. Statistic description of Game addiction

Based on the score criteria of the questionnaire, there are 25.54% of the subjects have internet addiction, among which 0.87% of the subjects suffer serious game addiction (i.e. with scores above 77 points) while 24.67% of the subjects have slightly addiction. The reason that the figure is higher than a lot of previous studies may be because that only those with game experience were required to attend the test when we recruited the subjects. Therefore, the result would be only to represent the percentage of the addiction people in the experienced game players rather than the percentage for all the students.

The mean and standard deviation of the addiction scores in the games on the questionnaire of subjects' demographic information see table 3.

Table 3 The mean, standard deviation and discrepancy test of the addiction scores in the games

Personal information items		Mean	Std. Deviation	t/F	Sig.
Gender	male	42.04	12.82	4.13**	0.000
	female	37.30	11.20		
Grade	undergraduate students	37.34	11.22	5.19**	0.000
	graduate students	43.44	13.07		
Whether have their own computer	have computer	41.06	12.79	3.37**	0.001
	have no computer	37.12	10.79		
Major	arts	36.55	11.86	13.82**	0.000
	science	42.00	13.86		
	technology	42.64	11.88		
Frequency of using	everyday	41.64	12.73	14.84**	0.000

computers	three to four times a week	39.57	11.86		
	seldom	32.54	8.25		
Main use of computer	study	38.20	11.33	16.25**	0.000
	playing computer games	49.42	13.18		
	watching videos	39.41	12.97		
	surfing internet	37.41	11.26		
	chatting	37.74	9.82		
Frequency of playing computer games	everyday	49.87	13.70	23.41**	0.000
	once in two days	45.21	11.01		
	only weekend	38.84	10.77		
	hard to say	37.05	11.34		
time spent on games per week	above 20 hours	55.29	16.19	37.94**	0.000
	10-20 hours	47.80	11.70		
	5-10 hours	42.54	10.11		
	2-5 hours	39.07	10.40		
	seldom play	32.50	9.96		
Ratio of the time spent on playing games to free time	all the free time	63.50	20.59	39.84**	0.000
	4/5 of the free time	50.67	10.85		
	1/2 of the free time	49.36	11.26		
	1/5 of the free time	38.56	10.46		
	seldom play	30.77	9.73		
Level of playing computer games	advanced	43.10	8.04	18.44**	0.000
	upper medium	43.67	14.75		
	medium	43.06	11.76		
	beginner	34.79	10.83		
The most frequency game that the person play	RPG(Role playing Game)	41.73	12.84	4.38**	0.000
	ACT(Action Game)	40.08	8.46		
	AVG(Adventure Game)	45.12	11.88		
	SLG(Strategy Game)	39.54	9.75		
	RTS(Real Time Strategy Game)	42.76	14.16		
	FGT(Fighting Game)	40.71	10.39		
	STG(Shooting Game)	42.86	13.33		
	PZL(Puzzle Game)	36.93	11.32		
	RCG(Racing Game)	32.60	8.45		
	SPT(Sports Game)	40.94	11.90		
	CAG(Card Game)	42.80	9.48		
	TAB(Table Game)	30.08	7.78		
	Cybergame (online game)	47.69	11.36		

Note: ** The mean difference is significant at the 0.01 level.

Table 3 shows that the game addiction scores in each item are all significant. The game addiction score of male students is significantly higher that that of female students. (t=4.13, p=0.000).

Graduate students are more susceptible to be attracted to computer games than undergraduate students (t=5.19, p=0.000). Students who have their own computer are more easily inclined into game addiction than those who have no computer （t=3.37,p=0.001）.

Result made by one-way ANOVA toward the game addiction scores of all the other items on the personal information questionnaire showed in table3 that the game addiction scores are all highly significant to each item as above. Further multiple comparisons shows below.

A. Multiple comparisons results of the students majoring in Arts, Science and Engineering, see table 4.

Table 4 Multiple comparisons results of the students majoring in Arts, Science and engineering.

Major		Mean Difference	Std. Error	Sig.
arts	science	-5.45*	2.28	0.017
	engineering	-6.09**	1.18	0.000
science	arts	5.45*	2.28	0.017
	engineering	-0.64	2.28	0.778
engineering	arts	6.09**	1.18	0.000
	science	0.64	2.28	0.778

Note: ** The mean difference is significant at the 0.01 level; * the mean difference is significant at the 0.05 level.

From table 4, the game addiction score of the student majoring in arts is significantly lower than that of the students majoring in science or engineering.

B. Multiple comparison on the frequency of using the computer, see table 5.

Table 5 Multiple comparison on the frequency of using the computer

Frequency of using computers		Mean Difference	Std. Error	Sig.
everyday	three to four times a week	2.07	1.49	0.164
	seldom	9.10**	1.62	0.000
three to four	everyday	-2.07	1.49	0.164

times a week	seldom	7.03**	1.97	0.000
seldom	everyday	-9.10**	1.62	0.000
	three to four times a week	-7.03**	1.97	0.000

Note: ** The mean difference is significant at the 0.01 level.

From table 5, the game addiction scores of the person who seldom uses computer is significantly lower than that of the person who uses computer frequently.

C. Multiple comparison of the different use of the computer, see table 6.

Table 6 Multiple comparison of the different use of the computer

Main use of computer		Mean Difference	Std. Error	Sig.
study	playing computer games	-11.21**	1.57	0.000
	watching videos	-1.21	2.95	0.682
	surfing internet	0.80	1.29	0.537
	chatting	0.46	2.15	0.830
playing computer games	study	11.21**	1.57	0.000
	watching videos	10.01**	3.10	0.001
	surfing internet	12.01**	1.62	0.000
	chatting	11.67**	2.36	0.000
watching videos	study	1.21	2.95	0.682
	playing computer games	-10.01**	3.10	0.001
	surfing internet	2.01	2.97	0.500
	chatting	1.67	3.43	0.627
surfing internet	study	-0.80	1.29	0.537
	playing computer games	-12.01**	1.62	0.000
	watching videos	-2.01	2.97	0.500
	chatting	-0.34	2.18	0.877
chatting	study	-0.46	2.15	0.830
	playing computer games	-11.67**	2.36	0.000

watching videos	-1.67	3.43	0.627
surfing internet	0.34	2.18	0.877

Note: ** The mean difference is significant at the 0.01 level

Table 6 shows that it is significant higher score for those persons who use the computer to play game.

D. Multiple comparison on the frequency of playing games, see table 7.

Table 7: Multiple comparison on the frequency of playing games.

Frequency of playing computer games		Mean Difference	Std. Error	Sig.
everyday	once in two days	4.67	2.45	0.058
	only weekend	11.04**	1.80	0.000
	hard to say	12.83**	1.63	0.000
once in two days	everyday	-4.67	2.45	0.058
	only weekend	6.37**	2.25	0.005
	hard to say	8.16**	2.11	0.000
only weekend	everyday	-11.04**	1.80	0.000
	once in two days	-6.37**	2.25	0.005
	hard to say	1.79	1.30	0.168
hard to say	everyday	-12.83**	1.63	0.000
	once in two days	-8.16**	2.11	0.000
	only weekend	-1.79	1.30	0.168

Note: ** The mean difference is significant at the 0.01 level.

Table 7 shows that addiction score of those who play game only in weekend is significantly lower than that of those who play game everyday or once in two days.

E. Multiple comparison on the time spent on game per week, see table 8.

Table 8: Multiple comparison on the time spent on game per week.

Time spent on games per week	Mean Difference	Std. Error	Sig.

above 20 hours	10-20 hours	7.49**	2.68	0.005
	5-10 hours	12.75**	2.60	0.000
	2-5 hours	16.21**	2.52	0.000
	seldom play	22.78**	2.52	0.000
10-20 hours	above 20 hours	-7.49**	2.68	0.005
	5-10 hours	5.26**	1.71	0.002
	2-5 hours	8.72**	1.59	0.000
	seldom play	15.29**	1.59	0.000
5-10 hours	above 20 hours	-12.75**	2.60	0.000
	10-20 hours	-5.26**	1.71	0.002
	2-5 hours	3.46*	1.45	0.017
	seldom play	10.03**	1.44	0.000
2-5 hours	above 20 hours	-16.21**	2.52	0.000
	10-20 hours	-8.72**	1.59	0.000
	5-10 hours	-3.46*	1.45	0.017
	seldom play	6.57**	1.30	0.000
seldom play	above 20 hours	-22.78**	2.52	0.000
	10-20 hours	-15.29**	1.59	0.000
	5-10 hours	-10.03**	1.44	0.000
	2-5 hours	-6.57**	1.30	0.000

Note: ** The mean difference is significant at the 0.01 level; * the mean difference is significant at the 0.05 level.

Table 8 shows that the longer the time spent in the game every week, the higher the addiction score is.

F. Multiple comparison of ratio of the time spent in game to free time, see table 9.

Table 9 Multiple comparison of ratio of the time spent in game to free time.

Ratio of the time spent on playing games to free time		Mean Difference	Std. Error	Sig.
all the free time	4/5 of the free time	12.83*	5.16	0.013

	1/2 of the free time	14.14**	4.53	0.002
	1/5 of the free time	24.94**	4.40	0.000
	seldom play	32.73**	4.54	0.000
4/5 of the free time	all the free time	-12.83*	5.16	0.013
	1/2 of the free time	1.31	3.02	0.664
	1/5 of the free time	12.11**	2.83	0.000
	seldom play	19.90**	3.04	0.000
1/2 of the free time	all the free time	-14.14**	4.53	0.002
	4/5 of the free time	-1.31	3.02	0.664
	1/5 of the free time	10.80**	1.38	0.000
	seldom play	18.59**	1.77	0.000
1/5 of the free time	all the free time	-24.94**	4.40	0.000
	4/5 of the free time	-12.11**	2.83	0.000
	1/2 of the free time	-10.80**	1.38	0.000
	seldom play	7.79**	1.43	0.000
seldom play	all the free time	-32.73**	4.54	0.000
	4/5 of the free time	-19.90**	3.04	0.000
	1/2 of the free time	-18.59**	1.77	0.000
	1/5 of the free time	-7.79**	1.43	0.000

Note: ** The mean difference is significant at the 0.01 level; * the mean difference is significant at the 0.05 level.

Table 9 shows that the higher ratio of the time spent in the game to free time, the higher addiction score will be. But there is no difference between 4 and 5 and between 1 and 2, respectively.

G. Multiple comparison on the level of playing games, see table 10.

Table 10 Multiple comparison on the level of playing games

Level of playing computer games		Mean Difference	Std. Error	Sig.
advanced	upper medium	-0.58	2.97	0.846
	medium	0.04	2.69	0.988

	beginner	8.30**	2.71	0.002
upper medium	advanced	0.58	2.97	0.846
	medium	0.62	1.72	0.720
	beginner	8.88**	1.74	0.000
medium	advanced	-0.04	2.69	0.988
	upper medium	-0.62	1.72	0.720
	beginner	8.26**	1.22	0.000
beginner	advanced	-8.30**	2.71	0.002
	upper medium	-8.88**	1.74	0.000
	medium	-8.26**	1.22	0.000

Note: ** The mean difference is significant at the 0.01 level.

Table 10 shows that the addiction grade of the beginner is significantly lower than that of other level players.

H. Multiple comparison on the type of the games, see table 11.

Table 11 Multiple comparison on the type of the games

Most favorite game		Mean Difference	Std. Error	Sig.
RPG	PZL	4.80*	1.84	0.010
	RCG	9.13*	4.00	0.023
	TAB	11.64**	2.79	0.000
ACT	TAB	10.00*	4.19	0.018
AVG	PZL	8.19**	2.21	0.000
	RCG	12.52**	4.18	0.003
	TAB	15.04**	3.05	0.000
SLG	TAB	9.45**	3.30	0.004
	Cybergame	-8.16*	3.98	0.041
RTS	PZL	5.84**	2.01	0.004
	RCG	10.16*	4.08	0.013

	TAB	12.68**	2.90	0.000
FGT	TAB	10.63*	5.10	0.038
STG	PZL	5.93*	2.08	0.005
	RCG	10.26*	4.12	0.013
	TAB	12.77**	2.96	0.000
PZL	RPG	-4.80*	1.84	0.010
	AVG	-8.19**	2.21	0.000
	RTS	-5.84**	2.01	0.004
	STG	-5.93*	2.08	0.005
	TAB	6.84*	2.71	0.012
	Cybergame	-10.77**	3.51	0.002
RCG	RPG	-9.13*	4.00	0.023
	AVG	-12.52**	4.18	0.003
	RTS	-10.16*	4.08	0.013
	STG	-10.26*	4.12	0.013
	Cybergame	-15.09**	4.99	0.003
SPT	TAB	10.86**	3.76	0.004
CAG	TAB	12.72*	4.47	0.005
TAB	RPG	-11.64**	2.79	0.000
	ACT	-10.00*	4.19	0.018
	AVG	-15.04**	3.05	0.000
	SLG	-9.45**	3.30	0.004
	RTS	-12.68**	2.90	0.000
	FGT	-10.63*	5.10	0.038
	STG	-12.77**	2.96	0.000
	PZL	-6.84*	2.71	0.012
	SPT	-10.86**	3.76	0.004
	CAG	-12.72*	4.47	0.005
	Cybergame	-17.61**	4.09	0.000

Cybergame	SLG	8.16*	3.98	0.041
	PZL	10.77**	3.51	0.002
	RCG	15.09**	4.99	0.003
	TAB	17.61**	4.09	0.000

Note: ** The mean difference is significant at the 0.01 level; * the mean difference is significant at the 0.05 level.

Table 11 shows that there is a high relationship between the most favorite game type and the addiction score. Results from multiple comparison show that the addiction scores of those whose most favorite game is TAB are significantly lower than that of others. The addiction degree of those who frequently play RPG, AVG, RTS, STG is significantly higher than that of those who often play RCG or PZL.

2. Relationship between Game Addiction Disorder and Personality

Table 12 Pearson correlation between Game Addiction Disorder and Sixteen Personality Factors

16 Personality Factors	Game addiction	
	Pearson Correlation	Sig.
Warmth (A)	-0.18**	0.000
Emotional Stability (C)	-0.19**	0.000
Liveliness (F)	-0.03	0.563
Reasoning (B)	-0.04	0.357
Dominance (E)	0.13**	0.007
Rule-Consciousness (G)	-0.20**	0.000
Social Boldness (H)	-0.07	0.161
Vigilance (L)	0.20**	0.000
Sensitivity (I)	-0.09	0.068
Abstractedness (M)	-0.04	0.378
Privateness (N)	0.08	0.076
Openness to Change (Q1)	0.01	0.883
Apprehension (O)	0.12*	0.011

Self-Reliance (Q2)	0.04	0.421
Perfectionism (Q3)	-0.21**	0.000
Tension (Q4)	0.21**	0.000

Note: ** correlation is significant at the 0.01 level; * correlation is significant at the 0.05 level.

Table 12 shows that the score of game addiction is negatively correlated to the score of warmth, emotional stability, rule-consciousness and perfectionism. It also shows that the score of game addiction is positively correlated to the score of dominance, vigilance, apprehension and tension. And the score of game addiction have no distinct correlation with other personality factors.

3. Relationship between Addiction and Game software element

Pearson correlation between game addition score and the score of each game software element and its test are shown in following table 13 respectively.

Table 13 correlation and its test between addiction and element

G1	G2	G3	G4	G5	G6	G7
.187**	.300**	.040	.107*	.275**	-.030	.080

G8	G9	G10	G11	G12	G13	G14
.138**	.199**	.170**	.264**	.070	.095*	.050

Note: ** correlation is significant at the 0.01 level;
* correlation is significant at the 0.05 level.

From the table above, we found that some elements were significantly correlated with computer game addiction. It meant the more addictive game player is, the more important these elements are. These elements include the Theme of games（G1）, fidelity（G2）, beauty and appreciation（G4）, interaction and competition（G5）, free creation（G8）,promotion and power（G9）, skill presentation and use （G10） , sense of achievement （G11） , physical control （G13） .

4. Relationship between Addiction and Game software usability

Pearson correlation between game addition score and the score of each game software usability dimension and its test are showed in following table 14 respectively.

Table 14 Correlation test between addiction and usability

S1	S2	S3	S4	S5	S6	S7
.113*	.206**	.041	.080	.097*	.059	.013

Note: ** correlation is significant at the 0.01 level;

* correlation is significant at the 0.05 level.

With the table above, we found that these usability dimensions are significantly correlated with computer game addiction. It means the more addictive game player is, the more important these usability dimensions are. These usability dimensions include Expression of Interface and Help information (S1), Suitable for Individualization (S2), Consistent or Consistent or Conformity to User Expectations (S5).

4. Discussion

The findings of the present study did provide some interesting results. We could see among people who played games, there were 25.54% of them were game addicts. The percentage is so high. Many people are easier to be attracted by computer games. Once they began to play, they might have 25.54% chance to addict into it. Some of them even have serious game addiction. But we can also see the addiction also depends on many factors. The fact is not people who play games will all addict into it. It depends on the players and the games themselves.

We have assumed that differences would be found among boys and girls in playing games. It confirmed the results of other studies that males were more susceptible to computer games (HO & LEE (2001); Li & Kirkup (2005); Colley (2003); Passig & Levin (1999); Quaiser-Pohl et al., 2006). In Chou & Tsai's (2004) study, they found that male students played computer games significantly more frequently and spent significantly more time per week than female students did. Sanger et al. suggest one possible reason for these differences: boys, on average, perform better than girls at tasks requiring visual－spatial skills. Such skills are essential when the player must demonstrate high levels of hand－eye coordination and make rapid judgments about spatial relationships. Besides, the aggressive content of game software, which is aimed more at boys than at girls, may be another factor responsible for the phenomena (see Chou & Tsai, 2004).

The result also showed that the addiction score of graduate students is higher than that of undergraduate students. The reason may be that in China most graduate students have their own computers. Our result already showed that students who have their own computer were more easily inclined into game addiction than those who have no computer. Besides, most of the graduate students that we recruited were majored in science and technology. But most of the undergraduate students that came to our research were majored in arts (see table 15). Our results have already showed that the game addiction score of the students majoring in arts is significantly lower than that of the students majoring in science or engineering. So there may be some sampling issues.

Table 15 grade and major

		undergraduates	graduates
major	Arts	208	19
	science	15	17
	technology	47	158

We can conclude from the results that the more you contact with computers or playing computer games, the higher the game addiction score is. The result is similar to previous studies. In Charlton & Danforth's (2005) research, they found that addicts played computer games for a greater amount of time than those who are highly engaged. Shotton argued that dependent computer program users spent more hours per week using the computer, and had difficulty controlling their amount of computer use (see Armstrong et al., 2000).

Moreover, people who are just in the beginner level of playing computer games are not addicts. They may not like to play computer games very much, so they play it unusual, which in turn makes them just in a beginner level.

There is an interesting finding that whether someone is inclined into game addiction is also related to the game type which he or she always plays. Role playing game, action game, adventure game, strategy game, real time strategy game, fighting game, shooting game and online game are more attractive. On the other hand, puzzle game, racing game and table game did not easily get people addicted into it. Most people just play them for killing time. Further Chi-Square test conducted between game Type and gender revealed that there was significant difference of frequencies for game type between male and female($X2= 121.40$，$P < 0.01$),see table 16. A further Analysis found that male prefers action game, real-time strategy game, shooting game and sports game, while female prefers role playing game, puzzle game and table game. No significant difference was found for the other game types. Puzzle game and table game are small games, which have no apparent scenario. So they are not easily for people to addict into, since it may just for people to escape from routines, or to escape from loneliness, or to fill time.

Table 16 Frequencies comparison between Male and Female for Game Type

Game Type	X^2	P	Frequencies comparison between Male and Female
RPG	3.35*	0.067	F > M
ACT	3.50*	0.062	M > F
AVG	2.13	0.144	No significant difference
SLG	2.55	0.110	No significant difference
RTS	44.55**	0.000	M > F
STG	8.33**	0.004	M > F
PZL	59.47**	0.000	F > M
RCG	0.611	0.434	No significant difference
SPT	9.952**	0.002	M > F
CAG	1.204	0.273	No significant difference
TAB	7.75**	0.005	F > M
CBG	0.054	0.817	No significant difference

Note: ** X^2 is significant at the 0.01 level; * X^2 is significant at the 0.05 level.

This result is not exactly as Chou & Tsai’s (2004). In their study, they found that game types that male subjects played most frequently are role-playing games, followed by strategy games, action games, sports games and so on. The least frequent game types include adventure and simulation. For female subjects, the most frequently played are puzzle games, followed by action games and role-playing games. The least frequent game types played by females include simulation and sports games.

Certain relationship between game addiction and personality did exist. Personality of Warmth, Emotional Stability, Rule-Consciousness and Perfectionism were negative correlated to the scores of game addiction. Dominance, Vigilance, Apprehension and Tension were positive correlated to the scores of game addiction. Please see the appendix of the explanation of 16 personality factors. People who are more susceptible to computer games are more like those who may not like to be too close to others, reactive, easily upset, temperamental, unorganized, or unprepared. They may not worry about conventions, obligations, or following rules and regulations. They may tend to be assertive, forceful, competitive, vigilant, suspicious, distrustful, self-doubting and impatient.

We will analyze some of the personality characteristics of addicts. First, they like to have distance with others. This result is not the same as the finding of Chous & Tsai's (2004) research. They found that students, especially male students, believed game playing to have a positive effect on their friendships. The reason of the difference may be that computer games may help people who play games but not addicts to develop better interpersonal relationship or promote their interaction with friends. In our study, all the subjects are game players. Only those with higher game addiction score have the lower personality of warmth. Ho and Lee (2001) found that boys who use computers to play games tend to be more social-behaviorally inactive. Kraut et al thought excessive computer usage may lead to social withdrawal and decline in psychological well-being (see Ho & Lee, 2001). Shotton also thought dependent computer program users were generally less social than their peers (see Armstrong et al., 2000).

Second, game addicts may not like following rules and regulations. In the real world, there are many rules that we have to follow. Game players can choose the computer game with the rules they really like and live happily in the virtual world. Third, game addicts are inclined to like competition and dominance. In order to be the best in the game, they spend a lot time on it and practice a lot.

Besides, there are also many negative personalities in game addicts. Lin & Tsai (2002) used the personality study about TV addicts to provide a broader view on Internet abuse or misuse. We can also use it to help us understand game addiction. In Lin & Tsai's (2002) study they wrote:"

Mcllwraith reported that adult self-labeled TV addicts tend to be more neurotic, introverted, and easily feel bored. They are more likely using TV to distract themselves from unpleasant thoughts, regulate moods, and fill time". Dependent game players may also use the computer game as an escape to the real world and negative feelings.

Results also showed that game some elements or features were significantly correlated with game addiction. It meant game players attached importance to the game elements of game theme, fidelity, beauty and appreciation, interaction and competition, free creation, promotion and power, skill presentation and use, sense of achievement and physical control. If a computer game has all these elements or features, it will be very attractive to many game players and will make people easier to addict into. Take the game element of interaction and competition as an example. Many addicts like competing with others and also want to know others' performance or experience during play. From the personality analysis we can see that addicts like competition. So if the game can satisfy people with such a characteristic, it will be popular.

Actually, personality and game's elements or features are not separated. Just because of computer games' specific features or elements which can satisfy people's feelings can make them spend a lot of time on it, even addict into. People who want to be stronger might be attracted by the element of promotion and power in games. Some people hope to get the feeling of success, but in the reality world, they may not get it. So they may look for it from the games to help them get the sense of achievement. Some people use games as a tool for them to realize their dream, so they attach importance to the game element of free creation which allows them to create something based on their wishes. Other elements like fidelity, beauty and appreciation, physical control are all related to the quality or aesthetic feeling of the game's pictures, music or physical equipment. Of course, the more vivid of the game, the more attractive it is. In a paper wrote by Wolfson & Case (2000) said "sound and color might influence responses to computer games. Stimuli such as bells, sirens, gongs, flashing lights and dramatic hues during a game can increase aesthetic satisfaction, provide feedback to the player, act as a reward for continued participation, and signify to bystanders that the player has achieved a success".

Game software usability also makes a contribution to game addiction. Usability dimensions of Expression of Interface and Help information (S1), Suitable for Individualization (S2), Consistent or Conformity to User Expectations (S5) are all important for computer game addicts. When the explanation or expression of the function or menus is clear, players will be easy to understand it, which is very helpful for them to like the game, because if they can't understand the meaning, they may not have patience to try the functions, not to mention addiction. In other study, Edwards and Holland (1994) also emphasized the ease of use and uniformity of the interface (see Passig & Levin, 1999).

In conclusion, the study was motivated by the tremendous increase in popularity of computer games in China. Playing computer games has some positive impact, for example, it is an important leisure activity for many young people and it is good for some people's personality development in some degree. However, playing computer games also has many negative impacts if people addict into it. This study has attempted to explore the status of computer game addiction, and the relationship between the addiction and personality. It is hoped that this empirical study will give people more knowledge of computer game addiction in current China and provide a better understanding of the mechanism of computer game addiction. The study finds that:

1. Game addiction score of male students was significantly higher than that of female students. Graduates were more attracted to computer games than undergraduates. Different kinds of games had different attraction to game players.
2. Personality of Warmth, Emotional Stability, Rule-Consciousness and Perfectionism were negative correlated to the scores of game addiction. Dominance, Vigilance, Apprehension and Tension were positive correlated to the scores of game addiction.
3. Game players attached importance to the game elements of game theme, fidelity, beauty and appreciation, interaction and competition, free creation, promotion and power, skill presentation and use, sense of achievement and physical control.
4. Game software usability dimensions of Expression of Interface and Help information, Suitable for Individualization, Consistent or Conformity to User Expectations did contribute to computer game addiction.

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Appendix. The Explanation of 16 Personality Factors

Warmth (A)

Low A: Reserved, impersonal, distant, formal. They tend to be reserved and cautious about involvement and attachment. They tend to like solitude, often focusing attention on intellectual, mechanical, or artistic pursuits, where they can be quite effective. Low scorers can be uncomfortable in situations that call for emotional closeness or extensive interaction.

High A: Warm, caring, soft-hearted, and generous. They tend to have an intrinsic interest in people and they often seek situations that call for closeness with other people. Their friends describe them as sympathetic and comforting. Extreme scorers may be seen as gullible, and may be uncomfortable in situations where close relationships are inaccessible.

Reasoning (B)

Low B: They are less able to solve verbal and numerical problems of an academic nature. This can indicate lower intellectual ability, but it is also related to educational level. Low scores can also result from a range of problems affecting concentration and motivation.

High B: They are more able to solve verbal and numerical problems of an academic nature. This is often indicative of intellectual ability, but is also related to educational level. This index should not replace full-length measures of cognitive ability.

Emotional Stability (C)

Low C: Reactive, easily upset, temperamental. They tend to feel a lack of control over life's challenges and to react to life rather than making adaptive or proactive choices. For some test takers, reactivity can reflect current life stressors; for others, it may characterize their way of life.

High C: Calm, stable, mature, unruffled. They tend to take life in stride and to cope with day-to-day life and its challenges in a calm, balanced, adaptive way. They tolerate frustration well, can delay gratification, and don't let emotions obscure realities. Extreme scorers may tend to avoid "negative" feelings or use strong defenses like denial.

Dominance (E)

Low E: Deferential, modest, submissive. They tend to accommodate others' wishes, and are cooperative and agreeable. They are likely to avoid conflict by acquiescing to the wishes of others, and they are willing to set aside their own wishes and feelings. Extreme deference can disappoint those who wish for

High E: Assertive, forceful, competitive. They tend to be vocal in expressing their opinions and wishes. While dominance can create a commanding, take-charge social presence, at times it can be seen as overbearing, stubborn or argumentative. For example, dominant people who are also

a more forceful or participating response from them.	Warm (A) may be more thoughtful than reserved people.
Liveliness (F)	
Low F: Serious, quiet, reflective, cautious. Though they may not be the life of the party or the most entertaining person in a group, their quiet attentiveness can make them reliable and mature. At the extreme, they can inhibit their spontaneity, sometimes to the point of appearing constricted.	**High F: Carefree, enthusiastic, spontaneous, energetic.** They are high spirited and stimulating and drawn to lively social situations. Extreme scores may reflect an impulsive or unreliable quality. They may find it hard to rein in their enthusiasm in situations that call for restraint or decorum.
Rule-Consciousness (G)	
Low G: Expedient, non-conforming. They may not worry about conventions, obligations, or following rules and regulations. This may be because they lack internalized standards or simply because they follow unconventional values.	**High G: Rule-conscious, dutiful, scrupulous.** They tend to be proper and conscientious, and conform to conventional cultural standards. At the extreme, they can be perceived as inflexible, moralistic, or self-righteous.
Social Boldness (H)	
Low H: Shy, socially timid, threat-sensitive, easily embarrassed. They find speaking in front of groups to be difficult, and may feel intimidated when facing stressful situations of an interpersonal nature. However, they may be sensitive listeners, who are more aware of risks in situations.	**High H: Socially bold, outgoing, gregarious, adventuresome.** They tend to boldly initiate social contacts, be fearless in the face of new or intimidating social settings, and to be risk-takers seeking adventure. Extreme scorers may be thick-skinned or attention seeking.
Sensitivity (I)	
Low I: Tough, realistic, logical, unsentimental. They focus more on how things work than on aesthetics or refined sensibilities, and may be so concerned with utility and objectivity that they exclude emotions from consideration. Because they don't tend to allow vulnerability, extreme low scorers may have trouble in situations that	**High I: Emotionally sensitive, intuitive, cultured, sentimental.** High scorers are attuned to sensitive feelings, and thus are empathetic, sympathetic, and tender-minded. They tend to be artistic and refined in their interests and tastes. Extreme scorers may be so focused on subjective aspects of situations that they overlook

demand awareness of feelings.	more functional aspects.
Vigilance (L)	
Low L: Trusting, unsuspecting, forgiving, accepting. They tend to be easy-going and expect fair treatment and good intentions from others, and to have trusting relationships. However, extremely low scorers may be taken advantage of because they do not give enough thought to others' motivations.	**High L: Vigilant, suspicious, distrustful, wary.** They tend to be attentive to others' motives and intentions and sensitive to being misunderstood or taken advantage of. They may be unable to relax their vigilance, and at the extreme their mistrust may have an aspect of animosity.
Abstractedness (M)	
Low M: Grounded, practical, concrete. They tend to focus on practical, observable realities of their environment and may be better at working on a specific solution than at imagining possible solutions. Extreme scorers may be so concrete in their focus, unimaginative, or literal that they "miss the forest for the trees."	**High M: Abstracted, imaginative, idea-oriented, contemplative.** They are more oriented to abstract ideas than to external facts and practicalities. Being focused on thinking, imagination and fantasy, high scorers generate many ideas and theories and are often creative. Extreme scorers can be so absorbed in thought that they can be absentminded and impractical.
Privateness (N)	
Low N: Forthright, self-revealing, transparent. They tend to be open, artless, and transparent. They are willing to talk about themselves readily, even about fairly personal matters. They tend to "put all their cards on the table", and to be genuine and unguarded. At the extreme, they may be forthright in situations where it might be more astute to be circumspect or tactful.	**High N: Private, discreet, non-disclosing.** They tend to be guarded, and reluctant to disclose personal information, and "play their hand close to their chest." They may be tactful, diplomatic and calculating regarding others' motives. At the extreme, they maintain their privacy at the expense of developing few close relationships.
Apprehension (O)	
Low O: Self-assured, unworried, complacent. They tend to be self-confident and untroubled by self-doubt. While this may make them more resilient in stressful situations, at the extreme, the person's	**High O: Apprehensive, self-doubting, guilt-prone.** They tend to worry about things and to feel anxious and insecure. These feelings may be in response to current life events or they may be

confidence may be unshaken, even in situations that call for self-evaluation and self-improvement. The extreme low score may reflect an avoidance of anything negative about the self.	characteristic. While worrying can help the person anticipate dangers, be sensitive to others' reactions, and anticipate consequences of actions, it can also be painful and make a poor social impression on others.
Openness to Change (Q1)	
Low Q1: Traditional, attached to familiar, resistant to change. They tend to stick to traditional ways of doing things. They prefer what's predictable and routine, and so they don't tend to challenge the status quo. At the extreme, they may not initiate or be open to change, even when the situation calls for it.	**High Q1: Open-to change, experimenting, freethinking.** They tend to be open-minded and innovative, and seek ways to improve the status quo. They enjoy experimenting, and tend to think critically or question authority. Extreme scorers may find it hard to "leave well enough alone."
Self-Reliance (Q2)	
Low Q2: Group-oriented, affiliative. They tend to prefer being around other people, and enjoy social groups and working in teams. At the extreme, they may not be effective in situations where they need to function independently or where others are giving poor direction or advice.	**High Q2: Self-reliant, solitary, individualistic.** They enjoy spending time alone and prefer to rely on their own thinking and judgment. While self-reliant people are autonomous in their thoughts and actions, extreme scorers may be uncomfortable working collaboratively or neglect interpersonal consequences of their actions.
Perfectionism (Q3)	
Low Q3: Tolerates disorder, unexacting, casual, lax. They tend to be comfortable leaving things to chance, tending to be spontaneous rather than planful, organized, and structured. Extreme scorers may seem flexible and spontaneous, but they may also seem unorganized, unprepared, or undisciplined.	**High Q3: Perfectionistic, self-disciplined, goal-oriented.** They tend to be organized, plan ahead, persevere, and work conscientiously. They are most effective in organized and structured situations, and may find it hard to deal with unpredictability. At the extreme, they may be seen as inflexible or preoccupied with tasks.
Tension (Q4)	
Low Q4: Relaxed, placid, tranquil, patient.	**High Q4: Tense, driven, high energy,**

They are laid back, easy-going, and composed. They are not easily upset or aroused, and frustrations rarely bother them. At the extreme, their low level of arousal can make them unmotivated. That is, because they are comfortable, they may be disinclined to change or push themselves.	**impatient.** They tend to have a lot of drive, to be high strung, and to be fidgety when made to wait. A certain amount of tension is necessary to focus effectively and can motivate action. However, extremely high tension can lead to impatience and irritability. The source of tension should be explored when scores are extremely high.

A cultural context directed design of a tool for usability evaluation of web interfaces

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Abstract

Globalization of user interfaces in the present WWW era has necessitated the need to take into account cultural dimensions in the design strategies. A major impediment is that there is very inadequate understanding of the role of culture in user interfaces and how they are built. Also, the present user interface design tools and guidelines are insufficient with respect to the role of culture in usability testing. The aim of this research work is to establish a set of objective guidelines to deal with the cultural aspects of user interface design. This paper presents a study of the existing websites of three diverse cultures of China, India and Denmark. Results of this study are used to frame heuristic guidelines to assist a designer in his cross-cultural user interface design strategy for each particular culture. Finally these guidelines are used to design a tool for evaluation of usability of websites in cultural context. This tool assists in the evaluation stage of the iterative design practice of user interface development. A discussion on how this tool integrates with the cross-cultural design strategy of a designer is also sought in this paper.

Keywords

Cultural models, Cross-cultural interface design, heuristic guidelines, usability, evaluation

I. INTRODUCTION

Rapid technology advancement has converted the place we live to a 'small world' with a global marketplace. Computer software and the Internet which were once a US dominated market, has now become a worldwide commodity and the market has now grown to include all nations, creeds, gender and task use. Recent researches point out that outsourcing the development work to cheap labor-cost areas and selling products to overseas market has been the latest trend for big companies. Still America is the biggest software exporter in the world with 80% of all software development (O'Sullivan, 2003), but a recent survey has shown that over 60% of American companies are not prepared for a global online marketplace (Sun, 2001). Fernandes (1995) points out that this is due to a lack of understanding of local customers' culture. The fact that the designer is not the end user any more and that the user's context (including social and cultural factors) is distinctively different from the designer's has long been accepted. The current situation suggests it is now normal to design IT products for users in other cultural contexts, and the cultural gap between designers and users is growing larger. Also, the design challenges for localization have become more demanding because a large amount of today's IT products are consumer-oriented information appliances (Bergman, 2000). Compared to enterprise information systems that are designed to improve work practices in the organizational context, information appliances are expected to fit into the fabric of individual user's everyday life, having "the capability of becoming attached to their users socially and emotionally" (Norman, 2000). While the local uses of IT enterprise products in organizational contexts might share similarities in work flows and organizational structures across cultures, the local uses of IT consumer products take on various cultural and social meanings in individual life spheres located in different cultural contexts. All these demanding challenges from both the developer's site and the user's site urge us to develop an effective way to address cultural issues in IT localization and design well-localized products to support complex activities in a concrete context. However, current localization practices have not been very successful yet. The lack of a broad and dynamic understanding of culture is one of the major problems hurting localization practices. From the development side, localization work is usually carried out with a narrow scope and only on a surface level (Sun, 2001).

In such a scenario to implement a truly cross-cultural interface such tools or guidelines are needed that can be integrated into the invention process itself and are capable of capturing the nuances of cultures, to design an interface that allows the targeted audience to feel comfortable, without sacrificing the creative and artistic aspects of design that make the internet an interesting place to explore.

II. METHODOLOGY :

The research work started with foraging a large number of websites belonging to Denmark, China and India. A number of websites from amongst them (20 websites for each particular culture) were then carefully chosen for identifying cultural patterns keeping in mind the following factors:

1. The brand of the website does not have an overbearing influence over the cultural appeal of the website.
2. Websites from all different domains like information, promotional and transactional websites were taken to minimize the influence of the genre of website on the design elements.

3. Only home pages of websites were used for analysis to maintain a throughout consistency.

After making an analysis of the various design elements of the web interfaces, some patterns were consistently observed. These patterns were then documented numerically through a statistical analysis.

Based on the statistical analysis each design feature was rated on a five point scale corresponding to each culture. This five point scale grading was then used in the design of the tool for measuring culturability, i.e. cultural sensitivity of the website.

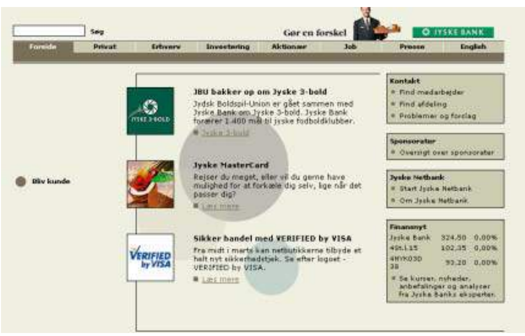
III. OBSERVATIONS:

Some of the key observations regarding design elements made during the study are as follows:

CURVES AND SHAPES:

1. Websites of Denmark show a consistent preference for simple regular polygons (squares, circles) and straight lines intersecting at right angles, while websites of Indian and Chinese culture use complex shapes and polygons using both straight and curved lines.

(i)



(ii)

Fig. 3.1 : (i) Danish site making use of squares and circles., (ii) Use of complex curves and curved intersections in an Indian site

2. Curves in websites of Denmark showed a tendency to cut each other at right angles while the intersection in India and China was mostly rounded or at obtuse angles.

COLOURS:

Hue:

1. Indian websites show a preference for hues of saffron and red color while Chinese websites showed a clear preference for red color. Danish sites showed preference for colors like red, blue and yellow. Hues of green color were not preferred as background color by any of the three cultures.

Saturation:

2. Danish websites prefer colors with low saturation values. While Indian and Chinese websites show a preference for colors with high saturation.

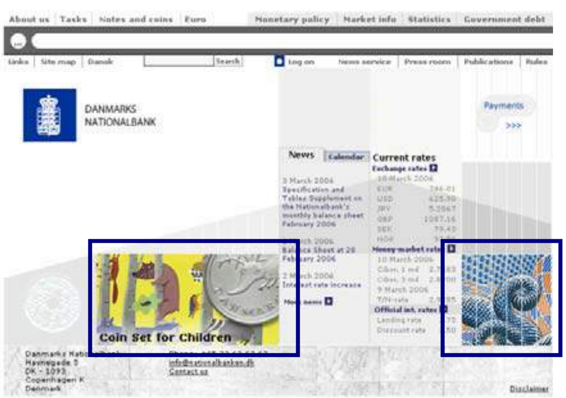
Brightness:

3. Indian websites show a clear preference for extremely bright colors. Danish websites prefer colors with more grey value when compared to Indian and Chinese websites.

VISUALS/ IMAGES:

1. Danish websites show a distinct preference for Illustrations and graphics over the websites of China and India which mostly used pictures and photographs as visuals.

(i)



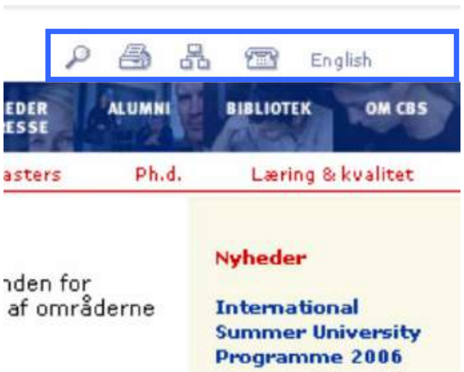
, (ii)

Fig. 3.2 (i) A denmark site using illustration and graphics, (ii) Use of pictures and photographs as visuals by a chinese site

ICONS

1. Denmark websites show a distinct preference for line/ graphical icons, while websites of India and China use more of image/ picture icons.

(i)



(ii) 

(iii) 

Fig. 3.3 (i) A Danish site using line icon, (ii) A Danish site using graphical icon, (iii) An indian site using pictures as icons

FONTS:

1. Danish websites show a preference for tall fonts (with high aspect ratio i.e. [H:W]) compared to Indian and Chinese websites.
2. Use of non decorative San serif fonts was most frequent in Danish websites followed by Chinese and Indian websites.

(i) 

(ii) 

Fig. 3.4 (i) Font on an Indian Website (ii) Font on a Danish Website

ALIGNMENT:

1. All the three cultures show clear preference for left aligned text.
2. Indian websites show a bit more permissiveness to center and right aligned text as compared to Danish and Chinese websites.

VISUAL CONCEPT:

1. People were most frequently the subject of images of websites of Indian Culture followed by those of Chinese and Danish culture.

2. Nature was most frequently the visual concept of Danish websites followed by that of Indian and Chinese culture.
3. Wealth and technology was equally preferred as a subject by all the three cultures.

IV. STATISTICAL ANALYSIS

These observations were statistically verified through a study done on 20 websites of each particular culture. The results of the study have been tabulated in Table 1.

	Denmark	India	China
Title Font			
aspect ratio (H/W) > 1 [char-X]	11/20	2/20	4/20
Use of San Serifed fonts	19/20	10/20	14/20
Tabs			
Tab setting			
Left Aligned	20/20	20/20	20/20
Right Aligned	0/20	6/20	3/20
Center Aligned	0/20	8/20	2/20
Visuals (Home)			
Use of Graphics / Illustrations	10/20	3/20	6/20
Use of Images/Pictures	15/20	17/20	16/20
Geometric Shapes			
Simple/ regular shapes (circle/ square/ triangle)	19/20	10/20	9/20
Complex/ irregular shapes	2/20	14/20	15/20
Icons			
Line/ graphical Icons	10/20	2/20	3/20
Picture/ Image Icons	3/20	9/20	7/20
Visual concept			
People	8/20	14/20	12/20
Nature	10/20	8/20	4/20
Wealth	8/20	8/20	8/20

V. GRAPHICAL ANALYSIS

Graphs were plotted based on the statistical data for each particular design element. The graph area was divided in five zones, to rate the design element on a scale of five [Preference- very high=5, high=4, moderate=3, low=2, very low=1].

FONTS

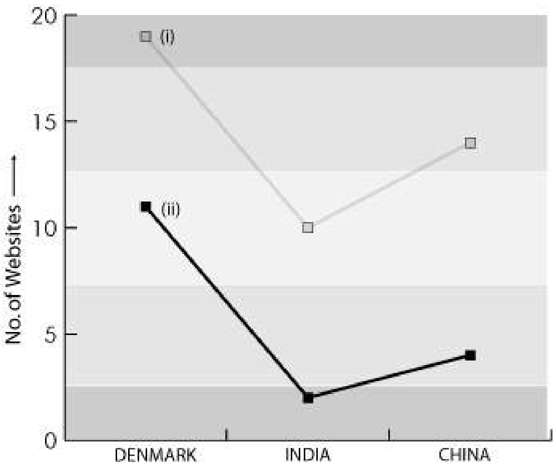


Fig. 2.1 (i) Use of tall fonts: Aspect ratio (H/W) > 1,
(ii) Use of san serif fonts.

LAYOUT

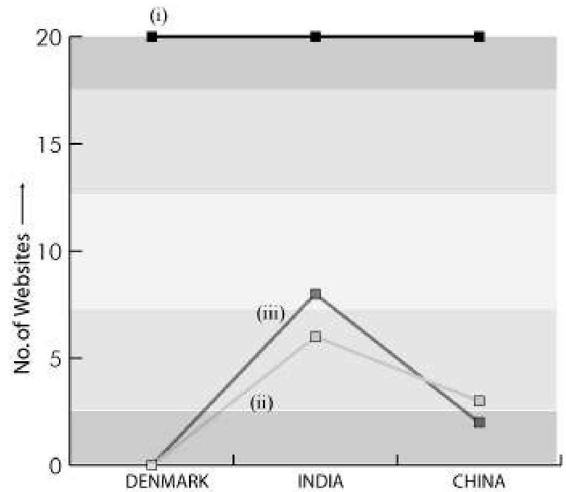


Fig. 2.3 (i) Left aligned , (ii) Right aligned, (iii) Center aligned

ICONS

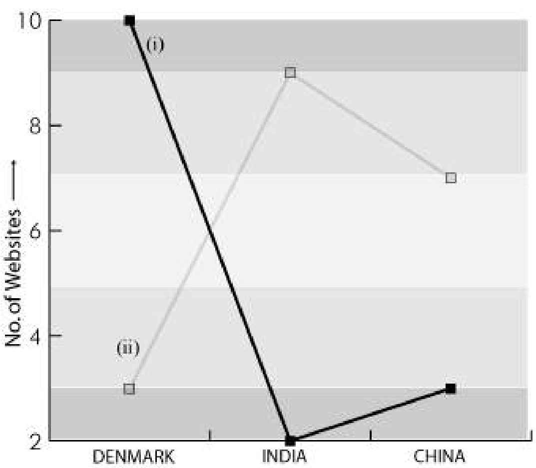


Fig. 2.3 (i) Left aligned , (ii) Right aligned, (iii) Center aligned

GEOMETRIC SHAPES

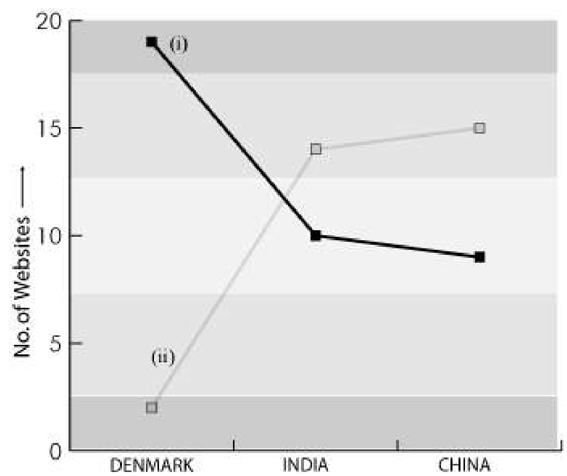


Fig. 2.3 (i) Left aligned , (ii) Right aligned, (iii) Center aligned

VISUAL CONCEPT

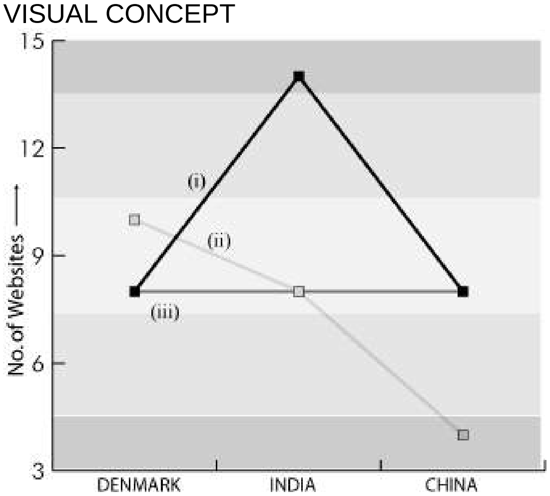


Fig. 2.3 (i) Left aligned , (ii) Right aligned, (iii) Center aligned

VISUALS

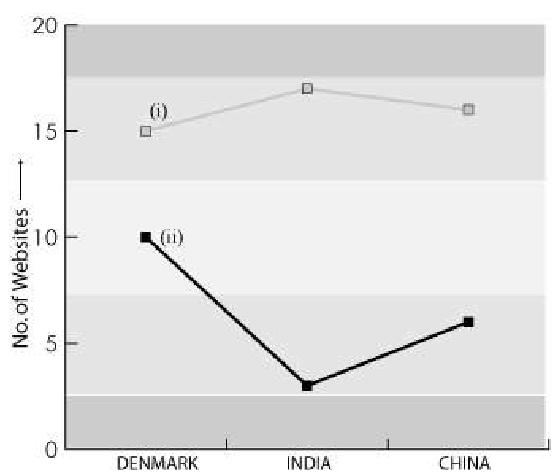
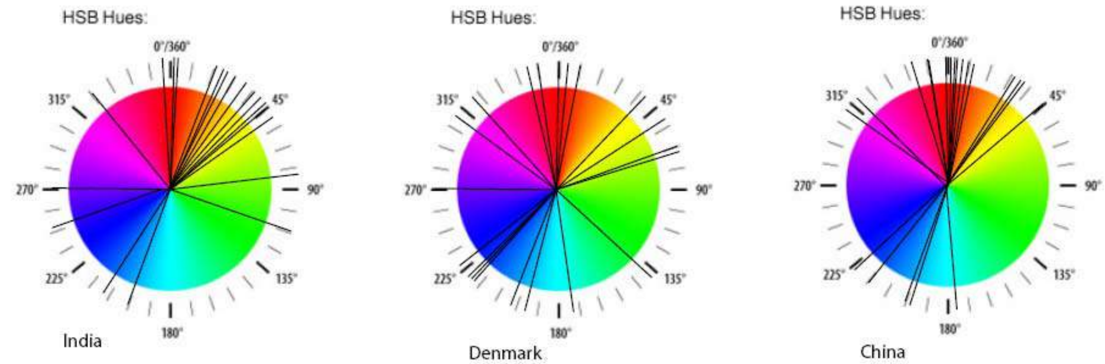


Fig. 2.3 (i) Left aligned , (ii) Right aligned, (iii) Center aligned

HUE

Hue values were plotted on a color circle to determine the patterns.



No. of websites corresponding to each hue value was then determined to know the hue value preference for each particular culture.

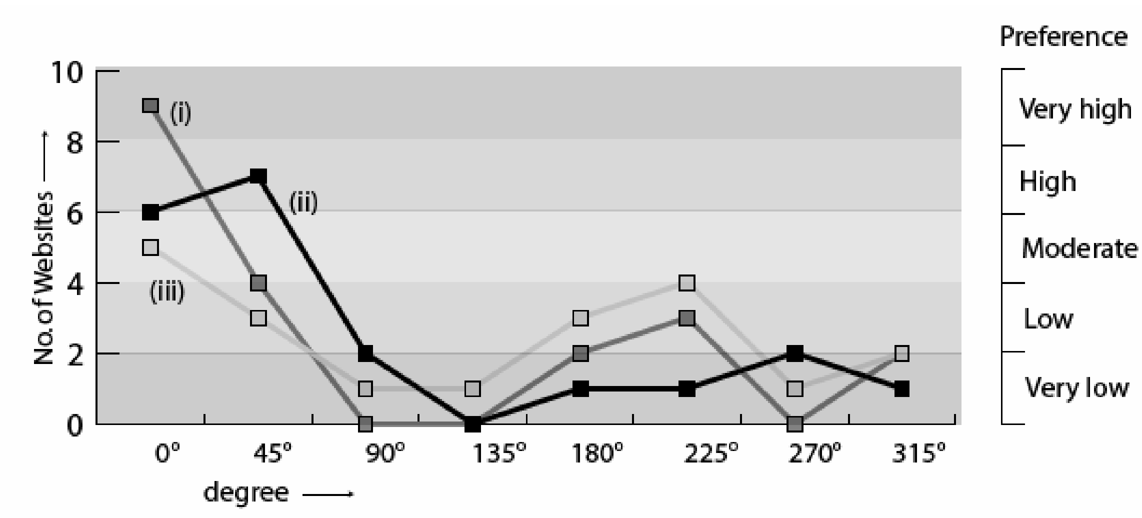
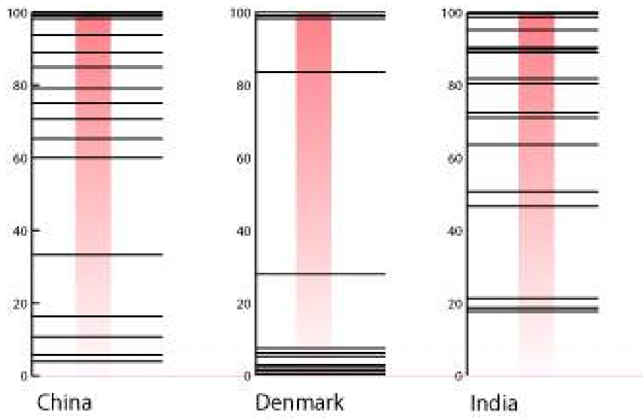


Fig. (i) China, (ii) India, (iii) Denmark

SATURATION

Saturation value of the most prominent color on the website was plotted to determine the patterns.



No. of websites in a particular saturation range were then plotted for each particular culture.

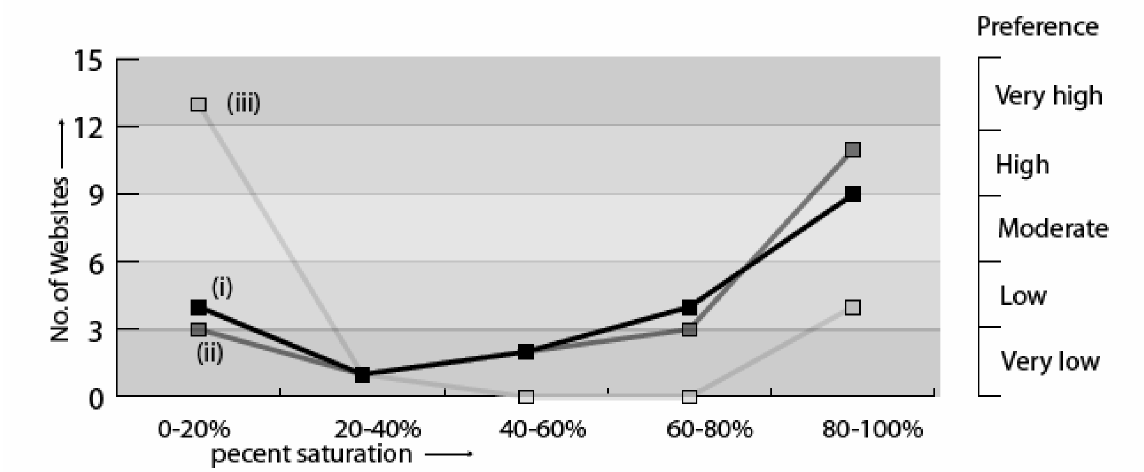
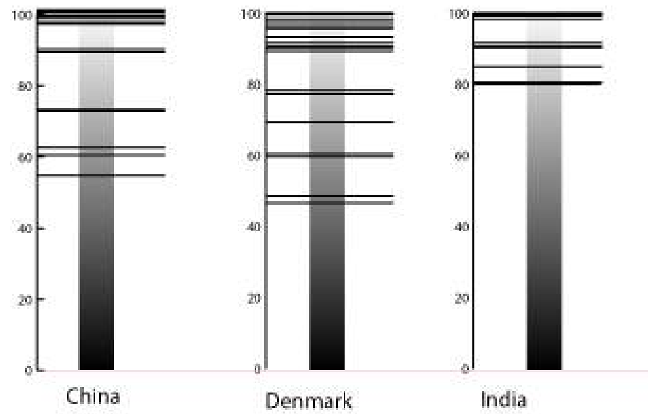


Fig. (i) China, (ii) India, (iii) Denmark

BRIGHTNESS

Similarly Brightness values were plotted to grade them on a five point scale.



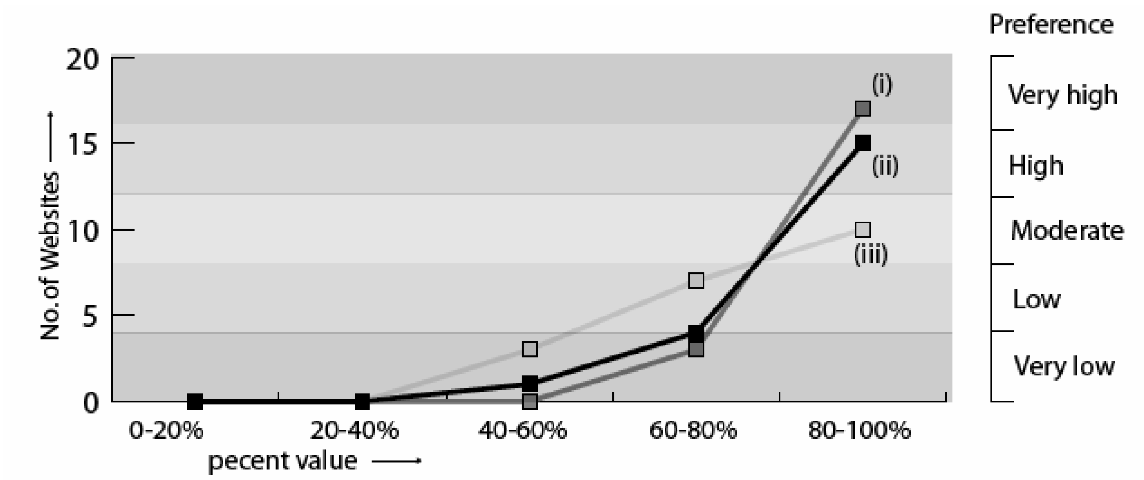


Fig. (i) India, (ii) China, (iii) Denmark

VI. PROPOSED CROSS-CULTURAL USABILITY EVALUATION TOOL

As we can see that the user of this tool will be the designer. So it is important to investigate how this tool integrates with the cross-cultural user interface design strategy of the designer.

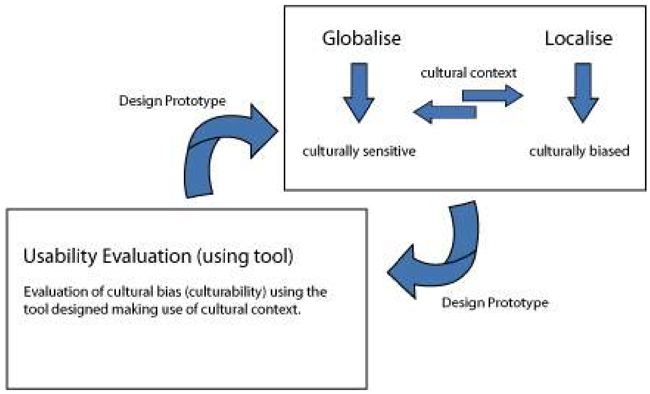


Fig. 4.1 cross cultural user interface design strategy

In the iterative user-centered design process of design, evaluation and implementation; the process of localization can be integrated into the evaluation stage. The designer can make use of the cultural context in the design of the tool to improve or reduce the cultural sensitivity of the website.

The tool works in the following simple steps:

1. The designer selects the particular culture; he wants to measure the cultural bias of his interface against.
2. For each particular design element there are some options. The designer needs to choose the alternative which is most close to the design element in his design.
3. The tool then gives the evaluated usability measure on a five-point scale.

SCENARIO FOR DESIGNING A WEBISTE WITH BIAS FOR A PARTICULAR CULTURE:

If the designer needs to design a website with a bias for Danish culture, the designer will follow the following simple steps:

1. He starts designing the website using the known design heuristics or his own intuition.
2. As he starts developing on the design, he moves on to the tool to check the cultural bias for each particular design element using the tool.

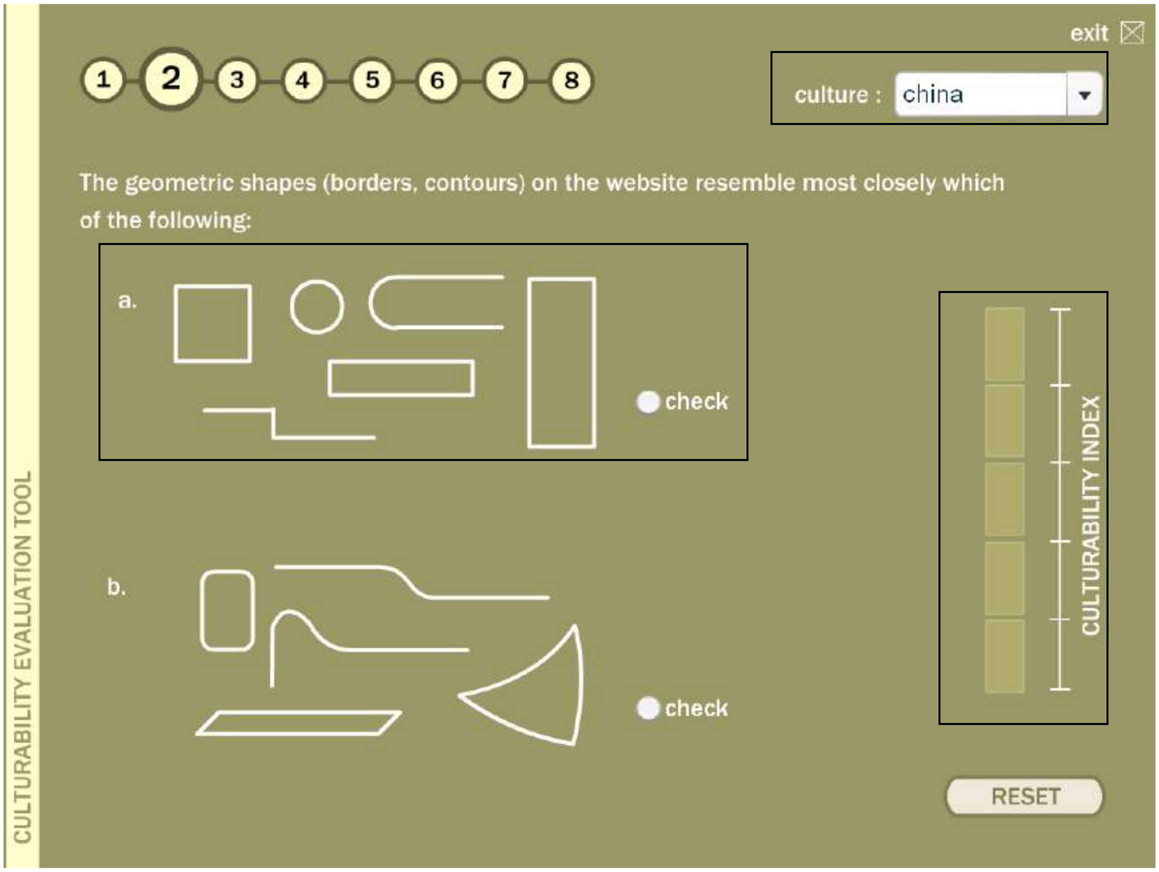


Fig. 6.1: GUI for the cross-cultural evaluation tool

As we can see in figure the tool has a combo box to choose any of the three cultures, against which he wishes to calculate the cultural preference of his website. The culturability index on the right side gives him the preference for the chosen culture on a five point scale. The designer can toggle the alternatives for each particular design element by selecting the “check” radio button. In the interface of the tool shown in figure options for geometric shapes appearing on the web interfaces are given.

3. As the designer makes iterations, he changes his design at each cycle getting inputs from the tool and attains the desired cultural bias in his interface.

In this way despite having no or minimal knowledge about the culture a designer can incorporate cultural preference in his interface with the help of this tool.

VII. CONCLUSION

The necessity of integrating culture in human computer interfaces has been well understood in recent past. This paper presents design for such a tool for usability evaluation which makes use of cultural context. Such a tool will help in encompassing the process of localization in the design process itself. This study makes us to conclude that such a tool is definitely possible, which can help out the designer in his cross-cultural user interface design strategy without using quick and shabby methods which make cross-cultural design process a mere translation of design.

The tool may be developed further to evaluate cultural preference for a particular domain of website like transactional website. The same methodology may be followed while designing the tool with subjects of the study being from that particular domain.

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Use, User, Usability: Bounded rationality perspectives in cross cultural framework

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Abstract

User determines the usability and use of a product in a limited information scenario. The user itself has been understood in a limited intellectual, emotional and socio-cultural context. The logical and the intuitive interplay within the individual in it's socio-cultural setting creates shades of interpretations of the stimuli from outside, within a range of 'reality' coloured by emotional state. This paper proposes a framework for the HCI professional to determine the mutual relationship of use, user and usability in bounded rationality perspective in cross cultural framework.

Keywords:
Bounded rationality, Usefulness, Utility, User, Cross-cultural framework.

Introduction

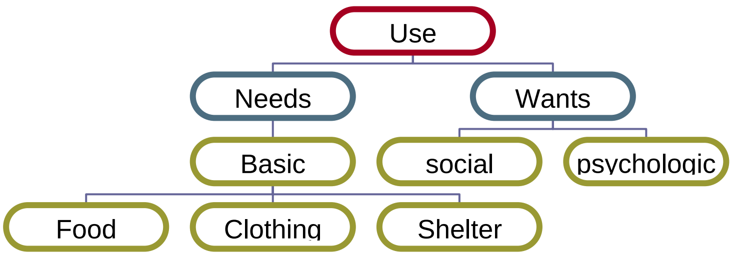
Designed products, both tangible and intangible, are created in order to satisfy the user in context of its needs and wants. The user makes choices from the available options by weighing them against the requirements. The information available with the user about the various choices is often not sufficient in order to make a completely 'rational' choice. This phenomena of decision making in limited information scenario has been dubbed as 'Bounded Rationality' (Kahneman and Tversky, 2000; Simon, 1976). For an HCI professional the problem of evaluating and enumerating the user's satisfaction in relation to the choices which are being made in a bounded rationality framework in context of the interaction with the computer, is further compounded by the nature of wants themselves. The wants are dynamic and are being constantly created and changed (Marshall, 1920, pp.86-91). They also follow a hierarchy (Georgescue and Roegen, 1954). The user's wants and their hierarchy need to be known in order to measure user's satisfaction and to suggest methods to improve the interaction. Taking a stand that the wants arise from the user's 'mental programming' which hofstede (1976) argues to be contributed by culture partly and borrowing from the 'classical conditioning' (Pavlov, 1890's; King et al., 1961) we need to understand the user in cultural, cognitive and affective frameworks. The bounded rationality of the user is to be analysed in the bounded rationality framework of the evaluator. And if the cultural difference between the user and the evaluator is significant then the bounds of rationality of the understanding further tighten. This paper attempts to analyse the bounds on rationality and rational understanding of the 'use' and 'user' and attempts to propose an approach in determining 'usability'.

Borrowing from Different disciplines

Various branches of anthropology, sociology and psychology have extensively dealt with the origin, structure and context of needs and wants by individuals and groups in various domains. For example, anthropology and sociology studies human as a community and social entity and tries to understand community related and society related needs. Comparatively recent disciplines like 'human computer interface' borrow from and extend the research in application domains of these faculties.

Use

'Use' as a construct of externalised needs and wants of the 'user' has been studied in ontological and procedural faculties. Needs and wants are separate in their relation to the user. A need can be something that is absolutely essential for existence, for instance food, clothing etc. whereas want is something that emanates out of a wish, a desire, for instance a game show or a computer. A thing in itself may not fulfill a basic need but it can lead to a fulfilling one, in that case it can still be treated as a want for it is want of the subject to use that means to fulfill the need.



The nature of need is physical where as a want is more social and psychological. Need has a static model of existence whereas the satisfaction of lower and more primary wants awakens higher wants. So the wants themselves grow in number over time. This phenomena has been dubbed as '*the principle of subordination of wants*' and '*the principle of growth of wants*' (Menger, 1950,pp.82-83; Marshall, 1920, pp.86-91).

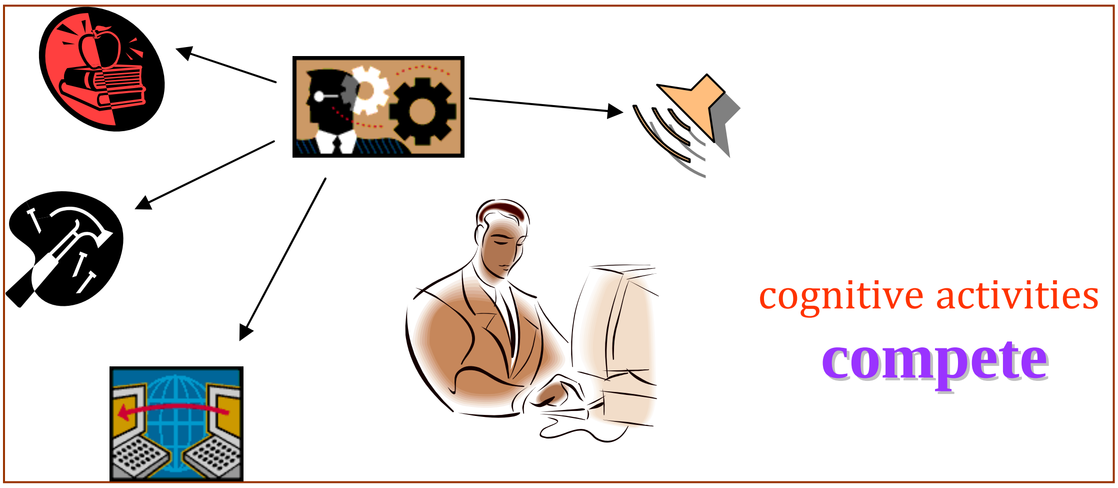
The challenge thus is to frame the dynamic wants in context of use and to provide a measurable scale of satisfaction of the user.

User

User can be treated as an information processor (Cognitive framework), a sensitive feeler (Affective framework) and a personification of social thinking (Socio-cultural framework). It may also be all three (and much more).

Cognitive framework

Individuals rely on variety of 'concepts' to make sense of the world (Kunda, 1999). A concept is a mental representation of a category (Smith, 1990). As these concepts help in classification (Trope, 1986), inferring attributes (Bruner, 1957), guiding attention (Sagar and Schofield, 1980), communication and reasoning (Kunda, Miller and Clair 1990) they are crucial to meaning making of the artifacts in HCI scenario. But these concepts themselves are created in limited information scenario (Kahneman, Slovic and tversky, 1982) and they continue to grow, expand and organize in a probabilistic framework (Rosch and Mervis, 1975). Hence there is a boundedness on the rationality of creation of these concepts themselves. Further these concepts are activated by stimulus features (Higgins 1996), Salience (Biernat and Veisco 1993), priming (Srull and Wyer, 1979), chronic accessibility (Marcus, 1977) and goals (Kunda, 1998) of the user. Thus the activation too takes place in a limited information scenario and hence it's rationality too is bounded.



Affective Framework

There has been a long history of debate on the nature and role of emotions. Stands differ on emotions from it being conscious (James, 1884; Freud, 1950; Clore, 1994), to unconscious (Kihlstorm, 1999; Berridge & Winkielman, 2003); from it being resultant of Pavlovian conditioning (Watson, Rayner 1920) to it being instinctive (Mc Dougall,1908); from Appraisal theory (frijda, 1986) to Neurological modelling (Rolls 1999,2000). The emphasis on role of emotion in the choice and decision making processes have been on increase in the fields of design (Norman), Marketing (Hansen, 2000) and economics (Allen et al., 2005) in last couple of decades. Emotions colour cognitive processes (Zajonc, 1980) have been argued extensively (Damasio et al) but the cognition itself being a tool in emotional arousal has also been reported (Cardinal et al, 2002). To the HCI professional hence the scenario becomes complex to assess the meaning making process and thus the decision making process of the user. Whether it is an icon on the screen that creates a particular emotion in the user or is the emotion in the user that helped create the meaning of the artifact? How do we evaluate it?

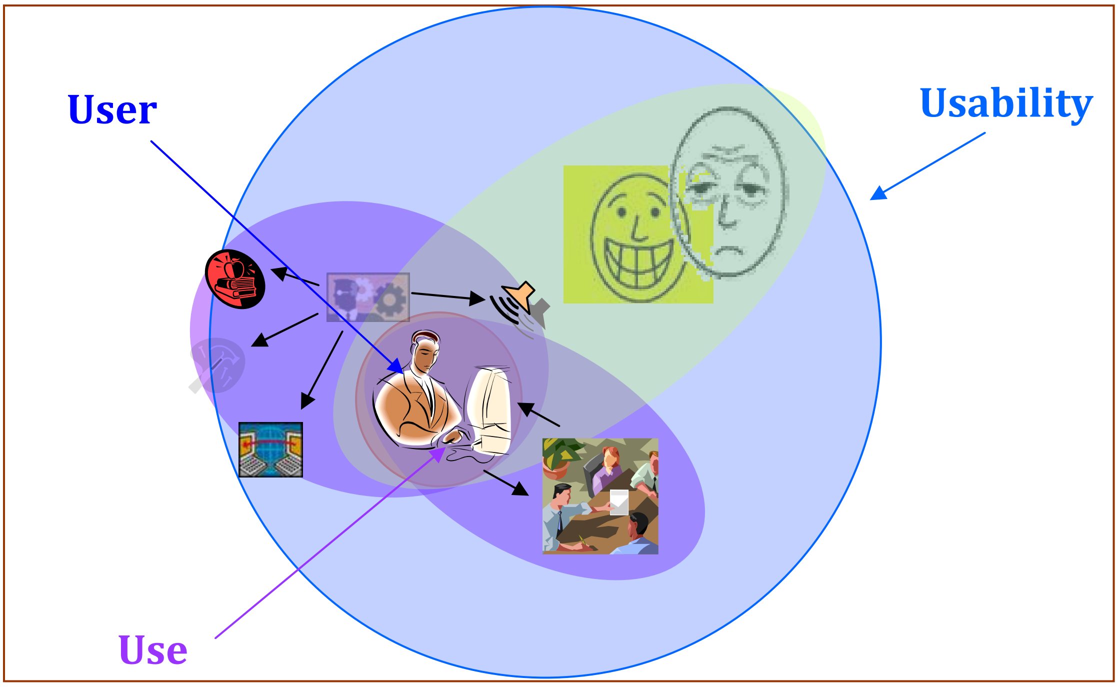
Cultural framework

Individual is placed in a socio-cultural context and is often the personification of the social thinking itself (Ghosh,1988). Culture as a contributor to the 'mental programming of the collective' through values, rituals, heroes and symbols has been argued in the seminal work by Hofstede. Differences in the mental programs of the individuals placed in culture on along different paradigms have been reported. Independent vs. Interdependent selves (Markus and Katiyama, 1991), Self-enhancement vs. Self-transcendence (Schwartz and Sagiv, 1995), Holistic vs. Analytical (Nisbett, Peng, choi, 2001), Thematic vs. Taxonomic (Ji,Zang,Nisbett,2004), Contextual vs. Independent (Ji, Peng, Nisbett,2000) are a few to mention. The differences have been reported at behaviour, cognition, attitude and attention levels. Hofstede (1984) has reported differences in the 'national cultures' of employees of a multinational across 72 countries along four parameters of culture, namely, power distance, uncertainty avoidance, individualism and collectivism and masculinity and feminity. But these reported differences may not be free from influence of the researcher's own culture (Hofstede, 2000). Chinese Value Survey (CVS) did brought out some items pertaining to value system that seemed strange to the America based researchers and the same may be true in case of the items administered by cross cultural researchers(Hofstede, 2000). The issue of understanding the 'other' in terms of value system remains debatable in cross cultural framework.

To summarise our the discussion of 'user' in cognitive, affective and cultural frameworks so far, it will be sufficient to state that we are dealing with minds as fuzzified probable concepts, programmed by culture and conditioned by experience, which resonates or dissonates with affect system of the individual of which we still know little.

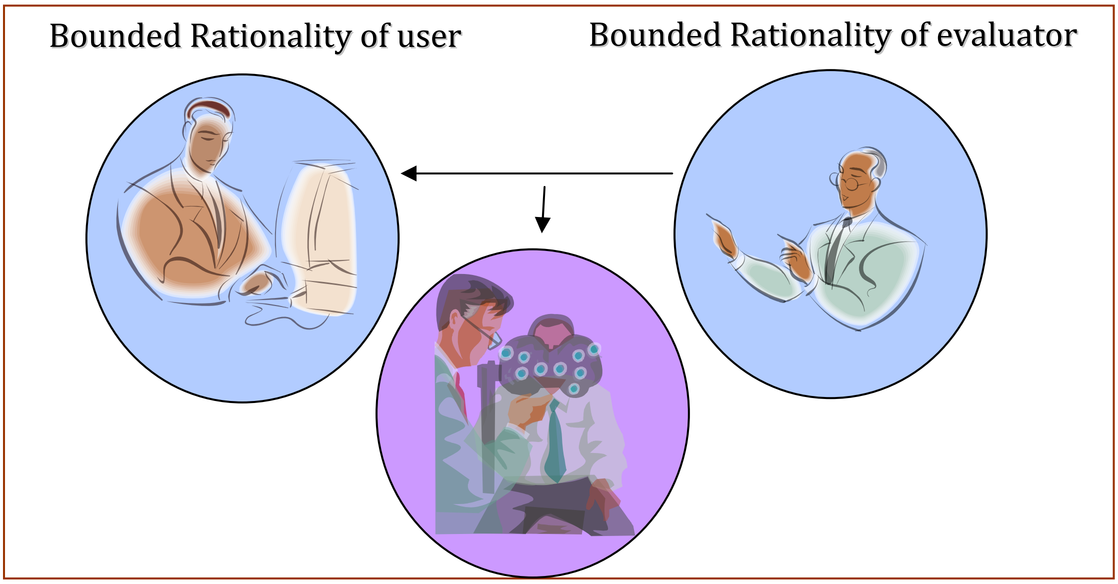
Usability

Usability is concerned with making designed products usable. Usable in the context of the use and the user. Some products may be usable in context of some user and for some usages but not for others.
Learnability, memorability, efficiency and satisfaction has been identified as usability attributes (Nielson, 1993). Learnability and memorabilty being cognitive processes are influenced by motivation and affect. Satisfaction in itself is a dimension of affect. Hence role of affect as a colouring agent of the cognitive process needs to be revisited in study of usability.



Connecting Use, User and Usability

The use of an artifact or object to derive satisfaction of having realised a want determines usability in the given context. GOMS model (Card, Moran and Newall,1983) and it's variations, Contextual Enquiry, Heuristic evaluation etc. all aim at seeing the use of an artifact as attempt to satisfy a particular want of the user. The user itself employs strategies of maximizing, optimizing or satisficing (Vermeule, 2005) between the available choices. But it does so in the limited information scenario. The user dynamically guiding and being guided by wants arising from it's concepts of world around it which in turn are products of it's conditioning and cultural positioning tries to satisfy it's wants . The process of satisfaction is the determinant of the usability. In order to achieve or measure the usability, HCI profession through this paper is being suggested to crusade along the want satisfaction line of the user.



Proposed framework

HCI professionals have to determine usability for the user in context of use and as the rationality of both the user and the evaluator are bounded we need to find an alternative model to frame the user and the context of use.

A method of analyzing the user and his satisfaction in the context of his wants is being proposed here.

As the wants are dynamic and change their orientation under influence of stimuli we need to create WANT INSTACES. A want instance the status of wants in the user at a given point of time. Then we analyse the behaviour of this want instance using three parameters, namely

1) Personal Want Rigidity (PWR) Index
2) Personal Want Intensity (PWR) Index
3) Personal Want Threshold Activation (PWTA) Index

Personal Want Rigidity (PWR) Index is a Measure of non flexibility of wants, Personal Want Intensity (PWI) Index is a Measure of intensity of want, Personal Want Threshold Activation (PWTA) Index is the Measure of stimulus level at which a want gets activated.

Hypothesis Generated:

PWI

Hypothesis1: PWI is inversely proportional to PWR.
Hypothesis2: Good evaluators will have low PWI.
Hypothesis3: Different people have different PWI.

PWR

Hypothesis1: Different People have different PWR Indices
Hypothesis2: PWR is highly correlated with personality types
Hypothesis3: Age affects PWR inversely.
Hypothesis4: Same person has different PWR indices in different domains of concepts.
Hypothesis4.1: PWR is directly associated with education.
Hypothesis4.2: PWR is directly associated with education.
Hypothesis5: Culture affects PWR

Conclusion

As the rationality of the users and the evaluators are bounded we have to search for alternative methods of measuring the usability of the of the designed products in context of use by the user. A possible way could be to analyse the wants of the users in his/her cultural and personal frameworks and help the cross cultural usability testing be more predictive of actual satisfaction levels of the user.

Future works

The proposed hypothesis needs to be tested in order to validate the framework proposed. Additional study need to be taken in fuzzy modeling of the user where mathematical models of the users dynamic wants can predict his exact want level under a given set of stimuli and thereby help the HCI usability evaluator understand the user in cross cultural frameworks.

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Digital Technology as a means to continuing Cultural traditions - Case study of a Tangible Interface to teach Dance

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Abstract: In this paper we demonstrate the development of a Tangible Dance Floor, that allows learning of various dance forms across cultures. Dance forms are very specific to cultures and its learning across cultures has become really difficult. Indian dance forms like Kathak and Bharatnatyam are extremely personal to the Indian culture and learning these in other countries is really difficult. Similarly, Tap dance and Ball Room dance are extremely specific to Russian and American cultures. Using Human Computer Interaction tools and methodology we design, specify and implement a system, which solves these cross cultural issues of learning.

In our methodology we studied various dance forms (Bharatnatyam, Kathak, Tap dance and Ball Room dance) from different cultures, conducted surveys. Studied the very important role of a teacher. We analyze that teachers to teach dance are decreasing day by day. Hence the need of a system to teach dance is really very important.

This Tangible dance floor teaches the dance in two steps. Firstly the user selects a dance form from the GUI where he is informed about the basic dance steps to be performed on the dance floor. When the user starts to perform on the dance floor a sound feedback alerts the consistency.

Keywords:

1. Understanding Dance

"Dance is a song of the body. Either of joy or pain." – Martha Grayham

Dance is a visually powerful art form. It uses vivid and eloquent mudras for communication. Dance communicates man's deepest, highest and most truly spiritual thoughts and emotions far better than words, spoken or written. It is used effectively to convey some meaning, emotion and cultural values. Dance is the imitation of our own action, reaction and conviction presented in sophisticated gesticulation, exploiting the body, mind and soul. A dancer dissolves her identity in rhythm and music, and makes her body an instrument for experience of the soul. [1]

1.1 Indian classical dance

Its theory can be traced back to the Natya Shastra of Bharata Muni (400 BC). Its various currents forms are: Bharatanatyam, Odissi, Manipuri, Kathakali, Kuchipudi, Mohiniaattam, Kathak, Sattriya

2. Culture specific Indian dance forms

2.1 Bharatanatyam

Also spelled Bharathanatyam, Bharatnatyam or Bharata Natyam) is a classical dance form originating in India. It owes its current name to Krishna Iyer and later, Rukmini Devi. Bharata could refer to either the author of the Natya Shastra or to a legendary king after whom the country of India was supposedly named, and natya is Sanskrit for the art of dance-drama. It was brought to the stage at the beginning of the 20th century by Krishna Iyer. [2]

Elements: Although most of the contemporary Bharatanatyam ballets are popularly viewed as a form of entertainment, the Natya Shastra-based dance styles were sacred Hindu ceremonies originally conceived in order to spiritually elevate the spectators. Bharatanatyam proper is a solo dance, with two aspects, lasya, the graceful feminine lines and movements, and tandava (the dance of Shiva), masculine aspect. Typically a regular performance includes:

Ganapati Vandana - A traditional opening prayer to the Hindu god Ganesh, who removes obstacles.
Alarippu - A presentation of the Tala punctuated by simple syllables spoken by the dancer. This really is sort of an invocation to the gods to bless the performance.
Jatiswaram - An abstract dance where the drums set the beat. Here the dancer displays her versatility in elaborate footwork and graceful movements of the body.
Shabdam - The dancing is accompanied by a poem or song with a devotional or amorous theme.
Varnam - The center piece of the performance. It is the longest section of the dance punctuated with the most complex and difficult movements. Positions of the hands and body tell a story, usually of love and the longing for the lover.

Padam - Probably the most lyrical section where the dancer "speaks" of some aspect of love: devotion to the Supreme Being; or of love of mother for child; or the love of lovers separated and reunited.
Thillana - The final section is an abstract dance when the virtuosity of the music is reflected in the complex footwork and captivating poses of the dancer.

Music - The music is in the Carnatic style of south India, "purer" than the classical music of north India (Hindustani music) in the sense that it was not heavily influenced by traditions, like those of the Persians, from outside of India.

Languages - Sanskrit, Tamil, Telugu and Kannada are traditionally used in Bharatanatyam.

Learning – Bharatnatyam is learnt by gurus of bharatnatyam in India. Initially there are very basic steps to be performed with co-ordination of beats. These basic steps range from 2-4 in number.

2.2 Kathak

This is one of the classical dance forms of India (originally from North India), and the national dance of Pakistan. It is characterized by fast footwork (tatkar) and pirouettes (chakar). It has today a form that has been influenced at various times in the past by mythological narratives by kathakas, temple dances, the bhakti movement (both Vaishnavism and Shaivite), and Mughal court dances in the 19th century; and these elements are readily discernible. Performers today generally draw their lineage from two major schools of Kathak: the Jaipur gharana and the Lucknow gharana (born in the courts of the Kachwaha Rajput kings and the Nawab of Oudh respectively); there is also a slightly less prominent Benares gharana.

Modern Repertoire

Modern repertoire can include presentation of the three phases of life, creation (symbolized by Lord Brahma), preservation (symbolized by Lord Vishnu), and destruction (symbolized by Lord Shiva). The structure of a conventional Kathak performance tends to follow a progression in tempo from slow to fast, ending with a dramatic climax. A short danced composition is known as a tukra, a longer one as a tora. There are also compositions consisting solely of footwork. Often the performer will engage in rhythmic 'play' with the time-cycle, splitting it into triplets or quintuplets for example, which will be marked out on the footwork, so that it is in counterpoint to the rhythm on the percussion. All compositions are performed so that the final step and beat of the composition lands on the 'sam' or first beat of the time-cycle. Most compositions also have 'bols' (rhythmic words) which serve both as mnemonics to the composition and whose recitation also forms an integral part of the performance. Some compositions are aurally very interesting when presented this way. The bols can be borrowed from tabla (e.g. dha, ge, na, tirakiTa) or can be a dance variety (ta, thei, tat, ta ta, tigda, digdig and so on). [3]

3. Cultural western Dance

3.1 Tap dance

It was born in the United States during the 19th century, and today is popular all around the world. The name comes from the tapping sound made when the small metal plates on the dancer's shoes touch a hard floor. This lively, rhythmic tapping makes the performer not just a dancer, but also a percussive musician.

Its evolutionary grandparents may well have been:

African dance to drum rhythms
African welly boot dance
Spanish flamenco, where nails are hammered into the heel and the front part of the dancers' shoes so that the rhythm of their steps can be heard Step dancing
Clogging, for example from Lancashire, where there may be no accompanying music, just the noise of the shoes
Irish Sean-nós dancing (different from step dance)

Characteristics of tap dance

Tap dancers make frequent use of syncopation. Choreographies typically start on the eighth beat, or between the eighth and the first count. Another aspect of tap dancing is improvisation. This can either be done with music and follow the beats provided or without musical accompaniment, otherwise known as a capella dancing. Hoofers are tap dancers who dance only with their legs, making a louder, more grounded sound. This kind of tap dancing, also called "rhythm tap", is typically found in cities or poor areas. The majority of hoofers, such as Sammy Davis Jr., Savion Glover, and Gregory Hines, are black dancers. Dancers like Fred Astaire provided a more ballroom look to tap dancing, while Gene Kelly used his extensive ballet training to make tap dancing incorporate all the parts of the ballet.

Steps in Tap Dancing

The simplest step is the toe tap, using the ball of the foot to make a sound. The same sound can come from the heel, although often it is not as loud or pronounced. These steps can be combined to make a cramp roll which produces a rolling sound like a horse gallop. It is done by placing weight on the left heel, then step on the right toe, and finally place the right heel down, remembering to keep all one's weight on the left leg. By slightly jumping into the step and doing it continually, the proper sound is made. The next step in tap dancing is the shuffle. Standing on one leg, the other is brushed out by sliding the toe of the shoe against the floor, then brushed back in. Making the step faster must be done by making smaller movements that are closer to the body. There are actually many different ways to perform a shuffle. Broadway-style shuffles use knee movement to swing the foot into a shuffle. Hoofers perform shuffles in 2 different ways. The more common shuffle comes from movement in the upper leg and hip. The first sound of the shuffle is almost like a drop, while the second sound is the foot being pulled up. The other type of Hoofer shuffle is from the ankle. This is used in more impressive, fast tap dancing. The difference in the sounds of the brush and the pull back is almost none; this shuffle is more of a "double tap". The final simple tap step is the flap. This is like the shuffle, but instead of brushing the toe back, the toe steps, i.e. brush-step. Both the shuffle and the flap make two sounds. By combining the tap/heel, the shuffle, and the flap, many other tap steps can be produced eg. shuffle tap-step ball change. The shuffle tap-ball change is a shuffle then a ball change. A ball change is like two toe taps, one on the left foot and one on the right. [4]

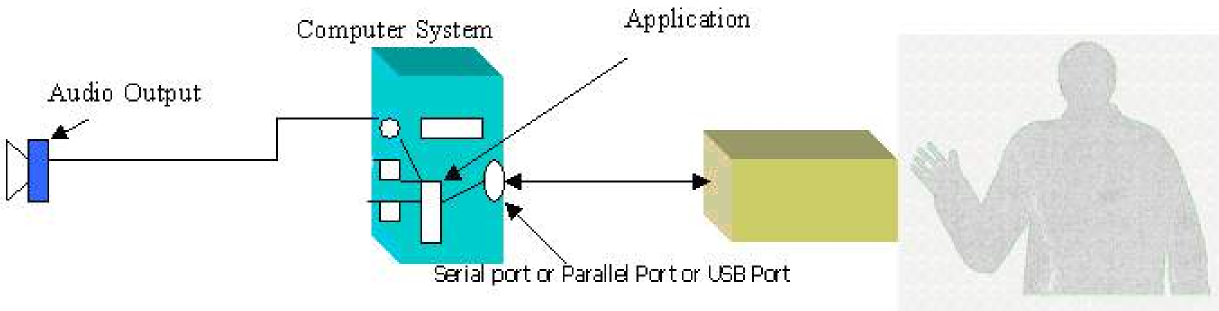
4. Learning dance

We discussed a few specific dance forms in this paper. From our research we learn that all these dance forms till date have been successfully taught by teachers or gurus (name for a learned teacher in India). There have also been several web based tools which try to teach dance steps through videos and music. However, this method has not been very efficient because this method has no means to direct the user when he performs wrong. Above that these web services concentrate more on teaching complex dance steps in an easy manner rather than pure basics which are the most important part of the learning process. In these entire dance forms there are very basic steps taught by the tutor. They are basically performing 2 to 4 particular dance steps at a time with consistency. Hence, whenever a user commits a mistake in these basic steps there is no one to correct. Currently when one begins to learn dance, the tutor first asks the student to perform basic steps either on a particular beat or with regular time periods. However, in the beginning the student does commit synchronization mistakes.

Also there are many instances when people don't like to learn dance forms from tutors for e.g. girls in the U.S do not like to learn Ball dance from tutors, however this dance form is an important part of their culture. Many dance forms though not learned outside but performed in groups create synchronization problems when performed for e.g. Dandiya, Tap Dance.

5. Digital technology as a means to continuing cultural traditions

Using HCI methodology we develop a tangible interface to teach dance.



System Diagram

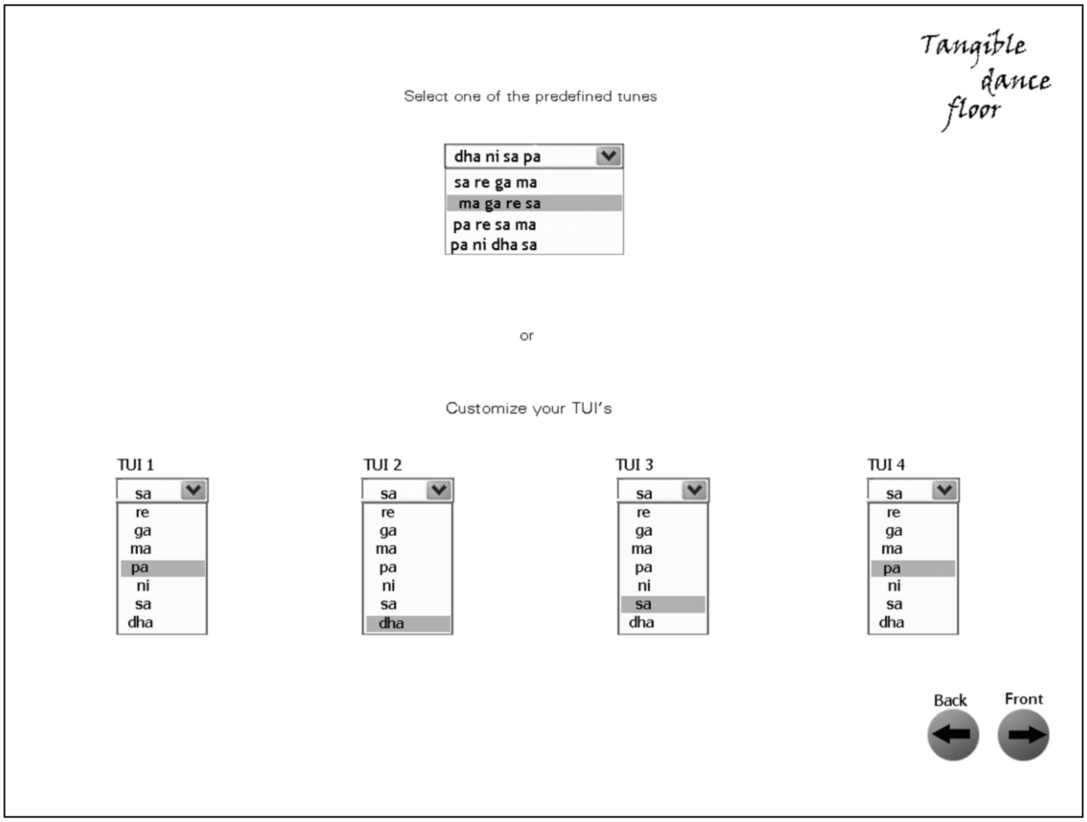
This tangible User Interface helps the user to learn a few dance forms and also makes him aware of the importance time synchronization. As the user steps on a particular TUI he / she gets a sound beat feedback associated to the particular TUI.

On the 1st GUI the user can select the kind of dance he wants to perform.

In the second GUI he can select the exact music in the particular dance form. This would teach how to perform the dance tune. The user can also customize each TUI to a particular dance beat provided in the database of the developed software.

Performing dance on the Tangible user interface

Wire frames



6. Conclusion

As these days teachers and gurus are reducing to teach dance due to increase in learners, there comes a need to use digital technology as a means to continuing cultural traditions. Dance being a very important part of every culture is loosing its essence and value. Hence in this paper we demonstrated various dance forms, the ways of learning them and their drawbacks. Finally we design, specify and implement a tangible interface to teach dance similar to a teacher.

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Using Culture based cues in Music for affective engineering of GUI

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Abstract — Music being digital has become a key expression of 21st century culture. Many people now have access to creative digital music tools through the widespread dissemination of computing and portable computing technology. New research questions are now emerging related to sophisticated human/computer interfaces, techniques and strategies for the control of information about music and creative musical processes. Music being universal and local, culture cues hold potential for being used as indices for a classification topology. Based on a posited topology, in this paper we propose an intuitive user interface which is useful for a layman who likes a particular genre of music but is unable to articulate it and therefore unable to seek out similar genre music from another culture. This system is based on contemporary algorithms & techniques to extract complex descriptive information from audio signals, for music classification and summarization based on beat, rhythm melody etc, which are universal characteristics regardless of culture. The proposed GUI provides the user to exercise his/her choice of a known culture and helps him locate similar music samples from another culture.

1. INTRODUCTION

The user is confronted with an enormous amount of digital music chosen on portable equipment as well as net. This situation shapes the need for the development of new user interfaces to access and retrieve music that takes full advantage of the music being digital. The paper focuses on retrieval, navigation and organization of music from large personal user collection of music from Western and Indian Culture. While the focus in literature is on the very important aspect of play list generation or music recommendation, not many have described interactive user interfaces to navigate through music collections. An interesting attempt is found where features directly extracted from the audio are used to build a map of the music collection. This work, however, addresses collections limited to a few hundreds of songs and is mainly concerned with PC based interfaces.

Music being universal and local, culture cues hold potential for being used as indices for a classification topology. Based on a posited topology, in this paper we propose an intuitive user interface which is useful for a layman who likes a particular genre of music but is unable to articulate it and therefore unable to seek out similar genre music from another culture. This system is based on contemporary algorithms & techniques to extract complex descriptive information from audio signals, for music classification and summarization based on beat, rhythm melody etc, which are universal characteristics regardless of culture.

The proposed GUI provides the user to exercise his/her choice of a known culture and helps him locate similar music samples from another culture. The main questions were: (i) How do users retrieve content out of their collection? (ii) What attributes do they use as cues? In our study we are focusing on those characteristics or attributes of the songs that can be obtained (e.g. through content analysis or web-mining) when the music is stored in a digital format on DVDs or hard disks on PCs. Some of these attributes (catalogue metadata), such as artist-name, album-name, song-name are well known and widely used. Others, less common, are related to intrinsic characteristics of songs such as tempo, rhythm, and timbre. Others, such as listening frequencies and preferences, are dependent on user's behavior. The purpose of this study is to identify what are the most important attributes as well as the best way to combine them into a meaningful interaction concept to ease organization, navigation and browse through music collections of various cultures.

This paper presents the realization of a music retrieval system that sorts songs on the basis of similarity to a given seed song. Similarity is based on a weighted combination of tempo, mood, genre and culture. We will first introduce several semantic descriptors of music contents, developed for different musical facets (rhythm, harmony, timbre, etc.) along with the single algorithms used to extract and combine these semantic descriptors of music content to develop an engineering model which will define the architecture of the system. Music similarity will be then discussed. Finally, we will present various aspects of the Graphical User Interface. A discussion on future trends and open issues that deserve further research will conclude the paper.

2. SEMANTICS OF MUSIC DESCRIPTORS

Low-level signal features are the main basis of music content processing systems. These features are good at characterising the acoustic properties of the signal, returning a description that can be associated to texture, or at best, to the rhythmical attributes of the signal [1], [2].
The proposed system adopts a broad definition of music similarity by taking into account various features that contribute to the overall similarity of two songs: timbre, tempo, genre and mood. In many cases, each feature adds new information to the similarity function. Indian Music and Western Music are for many people quite different genres, though their music can be classified as sounding similar in timbre, because of the instrumentation used by both. But in principle, the features do not need to be independent.

Purely data driven techniques for information retreival can lead to results that are low on the qualitative count and the results can be improved by using the cultural cues.. Our proposed description scheme can be seen as a function of musical dimensions: (2.1) rhythm, (2.2) harmony, (2.3) timbre and instrumentation, (2.4) genre, mood and tempo.

2.1 RHYTHM

In its most generic sense, rhythm refers to all of the temporal aspects of a musical work, whether represented in a score, measured from a performance, or existing only in the perception of the listener [4]. Rhythm is the variation of the accentuation of sounds or other events over time. "Rhythm involves patterns of duration that are phenomenally present in the music" with duration perceived by inter onset interval. In the literature the concept of "automatic rhythm description" groups a number of applications as diverse as tempo induction, beat tracking, rhythm quantisation, meter induction and characterisation of timing deviations, to name but a few. Genre classification results are greatly improved by using these high-level descriptors, showing the relevance of musically-meaningful representations for MIR tasks. For a more complete overview of the state of the art on rhythmic description and our own contributions towards a unified framework see [4].

In Western music, rhythms are usually arranged with respect to a time signature, partially signifying a meter. The speed of the underlying pulse, called the beat, is the tempo. The tempo is usually measured in 'beats per minute' (bpm); 60 bpm means a speed of one beat per second. The length of the meter, or metric unit (usually corresponding with measure length), is usually grouped into either two or three beats, being called duple meter and triple meter, respectively. If each beat is grouped in two, it is simple meter, if in three compound meter.

Some genres of music make different use of rhythm than others. Most Western music is based on divisive rhythm, while non-Western music uses more additive rhythm. *African music* makes heavy use of polyrhythm, and *Indian music* uses complex cycles such as 7 and 13, while *Balinese music* often uses complex interlocking rhythms. By comparison, a lot of Western classical music is fairly rhythmically simple; it stays in a simple meter such as 4/4 or 3/4 and makes little use of syncopation.

In this paper, instead of investigating a number of these different aspects, we have used a fixed set of features. Exact method used to extract these set of features is described in 3.1.

2.2 HARMONY

In any musical piece, harmony encapsulates the combination of simultaneous notes, or chords; their temporal arrangement, in various combinations; and their distribution, which overall signifies the key or tonality of the piece. Chords, their progressions, and the key are relevant aspects of music perception that can be used to accurately describe and classify music content [5]. To identify the harmonic similarities between symbolic data and audio, a successful methodology has been presented in [6].

A recent development includes the generation of a harmonic representation by means of a Hidden Markov Model, initialized and trained using musical theoretical and cognitive considerations [7]. This methodology has already shown great promise for both chord recognition and structural segmentation.

Our approach requires the use of a feature set that is able to emphasise the harmonic content of the piece, such that this representation can be exploited for further, higher-level, analysis. This feature can be accurately estimated from raw audio signals. Detailed description of how to extract these features is presented in 3.1.

2.3 TIMBRE AND INSTRUMENTATION

Timbre and Instrumentation together give another facet towards defining the differences as well as quality of music when comparing two pieces with each other. A musical piece generally involves the use of a variety of instruments played together in harmony to give it it's overall effect.All these sounds being produced in resonance have to be seperated for synthesis ,categorization and classification of these individual tonalities.Uptill now the reliance has been to categorize the overall timbre and instrumentation of a musical piece because tryimg to seperate them at a very high level has technological constraints which have not yet been overcomeGiven that the current technologies do not allow a sufficiently reliable separation, work has concentrated on the characterization of the “overall” timbre or “texture” of a piece of music as a function of low-level signal features. Despite the limitations there are some descriptors which can be used for classification. Examples are: lead instrument recognition, solo detection, or instrument profiling based on detection without performing any isolation or separation [8]. The recognition of idiosyncratic instruments, such as percussive ones, is another valuable simplification. Given that the presence, amount and type of percussion instruments are very distinctive features of some music genres and, hence, can be exploited to provide other natural partitions to large music collections, we have defined semantic descriptors such as the percussion index or the percussion profile [9]. Although they can be computed after some source separation [10], reasonable approximations can be achieved using simpler sound classification approaches that do not attempt separation [11], [12].

A research in the area of instrumentation has contributed to the current state of the art in instrument identification of mono-instrumental music [13], using Mel Frequency Cepstral Coefficient (MFCC) and a k-means classifier. More description on the methods used by us has been described in section 3.1.

2.4 GENRE, MOOD AND TEMPO

Genre, mood and tempo dissimilarities are computed by using the distance defined by Gowda and Diday in [14], which was initially developed for the task of clustering symbolic object. Genre and mood are, for the current experiments, manually annotated with a single label (although automatic genre and mood classification could be used [15]). In this case, the definition of dissimilarity ends up being based on identity: if two songs are labelled with the same genre (mood) their similarity is equal to 1, otherwise it is set to 0. This definition of dissimilarity could also be used to compare features made of multiple labels as in the case of the style information of ‘All Music Guide’ [16].

3. SONG SIMILARITY: A USER'S PERSPECTIVE

The judging of similarity between two songs or amongst a group of songs can be a highly varying activity because each user has his own perspective based on his cultural upbringing and other sociological and anthropological factors.Finding ‘similar’ songs, albums, or artists is one of the most appreciated features for music playing systems and devices capable to get access to large music collections [17].We as designers may simple state the differences percieved on the basis of instrumentation or compositional style but the reality as stated above depends on various factors. In reality,song similarity can vary based on factors ranging from the temporal availability of songs, the user's education and enthusiasm, the social settings, listening context, attention and cognitive limitations, and even depending on the songs that have to be compared at a given moment.Enthusiasm of the user will further depend on the attention span and cognitive load that the user can bear, the ease with which he can work with the music searching application, whether it supports peer to peer networking so that the user can come into contact with the preference choices of other people using the same application.Thus the overall usability of the devise ,in terms of it's ease of use and it's bedoy. Music psychology has already pointed out that besides instrumentation, at least tempo and genre information are relevant for generating similarity judgments of music [18]. In this section we consider two sources from which similarity can be computed: (1) audio file comparison and (2) World Wide Web. Audio-based similarity being based on low-level audio statistics pays a lot less attention to the cultural cues and relies more on clustering alogorithms. The narrow outlook of audio based similarity can be effectively overcome by web-based approaches which use, e.g., Google, All Music Guide[16] to find web-pages related to an artist and extract relevant information (e.g. word lists) from these pages. This section presents a overview of both the approaches.

3.1 COMPARISON OF AUDIO FILES

A simple Playlist generator [19], requires minimum user interaction and can be based on simple low-level audio statistics [20]. Spectral similarity can reflect to some extent timbre characteristics [21], [22], [21]. Timbre similarity in music has been extensively researched earlier [22], [23], [24], [21]. Unquestionably, timbre similarity will vary largely on the user's past experience and musical education.

A music listener without much theoretical knowldege might go for the type of instruments used in the musical piece as aainst the melody and harmony which might form the basis for more experienced and educated users. Each track has a specific spectra that occur in them and these can be used as indicies on which such a similarity will be based. In particular this is done by dividing the track into many very short (e.g. 30 ms) frames. For each frame, the Mel frequency cepstral coefficients (MFCCs) are computed. These MFCCs are then clustered using K-Mean Algorithm to find the most typical spectral shapes that occur. Once these cluster models are computed there are different ways to compare them. One approach is to compute the likelihood of generating samples from one cluster by the other one. We used the Nearest Neighbourhood Identification.

3.2 SEARCHING THE WORLD WIDE WEB

Over the years a lot of music guides and web-portals(databases) have proliferated over the internet which can be used to provide a different perspective towards song comparison. Just as movie databases (like IMDB) are extensively used over the world by users who wish to get acquainted with different movies (genre and culture based) , these music databases can also help make the users knowledegable about the different music cultures around the world and radically change their outlook and preferences. The challenge for a designer is to utilize these resources creatively so that the user views them as an additional resource embedded in his application and not just a means to browse the World Wide Web which he could have done without the existance of the device. In our case a Perl based program was used to retrieve data from World Wide Web and to display the top ranking results. The top ranked results (e.g. the first 50) are retrieved and parsed. Lists from different artists are then compared to each other using standard text retrieval techniques [33]). Using this type of similarity we can either classify artists into genres [23] or develop interfaces to browse music collections on the artist level [30].

4. DESIGN OF THE INTERFACE

4.1 USER’S GOALS

We created a user persona of his requirements for such an application to function successfully. The main objective obtained from this persona based approach was to provide the user with novel music choices similar to his tastes and ease of use of the application. By analyzing the scenarios, we were able to derive a set of functional requirements for our application architecture. The analysis of the scenarios focussed on the *information need* of the application to function properly in sync with the user's expectations. Here we describe the functionality of the controls that we have created.We walk you through the steps (a scenario) the user would be taking when he uses the application to search for a song.

Figure 1: The Home Page of Music Mantra

4.2 INFORMING THE USER

We have tried to follow the user's mental model and provided him with a simple and easily learnable user interface which follows a global navigation scheme, i.e. all the main controls of the interface are always present for the user so that he can jump from one mode to another at any stage of the application and can escape from any difficult situation with minimum number of clicks.These main controls can either be used as soft buttons or can be present on the body of the devise to aid as signposts as well as navigation devices. This can sufficiently reduce the cognitive load and serve as mnemonics for the user therby preventing disorientation. In the next section the design of the user interface is discussed.

Search tab

In the search tab the user selects the seed form from artist, album or song he or she would like to gather (see Figure 2 and 3). Then further user enters the name of the seed song, artist or album according to user preference. Thereafter user starts the application by pressing upon the GO button.

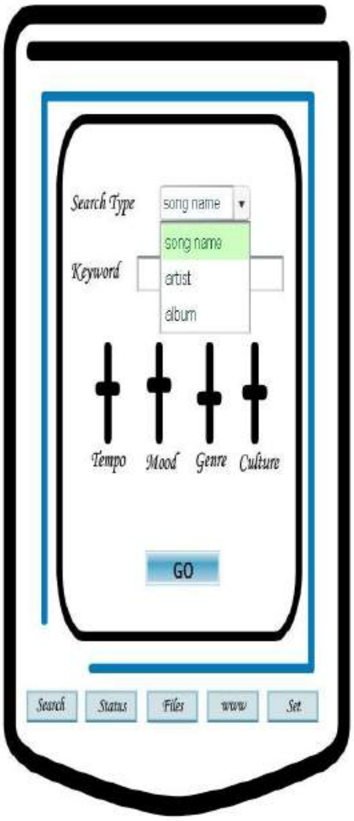


Figure 2: User selecting search type

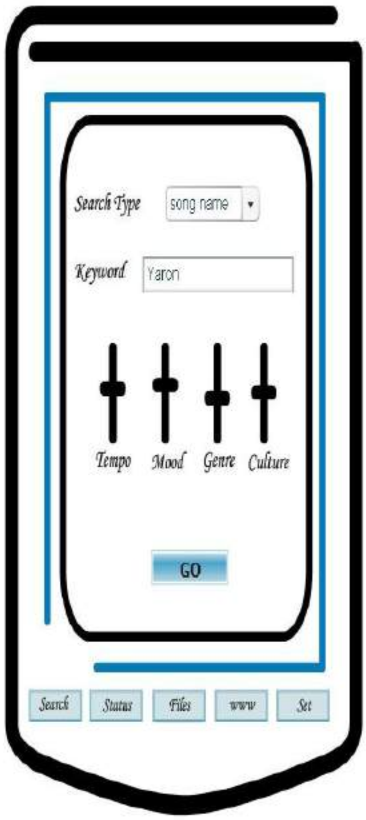
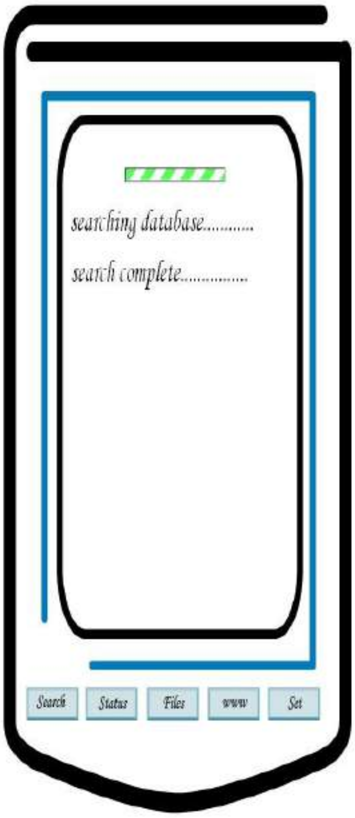


Figure 3: User entering the keyword

Status tab

The status tab shows the status in which the application is running. There are basically two statuses, first where the application is searching the user's database (see figure 4) and using the semantic descriptors to find similar music from various cultures. A MATLAB Code was employed for this task of the application. Second status of the application is when it is successfully able to connect to www through the PERL Code, where it requires initially passing the http proxy and then connecting to the proxy server (see Figure 5). Later on when it has successfully found the page on All Music Guide, it parses the search results (see Figure 6). Finally when both the tasks are complete the search tab enters the Ready mode (see Figure 7).



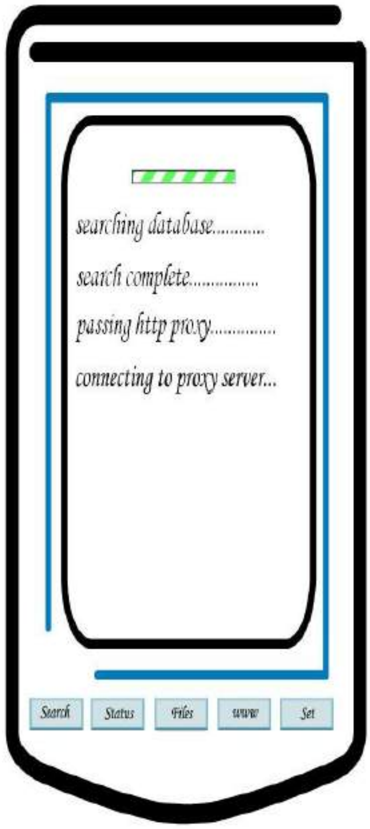


Figure 4: Application searching users Database

Figure 5: Application connecting over www

Figure 6: Application parsing the search results from www

Figure 7: Application after finishing the the two tasks

Files tab

The files tab displays the files that are currently in the download directory of the application. All songs downloaded by the user, including the ones being currently processed, are shown in a table form. This table structure allows the user to select any of search result indicated by highlighting of the result (see Figure 8) and then perform actions on the selection. The user may, for example, listen to a song to check its correctness and quality. Moreover, the user can open the folder location where the mp3 is stored in its hard disk.

Figure 8: Application showing searched files on users Database under Files Tab

www tab

The www tab displays the files that are found over World Wide Web which are not present in the download directory of the application. All songs searched by the Perl based code are shown in a table form. This table structure allows the user to select any of search result indicated by highlighting of the result (see Figure 8) and then perform actions on the selection. The user may, for example, start downloading the mp3 file from World Wide Web by simply double clicking the mp3 name. Further it can browse to the link which is shown next to the mp3 name by clicking on the link.

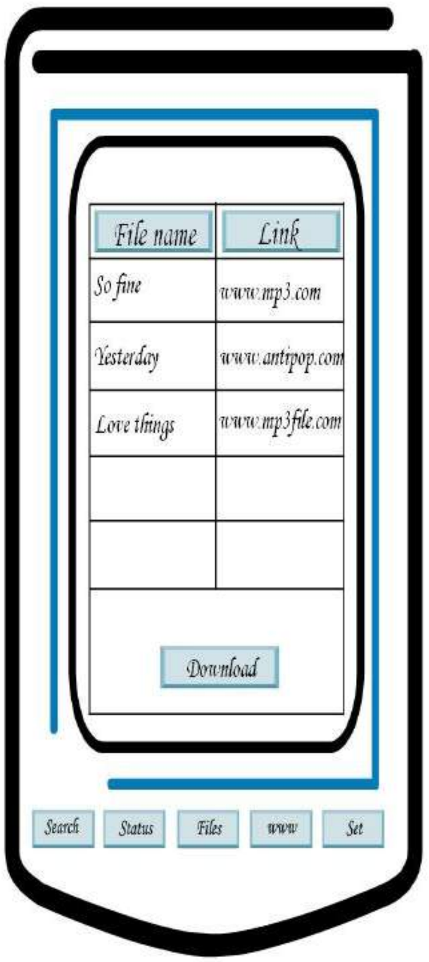


Figure 8: Application displaying the available download Over World Wide Web

Set tab

In the set tab the user can adjust the system preferences. The *Music Mania* can be switched on an off, the user’s music profile can be edited (see Figure9) and the desired music quality for the downloaded songs can be selected from a predefined list.

5. CONCLUSIONS AND FURTHER DIRECTIONS

This paper explores the combination of culture based cues and information retrival techniques to form a culturally informed application which seamlessly takes the user into unexplored areas. The user has his own music choices as a “musical map” to guide him through these uncharted lanes and zones.User perspectives and mental models towards making comparisons can vary a lot based on the various factors discussed. These must be researched throughly and must form the basis of the user interface design.
The device “Music Mania” is an application which can be used for Home PC’s with Internet-enabled MP3 players.Though we restricted our application to two classes of cultures only (Indian and Western Culture), but the same approach can also be employed for finding similar music from various other different cultures also. Further the application can also be integrated into a Music Teaching application, as an DJing application where a person undergoing a Djing course could make himself familiar with different genres of music by using the application and can have a much wider variety of music base to chose from.

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A Cross-cultural Study of How Refrigeration Mechanics Interact with the System

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ABSTRACT

In the field of Human Computer Interaction, some studies have looked at aspects and theories in cultural studies in order to evaluate methods and design approach of computer system development. Cross-cultural studies, in particular, have been used to compare the use of methods and design results across culture [1,2]. However, these studies are structured based on the developers' understanding of the system. In our research, a cross-cultural study is meant to provoke our analysis on the ways a system is organized, given a cultural context.

In a project to design novel user interfaces for refrigeration electronics, we use an anthropological approach [3] to critically reframe our understanding of refrigeration maintenance. In this paper, we present the ways in which ethnographic studies of refrigeration mechanics in Denmark, Australia and Indonesia and India have sensitized ourselves to issues that matter to refrigeration mechanics and those who are involved in the organization of refrigeration systems. Accounts of social and technical role, skill and tool use, movement and place-making in work context have shed light upon our understanding of how social and technical interactions are both influenced and influencing the work of refrigeration mechanics. With this sensitivity to user's conditions across culture, we have allowed ourselves to look beyond our limited understanding of the system, and recognize various constraints and opportunities that were shaded by our own cultural perspectives. This approach calls for thinking critically beyond the usability of computer system and finding ways to develop system that matters to users and those who are part of the system organization.

Keywords: Ethnography, User Interface Configuration, and Cross-cultural Issues.

1. INTRODUCTION

Ethnographic research has become important in the design of all kinds of new information systems. *For interactive systems it is vital that designers understand the work setting as a socially organized setting as a preliminary to design. It is in this respect that ethnography has a role to play. In other words, the prime objective is not so much ethnography as such, but ethnography as a means of uncovering the " real world" character of work for systems design* [4].

Here we examine the aspects of similarity and diversity between different cultures through an ethnographic field study approach. But what is ethnographic fieldwork? Even if the term suggests one standard technique, there are many ways of doing it. Fieldwork is a matter of techniques rather than a rigid step-by-step 'how to' prescription. In fact, fieldwork as research is a way of doing something [5] that unites many approaches. The essence of qualitative research is, that it is designed in the doing, as Wolcott [5] puts it about the designers: "*They are intended to allow researchers to follow a suitable course of inquiry rather than to dictate in advance what that course should be*."

2. ETHNOGRAPHIC FIELDWORK

In ethnography and cultural anthropology, fieldwork is mainly associated with the technique of participant observation. Interviewing is either a complement of participant observation or a major facet of it [7]. Bolmberg [8] present four main principles for ethnographic field work:

Natural settings**:** The foundation in ethnography is fieldwork, where you study people in their every day activities.

Holism**:** "Particular behaviors understood in relation to how they are embedded in the social and historical fabric of everyday life." [7]

Descriptive**:** The ethnographers describe what people actually do, not what they should do. No judgments are done.

Members' point of view**:** The ethnographers create an understanding of the world from the point of view of those studied.

In this paper we study and interpret cultural diversity through ethnography based on fieldwork. It provides an account of a particular culture, society, or community. Participant observation in ethnography is best described as a way to "*hang around, talk to folks, and try to get sense of what is going on*" [6].

Our field study research work involves:

1. In-depth interviewing.

2. Conversation with different levels of formality. This involves small talk to long interviews.

3. Problem-oriented research

4. Team research.

3. CASE (1): REFRIGERATION SYSTEM START-UP FIELDSTUDY

Date: September 26, 2005
Location: Netto Store At Rodovre, Denmark
Conducted By: Ingrid Van Rijn and Larisa Sitorus

3a. The Purpose

The purpose of this field study was to capture the process of commissioning/installation of the refrigeration system at a discount store. The task of assigning the controllers is the key concern of this field study.

3b. About The Site: The Netto Store

The Netto store [Figure 1] is a completely new built store. The plant (Control) room is placed in the basement as well as the storage room. The discount store has several showcases low and medium temperature, along with a couple of multi-rack cases. A cold room is placed in the back room on the shop-floor level. There is no freezing room. The store will be equipped with the new AK2 system. All the controllers are placed in a cabinet above the compressors.

Figure 1: The Netto Store

3c. The People

There are several refrigeration mechanics from Vojens Køleteknik and an electrician from the company Zink. A Danfoss technician, Preben Bertelsen, assists the refrigeration mechanics.

3d. Set-Up

The Store has a special compressor combination. For this, Danfoss technical support had made a sticker placed on one of the controllers; it shows the diagram of this special combination. In this combination, there are 5 compressors with 3 different sizes, and can be combined in 7 different ways. This combination works more efficiently in a way that one compressor will continuously run during the day, and have another compressor which would run during the night.

3e. A Faced Problem: Burning Controller

During our observation, we could see that there are several challenges that the technicians faced when interacting with the controller. One of them is to work tediously, making sure that everything is done correctly. Often problems can be caused by wrong positions and connections. The labeling of the controller can be difficult to understand and visualized, since they are poorly positioned. Preben comments on it: **"It is difficult to see the drawings on the bottom of the controller when it is mounted in the cabinet."** As Karl looks at some scheme on a cabinet (made by Jorgen Krause in Germany), Preben tries to remember the compressor Krause had named number 1 and finalize his assumption. As soon as the electrician finishes the last part of the wiring and Karl connects the Dan set module to check some values, they power the cabinet. As all of them except the electrician are outside the control room, the electrician informs them about the smoke coming out of the AK2 controllers [Figure 2]. Karl shuts off the cabinet and disconnects the controller. They try to speculate the cause of the burn. At this point Preben wonders why didn't the other controllers burn. He comments, **"Even though a wire might be connected wrong, and a 230 Volt is sent through, it should not have burnt. Why didn't the other controllers burn."** Preben has an extra controller to replace the burnt controller. Karl then checks the electricity diagrams. He discusses wiring with the electrician and assumes that some wires coming from the dairy case might be mounted incorrectly. He seems to know the numbers of each case while the electrician isn't quite familiar with the numbering and the corresponding cases on the shop floor. The problem is found when they go upstairs to the shop floor. The voltage of two circuits comes in the wrong way, which causes a 400-volt on the triac transistor, which caused it to burn. Now the new controller that Preben brought with him is connected but not mounted to see if it starts smoking. Everything is ok now and then they move on to the process of assigning the controllers.

Figure 2: Smoking Controller

4.CASE (2): FIELDSTUDY OF COMMISSIONING PROCESS AT AIR-CONDITIONING PLANT OF IIT GUWAHATI

Date: April 16, 2006
Location: IIT Guwahati, India
Conducted By: Prashant Dixit and Vikram Batra
Methodology: Interviews, Video Capture, questionnaires

4a. The Purpose

After the field study done at the Netto Store in Denmark, we decided to do a similar study in Indian scenario. The purpose of this study was to observe the cultural diversity and differences when it comes to configuration, commissioning and troubleshooting like activities.

4b. About the Site: Plant at IIT Guwahati

Two years ago, the Blue Star air conditioning plant [Figure 3] at IIT Guwahati, started taking shape. According to the various installation activities, the whole plant can be effectively divided into 3 parts: plant room equipment installations, field equipment installations and BMS [Billing Management System] installation. At the moment we visited the plant, the BMS and plant room installations were completely done and installing/commissioning of the field equipments were going on.

Figure 3: Plant at IIT Guwahati

4c. The People

The head technician is **Abhishek Banerjee** (A mechanical engineer) who is involved in installation, commissioning and handling of the equipment. He has been working with blue star for the last two years. **Shamshuddin,** the electrician is from a company named BKS. He is the in charge of all the wirings in controller, cables, and chiller.

4d. Set up

For this field study, we mainly focused on the two important entities of the plant. One is BMS [Billing Management System] and the other is VFD [Variable Frequency Drive].

(i) VFD: Variable Frequency Drive

VFD [Figure 4] records how much water circulation is taking place in the field and reduces the rpm of the pump. As the rpm reduces, frequency of the pump reduces and power consumption saving takes place. Thus the main function of VFD is power consumption saving. Three cables have been set in the field to measure how many gallons of water is circulation in the field. The cables collect data in BMS [Billing Management System], Danfoss's VFD reduces rpm of the motor by reducing the quantity of water circulation.

Figure 4: Danfoss's VFD

(ii) BMS: Billing Management System
BMS is a software and hardware combination. All the controllers have specific numbering. BMS only understands the specified number of the controller (controller 1, controller 2 etc.). All the commands to the controller are issued through the BMS software on the computer. And the controller can only accept a specific set of commands that have been programmed into it.

4e. A Faced Problem: VFD Signal Conversion
A problem [Figure 5] is being faced during the installation of VFD. To get the correct output a signal voltage has to be converted to amps. Using BMS we can see 3 types of signals in VFD: RPM of the motor, hertz capacity and the run-time of the motor. We could not see the RPM of the motor because voltage was not being converted into amps. So we used resistance to short two points in VFD. Using resistance it got converted into amps and the rpm could then be detected in the BMS

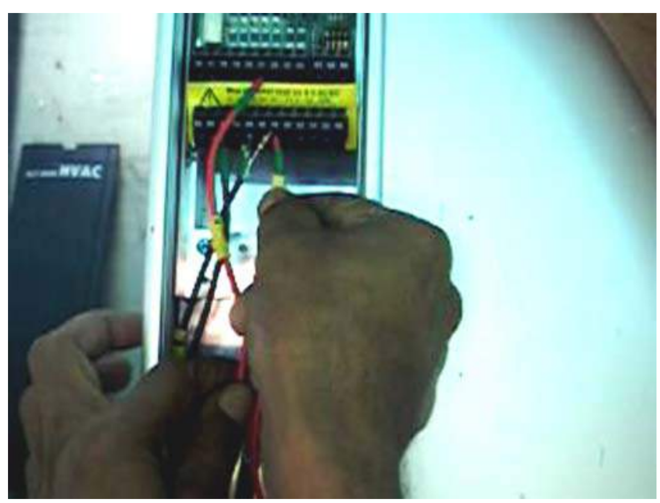

Figure 5: Troubleshooting with the VFD

5. CROSS-CULTURAL COMPARISON FOR THE TWO CASES

In the two culturally diverged case descriptions, we observed certain differences in how people react while facing a problem in activities like configuring the equipments, assigning the controllers and commissioning the refrigeration system. In the case of Indian plant we observed that the main problems are of communication [Figure 6] and unskilled labors. Unskilled labors do not seem to have problems in installation stages, but in different commissioning stages namely air balancing, water balancing (water sloping) they find themselves helpless since those unskilled labors barely know the technical side of entire plant and its architecture. The multilingual society of India causes the problem of communication between the head engineers and the technicians working under them. Most of the time we see that the engineer and technician or workers belong to different origins and thus their mother languages differ from each other. Here we present a comparison diagram [Figure 7] to show how the relationships between people and their roles, people and interaction happening between them, tools and artifacts that they use, vary from one culture to another when it comes to interacting with refrigeration mechanics

Figure 6: Problems with Communication

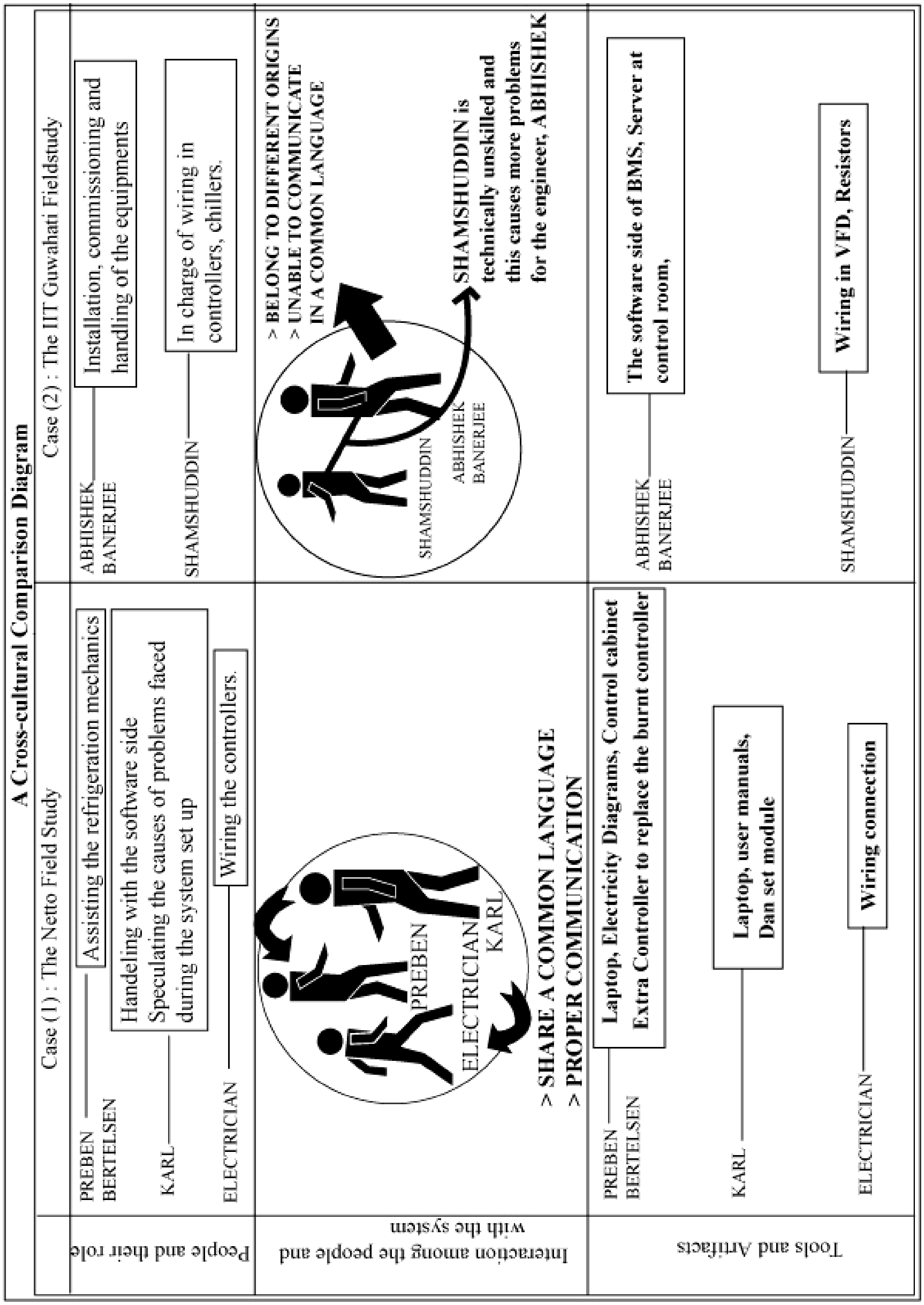

Figure 7: Comparison Diagram

6. DESIGN IMPLICATIONS

The practice of configuration involves multiple user-product interfaces, movement between differing working processes, and an ability to adapt skilled practices to a changing environment. Some of the preliminary findings about the configuration practice include:

- Configuration is a specialist job. Digital refrigeration controllers are still rare in most of the world. Often configuration is performed by a company employed field technician, who then trains a contractor in the process. Many contractors still prefer manual systems, which - though providing limited flexibility - offer more integrity
- Configuration requires preparation. The field technicians need to carefully inspect the site and the completed installations. They rely not only on the service tool software to configure the system, they also use manuals, personal notes, sketches, layout plans, wiring diagrams, and the user interfaces of the controllers.
- Diagnosing a configuration problem is tricky: It involves checking wiring and conditions of the hardware, rechecking the entered parameters, and running the system through manual simulation. Finding the cause to a problem is a tedious task, going through many trials and errors. It takes time to make sense of an entire plant.
- Configuration isn't only a technical task. It involves nurturing social relationships. Field technicians act as trainers for contractors or customer employed technicians. Due to their extensive customer contact field technicians earn customer trust, and in effect act as a mediators between customer and the company.

At the outset, configuration is a compromise between customer interest in tailored systems and manufacturer interest in mass production. To design the user interface for a good configuration solution, however, is also a question of negotiating conflicting views of the configuration job: Its purpose and its practice.

Our findings suggest that embedded configuration, in an attempt to embody the interconnectedness of relations underlying current configuration practice, raises a number of important questions for discussion: In what ways do today's physical and digital interfaces support user interaction? To what level of automation should embedded configuration be implemented? How would such a system impact upon the everyday work practices of technicians? And if not a fully automated embedded configuration, what role could a user interface design play in enhancing the embodied skills of human users?

By working across differing knowledge traditions, we aim to understand the similarities and differences in working processes, as a way of opening up a dialogue between various practitioners in the design project. In our case, we have seen the intricateness of cultural influences in the practice of refrigeration mechanics. Further decisions in the design process need to be based on a collaborative awareness and understanding of the practice of the users. From this study, we have argued that there is a crucial need to looking further into the ways culture influences the process in which skills and knowledge are communicated and gained through bodily and social interaction. In our research, we aim to research further into the possibilities of design in supporting learning and skill-gaining interactions among technicians during configuration practices.

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A Study of Culturally Rooted Barriers Affecting Mobile Usage among Indian Women

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ABSTRACT

The mobile phone has become ubiquitous in India like elsewhere in the world. While the youth has readily adapted to the device and find themselves at ease using it, the middle age population has difficulty in its usage.

This paper studies the barriers that inhibit the middle-age Indian women from adapting to the usage of mobile phone. The relationship between these barriers and their possible cultural roots if any is the focus of this study.

A survey was done to elicit information from 30 Indian women in the age group 35 to 55. Interviews, photo documentation and task analysis were adopted. The questionnaire was framed to connect the perceived barriers to cultural origins and was conducted in the interview mode.

The results indicate that cultural dimensions such as masculinity vs femininity,, absence of individualistic perspective and economic dependence (in case of non-working Indian women) do play a part in creating barriers that prevent easy adaptation to the mobile phone.

KEYWORDS: culturally rooted barriers, mobile phone usability.

INTRODUCTION

The profile of the urban, middle class Indian woman has undergone significant change in the past decade. While on one hand there has been a significant rise in the number of women leading an active professional life, in the home front too, she has emerged as a key decision maker in all family matters. Statistics reveal that 11.5% of the Indian population comprises of working women (according to *Tracing a Timeline for Work and Family Research in India* by *Ujvala Rajadhyaksha, Swati Smita).* An idea about the percentage of working Indian urban women belonging to the age group of 36 and above can be quoted from the research done by *South Asian Research & Development Initiative [SARDI]* on conditions of working women that in metro cities like Pune and Delhi 54% of working women are above 36 years of age.

At home she plays multiple roles of a resource manager, budget planner, teacher to the children etc besides performing day to day household chores. This ensures that even the contemporary housewife is not confined within the premises of the house but needs to travel on a regular basis, often alone.

In most Indian families household work is still regarded as predominantly a woman's prerogative - an attitude that is undergoing a slow change. Due to this culturally rooted mindset, most middle class Indian women, working or otherwise, find themselves occupied most of the time with little time to spare for themselves.

The century old mental conditioning of placing family and specially children over oneself that is still prominent in middle aged Indian women due to which they place their own desires and recreation at a lower priority level than those of their family members. Most decisions are made with the welfare of the family and children as the topmost criteria *(High Collectivism)*.

This "mental conditioning" at times even becomes a cause for a low confidence level in them and they often tend to underestimate their own abilities. There is a marked reluctance towards spending either time or money on themselves and this is more pronounced in women who are economically dependent. A “calculative” mentality with respect to time and money is noted in most women of the focus group and decisions are made more with long term goals in mind rather than immediate benefits *(Long Term Orientation)*.

CULTURALLY ROOTED BARRIERS

The term “**Cultural Barriers**” refers to the mindsets, attitudes and perceptions of a group of people, determined by certain factors in the upbringing and the social environment which may create a hindrance in their usage of the mobile phone.

Referring to an article in Forum.Nokia.com *(Ref: Tip of the Month Usability)*, Culture shapes the development of values and beliefs and therefore influences interaction with a product.

All cultural factors that contribute in forming an erroneous mental model of the mobile phone and its usage create barriers or hindrances for the user in understanding the device.

The ease of adaptability with the mobile phone interface is dependent on the following parameters:

- •Explorative learning or learning by hit and trial - The more a user is comfortable with these methods of learning, the easier does he/ she finds the usage.
- •This in turn is governed by the “urge to explore” the device which depends on how much a person feels its need or is attracted to it.
- •The user not being afraid to commit errors in the process of learning and not losing patience after one or two failed attempts to achieve a task.

These parameters are often culture dependent and determined by the “learning model” a person is exposed to since childhood.

For instance, in high Power Distance culture, learning is more through following of instructions rather than exploring and the consequences of committing errors are often serious. Such factors hinder the development of explorative traits in a person and can be a potential “cultural barrier” in the usage of mobile phone.

EXPERIMENT

Based on a discussion among the authors and study of existing researches and articles on urban Indian women an intuitive list was prepared of cultural elements that could be possible barriers to the use of mobile phone among the focus group. Prominent among these were

- •**A lack of an individualistic perspective** - The mobile phone is perceived as a highly personalized device. This may not be compatible with the family orientation that is a characteristic of most middle aged Indian women.
- •**Technophobia** causing a general resistance to any change that could disturb the existing equilibrium or comfort zone (e.g. mobile phone taking up most of the time and attention of the children that they would otherwise give to their parents)
- •**Discomfort with typing** and the **English language** given that mobile interfaces with regional languages are hardly prevalent.
- •Perception of the mobile as ”**expensive**”, “**belonging to someone else**”, in case of economically dependent women which prevented them from exploring it or “playing” with it.
- •**Accepting ageing with ease** - The social insecurity associated with old age in the western part of the world is much less pronounced in India. People, therefore, do not feel the urge to keep themselves “updated” by using latest technologies or other “youth products” to be considered at par with the younger generation.

An experiment was conducted on 30 urban middle class women in the age group 35-55 in order to verify the intuitive list of cultural barriers and also identify any other cultural barrier which might come out through the experiment. The experiment comprised interviews and task analysis. The women chosen for the interview were all familiar with the mobile phone and had easy access to it.

METHODOLOGY

The interviewees were graduates, comprised both working women and housewives and were used to electronic gadgets like TV, music system, washing machine etc. Most of them were users of mobile phones that belonged to their family members or to them or at least had easy access to it.

In the first stage an informal interview was conducted with around 20 women to find their general attitude towards the mobile phone. Next, a questionnaire was prepared aiming at judging their familiarity with the device, their priorities, preferences and level of acceptance towards new technology.

The questionnaire was carried out in the interview mode and was supplemented by task analysis where the user was asked to perform simple tasks like storing a number or setting the time using an unfamiliar model.

The following variables were noted:

- **Whether the task could be completed** - the fundamental condition for effectiveness.
- **Number of errors and if they could be rectified -** a measure of learnability.
- **Number of requests for assistance** - the perceived difficulty level.
- **Time taken** - a measure of efficiency.

A subjective evaluation of the focus group was made on the basis of Hofstede's cultural dimensions:

- **Power Distance** - *Towards High*

  Though the women interviewed do not perceive themselves to be "under someone" in the household domain, a strong adherence to social norms, and in case of non- working women, a feeling of dependence have similar effects as high power distance.
- **Individualism vs Collectivism** - *High on Collectivism*

  Family given higher priority than self.
- **Masculinity vs Femininity** - Family and relationships given more priority than goal orientation, distinct division of roles on the basis of gender observed.
- **Uncertainty Avoidance** - *Medium*

  The subjects preferred to be in a "comfort zone" or the realm that they are familiar with, but were otherwise not apprehensive of uncertainty.
- **Long vs Short Term Orientation** - *Long Term Orientation*

  Decisions are based mostly with long term implications in mind

These evaluations differ from those made by *Hofstede* through the study of workplace culture in India since the focus group chosen is different.

The data collected from the questionnaire and task analysis was then analyzed to identify problems that the focus group faced with the usage of the mobile phone and their possible cultural origins.

Data was collected from the interviews under the following categories:

1. **Perception of a mobile phone** - Whether they considered it to be simply a "mobile phone" providing connectivity or a multifunctional device also whether they felt it was a necessity or a luxury.
2. Their willingness to **adapt to new technologies** and learn to use new gadgets.
3. Views regarding the **social impact** of the mobile.
4. Frequency of use of the mobile and for what functions.
5. General perception of pastime and entertainment.

DATA COLLECTED

Interviews were conducted through questionnaire with 30 women of age between 35-50. The data collected was as follows:-

Perception of a Mobile Phone	•24 out of 30 women perceived mobile as a connectivity device whereas 6 perceived it as multifunctional.
Willingness to Adapt to New Technologies	•Users were open to the idea of learning the use of new gadgets. •12 out of 30 said they would be willing to replace their music system with an i-pod. 9 were ready to use i-pod but without replacing their old music system and 9 were unwilling to use an i-pod instead of their old system. •All 30 participants said that learning to use a new microwave or washing machine was considered important. •For learning, users preferred to be instructed by someone already using the gadget. •Manuals were the second preference. •Explorative learning is considered time consuming and is used only as a supplementary learning method along with the above two.
Social Impact of Mobile	•Social impact of mobile was not perceived as detrimental •All wanted their children to have one after 12th standard. •All were of the view that photography is not a bad feature •They did not hold the view that mobile usage induced individualist culture" or "spoiled" the youth.
General Perception of Pastime and Entertainment	•All the women preferred spending time with their families in free time or if they were alone listening to music or reading novels, books, magazines was preferred.
Frequency of Various Functions Used in a Mobile	Calls: Used daily. SMSs: Only for passing necessary information Used very rarely by housewives. Radio: Preferred by all. Camera: All like the feature but want others to accomplish the task for them. Alarm: 8 used daily and 22 used only when alarm clock was not working. Recorder: Used occasionally by working women. Housewives wanted other members of the family to the task for them in case they wanted to use the feature.

Table 1.1

TASK ANALYSIS

Task analysis was done on 10 women of age between 40-45.

•4 were working women.
•6 were non-working.
•All three tasks could be accomplished by 3 working women.
•Out of the four, one was able to complete the task of saving a number in the phonebook with continuous guidance.

•The women in non-working group required help at every step and finally gave up without accomplishing any task.

•Model used for task analysis Nokia 6600 and Nokia 2100.

In Nokia 6600 all participants faced difficulty mainly with the joy stick and finding the menu button, call receiving and call ending buttons. They were finding the hardware interface complicated but once entering the main menu they found the software interface friendly.

In Nokia 2100 participants found it difficult to understand the functions of the arrow keys as navigation and list browsing tools. Users faced problems with browsing lists as the items appeared one at a time.

The details of the 3 working women who could accomplish the task is as follows:-

Saving a number in the phonebook	•The Task could be accomplished in 10 to 12 minutes. •3-4 times help was requested. •4-5 errors which were rectified by them.
Setting date and time	•Task could be accomplished in 8 to 10 minutes. •1-2 times assistance was requested. •2-3 errors encountered which were rectified.
Setting alarm	•Task could be accomplished in 5-6 minutes. •1-2 times assistance was requested. •2-3 errors were encountered which were rectified.

Table 1.2

ANALYSIS

Perception of the mobile phone - "Connectivity" is the keyword associated with the mobile phone and most users interviewed perceive it as primarily a phone rather than a multi-utility device.

Its necessity is acknowledged by all. It is seen as an essential communication tool which helps them to keep in touch with friends and relatives. The concept of mobile phone as a mark of identity or fashion statement is not very relevant for the focus group.

Acceptance of new technology - Users were open to the use of new technology products. However there is a level of difficulty associated with the learning of new gadgets and some input in terms of time and effort required. The women interviewed treated this requirement as a sort of "investment" and therefore were willing to make an effort to learn only those devices that were perceived as useful and for which the time and effort would be worthwhile.

For instance, a new microwave is more likely to be learned and used by them because it is considered beneficial for the entire family. Learning to use the mobile phone beyond its essential functions was not considered necessary by most.

While learning a new device, taking help from someone (friend or family member) who is already familiar with its use is the most preferred mode, followed by manuals. Explorative learning is not preferred by most as it is "time taking".

Views regarding social impact of the mobile- Contrary to the intuitive list, almost all the women interviewed were positive about the social impact of the mobile phone and considered it an essential and desirable social tool. They did not view it as synonymous with "materialist culture" or "individualistic culture".

The prominent misuse of the mobile as perceived by them is the waste of money through unnecessary calls and messages by the children and youth. A certain level of maturity and responsibility was associated with the proper use of the mobile as indicated by the unanimous view that children should be given a mobile only after a certain age (16-17).

Frequency of use of mobile phones and for what functions - Here, a marked difference is seen between working women and housewives. Housewives seldom use the device except to make calls.

- Messages are sent on specific purpose to convey information or instructions and more recently, for SMS polling and not as instant messaging. For chatting or informal conversations calls were preferred over SMS. This can be attributed to difficulty in typing with the mobile keypads with more than one character assigned to each key.
- Other functions of the mobile are used less frequently. This observation emphasizes the fact that mobile is used more as a necessary tool than a re-creational device by the focus group.
- **Gaming** as a pastime is not a preferred option.
- It is to be noted that most of the women interviewed perceived mobile usage as a “skill” which is to be “learned” and requires “practice”. A general fear of damaging the device or making accidental calls/ SMSs also deters them from freely exploring it. Since the value attached to money is high and wastefulness is not appreciated, errors are perceived as “costly”.
- Mobile use is considerably higher in case of women living away from their families as it acts as the only connection between them and their families.
- In some cases language also forms a barrier as interfaces in regional languages are seldom used.

General idea of entertainment and pastime - Preference is given to modes of entertainment that bring the family together such as watching television, spending time with kids etc.. When alone (e.g. in a journey or waiting at a dispensary), they preferred books, magazines or music.

- Mobile gaming was used by some women simply due to non availability of better forms of recreation.
- Most women attach a low importance to their own re-creation and hobbies and usually devote the free time to family/ children *(Collectivism)*. This is in concurrence with the data gathered by a 2006 study of 375 working women across seven cities by global market research company, *Synovate*, which shows that an overwhelming majority - 45 per cent-said their idea of leisure is to spend time with their children.

TASK ANALYSIS

Here again marked differences were observed between the performance of working women who used the mobile phone on a regular basis and most housewives who used it occasionally.

Most faced great difficulty with the usage with respect to the following:

- Use of arrow keys for list browsing and changing screen (Nokia 2100).
- Joystick (Nokia 6600)
- Menu button (Nokia 6600)

•Extreme brevity of instructions.

Users relied heavily on instructions and asked a lot of questions. Confidence on own intuitions were low and most actions were verified before being performed *(Uncertainty Avoidance)*.

Vocal instructions were preferred over written.

DISCUSSIONS

The aim of this paper is to find correlation between the results of the experiment and the intuitive list of cultural barriers to the usage of mobile phone and also to identify any other cultural barrier that was not foreseen.

From the experiments conducted, the most prominent cultural barriers to the use of mobile phone are the mindset of attaching a low priority to self and a calculative mentality towards time and money.

The over-emphasis on the virtues of "obedience" and "conformity to social norms" which are prevalent in the Indian society particularly in regards to women has a strong influence on the shaping of the mindset of women of the specified age group. Added to this is the education model in India which relies more on following instructions than free experimentations.

All these factors contribute to low self-esteem in women and a tendency to rely on others and placing the family above themselves. The observed over-dependence on instructions for learning can also be attributed to the same cause.

Owing to a general respect for money and a mentality of valuing every object, wastefulness is looked down upon. This creates a hindrance in exploring the mobile or "playing with it" for the fear of damage. **Techno fright** due to the lack of understanding of devices is also a major cause in several cases.

However, no results were found to indicate resistance to new technology or unwillingness to adapt to changing scenarios.

The experiment could not successfully verify the factor of comfort with ageing being influential in mobile usage, but with appropriate experimentations it might be verified.

Referring to the paper titled *"Culture and International Usability Testing: The Effects of Culture in Structured Interviews"* by *Ravikiran Vatrapu* and *Manuel A. Pérez-Quiñones* in countries with high power distance like India, interviewees are reluctant to report negative feelings openly to the interviewer. Keeping this fact in mind, it may be argued that some of the results obtained through the interviews could have been biased.

For instance, responses to questions regarding acceptance of new technology might have been governed by the interviewee's perception of the "right response" and not necessarily the truth.

The same is applicable for responses regarding negative impacts of the mobile.

CONCLUSION AND IMPLICATIONS

The results of the experiment and the subsequent analysis indicate that the following cultural factors do create barriers to the usage of mobile phones for middle aged urban Indian women:-

•Lack of individualistic perspective or high collectivistic traits
•A "calculative mentality" towards resources driven by long term orientation.
•Preference for instructional learning rather than explorative learning due to factors of upbringing which glorify virtues of "obedience" *(High Power Distance).*
•Low confidence and tendency to depend on others.

Researches on culture dependence of mobile usability *(Ref: Forum.Nokia.com article Tip of the Month Usability, Culturally Speaking)* indicate that effectiveness of mobile applications are culture dependent.

For future mobile phone interfaces to reach out easily to the focus group of this paper, it would be beneficial to incorporate the following features or characteristics:-

- •Inclusion of lesser number of functions such as essential features like SMS, phone book etc ..
- •Orienting the concept of mobile entertainment to appeal to the focus group such as radio, music etc. Introducing e-books as a form of mobile entertainment is likely to be received well.
- •Explicit instructions in the interface both text and graphics. Voice-overs are likely to enhance the usability of interfaces in a culture where spoken instructions are more easily understood than textual.
- •Complete keypads for SMS with one character ascertained to one key.

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ANNEXURE

QUESTIONNAIRE

1) How do you perceive your mobile phone? *(as just a connectivity device or a multifunctional device)*

2) Do you consider owning mobile phone a necessity?

3) Do you participate in SMS polling?

4) How often do you message your relatives, friends or others?

5) Would you like to replace your old music system for an i-pod?

6) At what age would you prefer giving your child a mobile phone?

7) Do you think that mobile phone induces individualist or materialistic culture in the youth or diverts their attention from academics and socializing? Do you perceive the mobile as something detrimental to the culture and society?

8) How do you perceive the feature of camera in a mobile phone?

9) What do you prefer doing in your free time?

10) What do you prefer doing in free time when away from family for instance on a journey alone or while waiting at a dispensary?
i) Books/ Magazines
ii) Music
iii) Exploring mobile phone
iv) Puzzles/ Games
v) Others *(specify)*

11) Would you prefer to have your regional language in the mobile interface instead of English?

12) If you are gifted a new device which you are not familiar with would you
i) take time and effort to learn to use it.
ii) give it to a friend/family member who can use it better.

13) What do you prefer for learning the functions of a new device/ gadget
i) Reading the manual
ii) Exploring yourself.
iii) Guided by someone who is already familiar with its functioning.

14) If you had an option of choosing one out of two gifts which one would you prefer *(suppose that all three have the same price value)*
i) Mobile phone for yourself.
ii) Microwave for home.
iii) Jewellery for yourself.

15) How often do you buy something just for yourself out of desire?

16) Would you prefer to send and receive hand written messages to typed text?

Website Navigation Systems on the World Wide Web for Indian Cultures

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Abstract

Vast amount of information is available on the Net in the form of Documents whether they are Pdf files, Word Files or as HTML files. The resources of information are various websites that have the target user groups which may be cultural specific or may not be cultural specific. They all contribute to the information systems in various working environments especially in the trade environments and information exchanges over the industrial communication.

These websites have to convey the information relevant to their target user in an efficient way by incorporating able navigation and visual systems like buttons, menus, text, color, hyperlinks, sounds , animations and graphics.

The paper highlights the website navigation systems and their psychology and perception by cross-cultural people of India who have different qualifying levels of education.
We have studied these cultural dimensions of the varied target groups of users that are from India and have also derived carefully the results that have been accumulated by a series of tests through usability pattern data on the visual ergonomics and various interrogations done on a wide range of users.

Thereafter, the paper converges on conclusions i.e. viable Graphical User Interfaces based on Cross-Cultural Differences. The cognitive patterns thus developed have been documented and form a part of the paper presentation.

Introduction – Website Navigation

Navigation design is about predicting the actions of your site's users and building a site that will support them. In order to do this, you have to understand your audience's goals and needs.

Finding out about users' goals and needs means talking to the people who will be using the site. If it's an intranet, build in a discovery phase in order to spend time talking with employees about their daily activities. Or if it's a commercial site, talk to potential customers. Ask them to use and rate other stores. Find out what they like and don't like, and try to get at the goals behind their comments. Real solutions have to be uncovered, not constructed, and talking to your audience is the fastest way to ferret them out.

Navigation should tell people where they are, and if possible, where they've been. Users should also be able to tell easily what is linked or clickable and what is not.

Our findings have been confirmed in independent studies by several others. This is truly a general phenomenon that characterizes user behavior across sites and studies. The findings are as follows :

1. Users comment on the content first; if the content is not relevant, then they don't care about any other aspect of the design
when they arrive on a page, users ignore navigation bars and other global design elements: instead they look only at the content area of the page.

2. Users don't understand where they are in a website's information architecture.

3. Users are extremely goal-driven and look only for the one thing they have in mind - they don't spend much time on promotions for anything else.

4. Users rarely look at logos, mission statements, slogans, or any other elements they consider fluff (in particular, they ignore advertising and anything that looks like an ad)

5. If a page does not appear relevant to the user's current goals, then the user will ruthlessly click the Back button after two to three seconds.

6. If users don't understand a certain design element, they don't spend time learning it - instead, they ignore it and continue the hunt for their own goal.

Navigation Issues

First of all, let us see the various cultural sections in the society of India based on their individual professions, and also based on their classfication as regards to their age groups, their working fields and also their qualification levels where we do not consider the job scenarios after academic qualification.

The Indian society is full of people from different religions and it consists of people from various backgrounds even in the same religion. In the world of today, where there are no communal conflicts between people as far as education is concerned, we have children from each and every religion studying together.

Children Specific Navigational Issues

Children begin their quest through knowledge by basic schooling running right through until they graduate and further engage into post-graduation. Their minds go through a series of development processes and hence have varying modes of perception of websites related to them.

Teens in our study reported using the Internet for:

- School assignments
- Hobbies or other special interests
- Entertainment (including music and games)
- News
- Learning about health issues that they're too embarrassed to talk about
- E-commerce

These kinds of websites are the only ones that are a requirement for children.

The idea that children are masters of technology and can defeat any computer-related difficulty is a myth. Our study found that children are incapable of overcoming many usability problems. Also, poor usability, combined with kids' lack of patience in the face of complexity, resulted in many simply leaving websites.

Age-Appropriate Content

Extensive text was problematic for young children, who are just beginning to read. We observed severe usability problems when kids were inadvertently thrown into sections that were written above their current reading level.
Also, kids are keenly aware of their age and differentiate sharply between material that is appropriate for them and material for older or younger kids, however close in age they might be.

Differences between Children and Adult Users

Our usability findings for kids often differed from those we typically find when testing adult users. Some of the more striking differences were:

- Children were willing to "mine-sweep," scrubbing the screen with the mouse either to find clickable areas or simply to enjoy the sound effects that different screen elements played.
- Geographic navigation metaphors worked: Kids liked the pictures of rooms, villages, 3D maps, or other simulated environments that served as an overview and entry point to various site or subsite features.
- Children rarely scrolled pages and mainly interacted with information that was visible above the fold. (We also observed this behavior among adult Web users in 1994, but our more recent studies show that adults now tend to scroll Web pages.)
- Animation and sound effects were positive design elements for children; they often created a good first impression that encouraged users to stay with a site.
- Half of our young users were willing to read instructions; indeed, they often preferred to read a paragraph or so of instructions before starting a new game. In contrast, most adult users hate instructions and try to use websites without having to read about what they are supposed to do.

Most of these differences are related to differences in the online activities of children and adults. Diverse design elements and multimedia effects tend to work for children. Unlike adults, who typically use the Web in business settings and for goal-oriented tasks, children often use the Web for entertainment, though older kids also use it for schoolwork and community.

	Animation and sound effects	Mine sweeping for links	Advertising	Scrolling	Reading
Kids	🙂	🙂	🙂	☹	☹
Teens	😐	☹	😐	😐	☹
Adults	☹	☹	☹	🙂	😐

Key:

🙂 Enjoyable, interesting, and appealing, or users can easily adjust to it.

😐 Users might appreciate it to some extent, but overuse can be problematic.

☹ Users dislike it, don't do it, or find it difficult to operate.

Several types of classic Web usability problems causing difficulties for the kids are as follows :

- Unclear navigational confirmation of the user's location confused users both within sites and when leaving them.

- Inconsistent navigation options, where the same destination was referred to in different ways, caused users to visit the same feature repeatedly, because they didn't know they had already been there.

- Non-standard interaction techniques caused predictable problems, such as making it impossible for users to select their preferred game using a "games machine."

- Lack of perceived clickability affordances, such as overly flat graphics, caused users to miss features because they overlooked the links.

- Fancy wording in interfaces confused users and prevented them from understanding the available choices.

Conclusion

Children want content that is entertaining, funny, colorful, and uses multimedia effects. However, for homepage design and navigation systems, the user interface should be unobtrusive and let kids get to the content as simply as possible. Children enjoy exploration and games, but it should not be a challenge to operate the website itself. The content should be cool, but the design must offer high usability or kids will go elsewhere.

Navigational Issues – Gender Differences

In this study, we found big differences between boys and girls. Boys were significantly more annoyed by verbose pages than were girls, possibly because at teenage, boys are not as accomplished at reading as girls. In contrast, girls complained much more than boys when sites lacked good instructions. Also, boys spent more time alone with computers, and girls spent more time using computers with a parent.

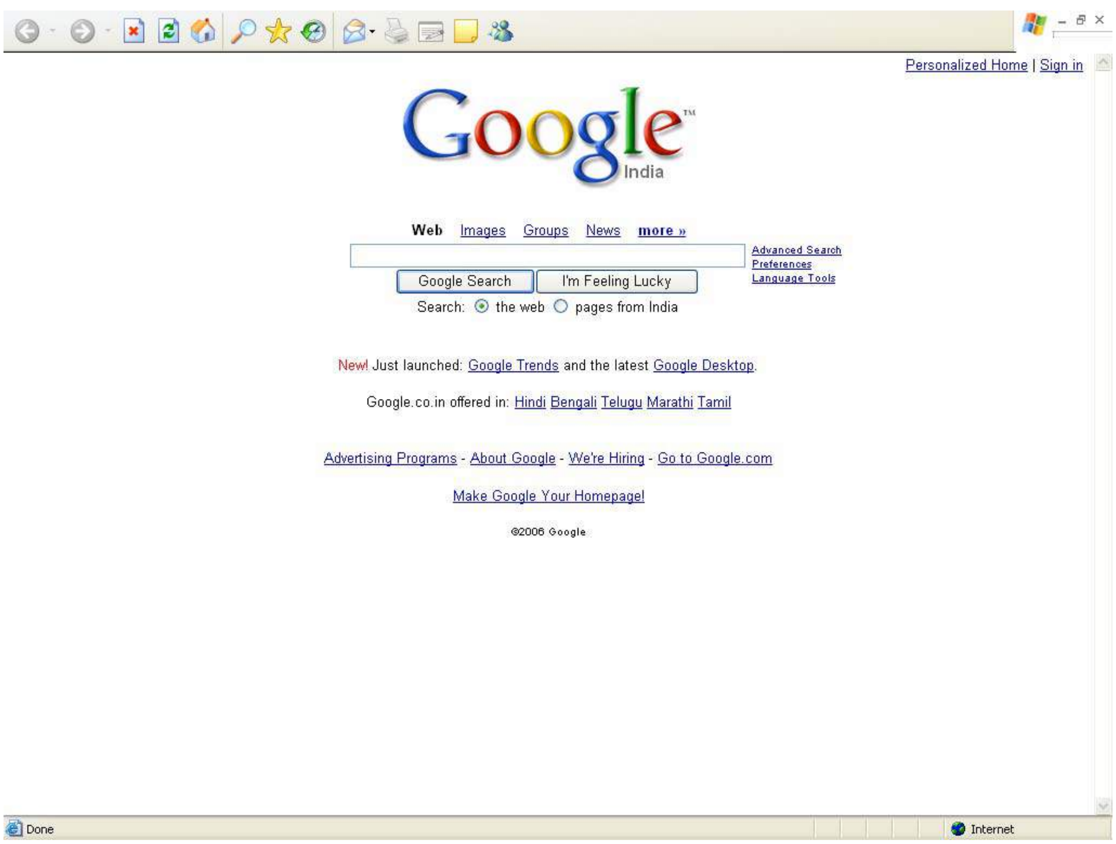
Nonetheless, we strongly recommend that anyone planning to run usability studies with children strive to include equal numbers of boys and girls. When studying adult users, we always try to include a reasonable representation of both genders, but the numbers need not be identical. Although men and women sometimes differ in the type of content that interests them, in terms of interaction design, the big issue is bridging the gap between humans and computers -- not how to accommodate the comparatively smaller differences between the genders. For kids, however, the differences are bigger and thus there is a greater need for a balanced set of test participants.

Adult Navigational Issues

Adult navigation issues are those issues where apart from the issues already mentioned that are related to age differences have been included besides other facts that vary on a plethora of fields like their profession pattern, their working platforms, their language orientations and many other occasional factors like visual impairment. An important issue can be the organization of website navigation according to the people of villages who need to be imparted education related to basic agriculture techniques and the latest of technologies coming into the field. We discuss all these issues on the basis of experiments that many have done and the studies that we carried out.

Linguistic Patterns : The languages spoken in India are extremely large in number and each sect speaks a different dialect. However, there are hardly a handful of websites that account for this variation in the languages.

Lets take an example of Google.com which provides a platform for users to gain accces to information on the net in the language that they are comfortable.



Here we can see the option given to the users for India to access the websites in the language that they wish. While this is a positive sign for the designing of website navigation, most of the Indian specific websites offer no such provision which ultimately proves to be an hindrance in the usability of their websites and therefore, they end up being deprived of serving the purposes that they were made for.

Website navigation issues for Villagers : It is known that more than 50% of the population of India resides in the underdeveloped areas of the country or being more specific, villages. The people here earn their living by India's biggest industry – Agriculture. People have to be educated for this profession and this job is done by the Government of India by taking many measures. Although government appoints official s for training the villagers, still spreading e-learning is a very viable option. But the villagers who are hardly aware of this mode of knowledge need to be made accustomed to such a tool for learning and therefore integrating them with the mainstream of the Indian industries spread in the townships and the metropolitans. There has been a rapid rise in such ventures in our country in the recent past.

With the launching of these kind of websites, the designers have to take care that the websites are made for the illiterate part of the population of India and there has to be just the proper type of navigational accessibility for the target users in these websites.

There have to appropriate number of Images or more appropriately visuals to describe what every option in a webpage indicates because though the websites will be designed for languages that those people speak but since illiteracy rate is high in such areas, there have to be visuals supporting the text and that too, neat and clear so that the farmers would not run away from the webpages thinking that the pages are of no utility to them and they could gain much more by oral imparting of knowledge.

Inference

What we emphasize is that website is an interface with a huge chunk of data on one hand and a user with his own perceptions on the other and so to communicate the message, we insist that the data should be presented in a user-specific way. Culture differences may range from gender specific to age specific and also to qualification specific. So to get to that target user, the website designers should present data on the web not in a way that they want to, but in a way that the target group of users would want to attain information from the web – a goal shared by all usability experts.

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Cultural factors influencing interface design used by Indian youth

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Abstract
Indian cultural integrity and cross cultural influences may infuse a selective approach to browsing particularly among the youth. We assume that Indian youth are influenced by customs, nature, music, festivals, making and keeping relationships and more specifically to cricket, matrimonial, bollywood, astrology, finance as interest areas. The reactions to these areas are culturally conditioned.

This paper intends to look at the factors which influence interface design for Indian youth and suggestions for an interface which suits them. It gives a brief overview of the internet usage as such and the elements on the page i.e. colour, language, icons, images, content, page layout which influence the youth.

Information for the above study was collected by a designed survey through internet and personal interviews of Indian youth belonging to age group 18-30 years. The response of around 50 people belonging to the above mentioned age group was collected through recording and analyzed.
The findings of this paper can have their applications in HCI design.

Introduction
With internet usage in India increasing at tremendous speed there is a need to address the Indian population in terms of interface designed specially for them. There has been a growth in usage by 912% in 2005 as compared to 2000 [9].
Also, the population of youth in India which is presently 540 million [10] is increasing with time, but very few efforts have been made to study the elements which make an interface/ web page appropriate for youth. This paper is an attempt to answer this need by taking account of the elements of an interface and then molding these elements to best suit the youth. We recognized the elements as colours, text and language, images, icons and other factors (flow and content).
While text and formats, are elements that designers commonly think of while being specific to address a target group, the remaining items however, are generally overlooked [4].

Literature search
We initially tried to find out studies, researches done on Interface design for youth. We could'nt find many researches. We studied previous researches done on website for teens. We went through previous papers based on cultural factors that influence interface design. Findings in these papers were interesting, useful and created a base for our study. Previous findings like significance of colours in different cultures helped us to compare those finding with our findings.
Statistics of previous surveys done on browsing habits, youth population, Internet users

helped us to collect numerical data being analysed and collected at a macro level.
Then we looked for literature on Indian culture, We found an interesting article in a local newspaper in which results of a general study on Indian youth were mentioned.
We went through papers on internationalization of an interface, that helped us to understand cross cultural issues that should be taken care of while designing an interface.
In our literature search we could not find any previous study done on “Interface design for Indian youth”.

Methodology
About 50 people (age group 18-30) from all parts of India were approached through mails and mutual friends and they were encouraged to fill up our online questionnaire. We got replies from youth belonging to varied parts of India; to name them, Western, Eastern, Northern, Southern and Central India. Among these maximum (24%) subjects belonged western India.
Questionnaire was balanced with both objective as well as free text questions.
There were 4 main topics 1) Questions to test “Indianism” of subject 2) Questions to test academic and personal dimension of subject 3)To get information about interest areas of subject and 4) Questions that will help us to understand the way young people are using internet.
It is very important take account of Indianism of a subject, Indianism means to note whether the subject is more influenced by Indian culture or by western culture, to test this questions like what is your favourite festival? How many years of your life have you spent with your grandparents? were asked
Questions like Aim in your life, Academic qualification, Do you discuss sex related matters with your parents? were asked to get an overview of personal and academic side of subject.
Hobbies, type of music they like to listen, favourite colour, food, sport, finance and astrology based questions were asked to know their interest areas.
Do they access local language site, if yes, are they effective? are they required? Do they participate in online competition, E-business? What type of sites do they access? These questions helped us to understand browsing habits of Indian youth.
Some questions like significance of Indian festivals, What would they do if offered 1 crore rupees? were also asked. These questions helped us indirectly in making out conclusions.

Based on the above methodology, in this paper we ascertain the important elements responsible for an interface to be friendly for the Indian youth and the cultural factors influencing these elements. Most of the findings of the paper deals with the conceptions of the Indian youth but can be generalized to certain extent in order to find a solution to interface design for Indians as a whole. The findings are categorized as colours, language and text, background music, images, icons and other factors. These findings are as bellow,

Colours
Colour can form the basis of a universal system of symbolism that goes beyond the narrow confines of language. According to Murch, a well-known human factors researcher, “Colour can be a powerful tool to improve the usefulness of an information display in a wide variety of areas if colour is used properly. Conversely, the inappropriate use of colour can seriously reduce the functionality of a display system.” [1]
Table1. Cultural association of colour (adopted from [4])

Culture	Red	Blue	Green	Yellow	White
United States	Danger	Masculinity	Safety	Cowardice	Purity
France	Aristocracy	Freedom, peace	Criminality	Temporary	Neutrality
Egypt	Death	Virtue, Faith, Truth	Fertility, Strength	Happiness, Prosperity	Joy
India	Life, Creativity		Prosperity, Fertility	Success	Death, Purity
Japan	Anger, Danger	Villainy	Future, Youth, Energy	Grace, Nobility	Death
China	Happiness	Heavens, Clouds	Ming dynasty Heavens, Clouds	Birth, Wealth, Power	Death, Purity
***Indian youth**	**Love**	**Cool**	**Nature**	**Bright**	**Peace, Purity**

* According to the data interpretation of the conducted survey.

Some effective suggestions regarding usage of colour made by Marcus [2] which should be incorporated while designing an interface are:

1. Use blue as background (same as the favourite colour of Indian youth)
2. Use spectral color sequence (red, orange, yellow, green, blue, indigo, violet)
3. Keep the number of colors small
4. Avoid using adjacent colors that differ only in amount of pure blues
5. Use bright colors for danger or for getting the user's attention .We suggest the use of yellow background with foreground as red for this purpose.

The conducted survey pointed blue as the favourite colour of about 55% of the subjects. Therefore considering the inclination of youth towards blue, a page with blue background will be most suited. As far as the colour of the text and other foreground colours are concerned white yellow, red are the best suited ones while black is the worst suited [3].
Consistency is vital when assigning meanings to colors. There are also certain restrictions which should be followed while using some colours together for e.g. one has to be careful while using saffron, white and green (the colours in Indian flag) together in an interface made for Indians.

Language and Text
Language is the simplest mode of interaction but this interaction will become complicated if the interface is designed without taking cultural factors into consideration.
An important issue is the use of local languages. According to the conducted survey about 33% of the subjects have already used sites with local language out of which 83% feel that the sites were not effective. Main reasons being (Taking the example of Hindi)

1. At a higher level translation fails because the language idioms and the cultural contexts of target cultures are not being considered. This often had to do with local differences and specialized terminology [4].
2. It is important to note that it is viewed more as a spoken than standardized written language.
3. Users may not be as 'picky' about the representation of written text, as long as it matches their expectations phonetically.
4. Using Hindi equivalents for common English terms used in computer interfaces (or using transliterations of English computer interface terms into Hindi), such as "Cancel" or "Delete," produces confusion [5].

The most optimum solution to these problems is the use of 'Hinglish' in Indian interfaces. Hinglish, a portmanteau of the words Hindi and English, is the usage of Hindi and English, combining both, in one sentence This highly popular mixing of both the languages in most parts of northern and central India has grown from the fact that English is a popular language of choice amongst the urbane youth who finds itself comfortable in its lexicon. Another factor contributing to the spread of Hinglish is the popularity of Bollywood films [11].

Professor David Crystal [13], says 350 million Indians speak Hinglish as a second language, exceeding the number of native English speakers in Britain and the US. He also states that Indian expertise in writing computer software also means that Hinglish will spread via the internet. The words like cool, dude, funky, rocks are generally used in youth lingo, this lingo if used in the interfaces specifically designed for youth, can make them more interesting and catching.

While taking consideration of text size it is valuable to note the study completed by Jakob Nielsen, a principal at the Nielsen Norman Group, which states that the font size should not be kept too small while designing web sites for youth because they lean backward while working on computers [12].

Use of background music

Music up till now has not been considered as an important factor in interface design but it can act as a catalyst in situations where attention gets diverted, especially in case of youth. (e.g. e-learning)

Existing research seems to support the hypothesis that certain types of instrumental music, especially slow- to medium-paced, non-percussive music, is beneficial in improving concentration and several other learning situations [7].

This finding is also supported by our survey which reveals that 69% of the subjects said that their efficiency is enhanced by music. In India, meditation which has been used as a tool for enhancing concentration, uses music as a supplement. While Indian youth enjoys almost all genres of music, soft instrumental music is preferred by most of them. This finding is supported by our survey in which 76% of subjects clearly stated soft music as their favourite and so can be used as background music.

Images

Image Recognition

Images are the visual language of a culture. Like words, images don't always translate. What we recognize in our culture may have little or no meaning in another. Designers must be sufficiently aware of differences among cultures to recognize images that are culturally specific specially considering the dynamic mind-set of youth.

picture1

For example, in India the band shown in the picture above is called rakhi which signifies the relation of brother and sister but for western cultures it may signify friendship band.

Image Acceptability

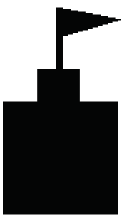
There is a difference between what is comprehensible to a culture and what is acceptable. Because social norms vary greatly between cultures, what is acceptable in one culture can be objectionable in another. In particular, we need to be careful when designing images that contain religious symbols (e.g., swastika, crosses and stars), the human body, women and hand gestures [4].

There are also levels of how well an image creates an impression on the target. Images which match the preferences are bound to create an impact than non relevant images [8]. A study of the survey points out that Indian youth prefers images related to nature and bollywood films. Using images related to these areas can draw the youth attention.

Icons

Commonly used icons may also be subject to misinterpretation across cultures. When icons are used to convey information to the user, it is very important to understand influencing factors which have already created an impression on brain for their recognition.

For example, when the following icon was shown to Indian subjects, they identified it as a temple, while in west this icon is used to represent school on maps.



When asked about sports, Indian youth was found to be more interested in cricket than any other sport and they recognized image 1 as more appropriate icon for sports than image 2.

image 1

image 2

Designers should take account of interest areas of user while designing icons so as to make them more expressive and communicative.

Other factors

Often the text and graphical components of an interface will be arranged on the screen in a way that depicts the logical flow of information. In India icons, Tab panels should be arranged from left to right and top to bottom.

Important issue of content arises while designing web site for youth. After study we found need of certain information on web pages. Our survey revealed that only 13% of subjects feel free to discuss sex related issues with their parents so to obtain correct information about sex, a web page dedicated for youth should have a sex education section. The need for sections on career counseling, social networking was also found. Indian youth preferred matrimonial over dating which is supported by the fact that 80% of matrimonial sites are Indian.

Our study also demonstrated the fallacy of myth that Indians follow astrology, Indian youth is not much int0 astrology and predictions. So the content should be fabricated taking the above factors into consideration.

Conclusion

The feedback we received from participants, the observations we made, Personal interviews of subjects made us to decide the way in which interface should be designed for Indian youth. Blue is best suited as background colour with foreground colours as white, yellow and red. Designers should avoid using saffron, white and green colour together because they create a model of Indian flag when placed near to each other. Using pure Hindi in Indian interfaces should be avoided instead a portmanteau of Hindi and English called “Hinglish”, the most popular language among youth should be used. We found that in most of the cases background music increases work efficiency thus if used properly can yield better results in e-learning. Cricket, Bollywood movies are the most favourite interest areas of youth, though they don’t have direct application in interface design, they should be taken into consideration while designing icons on the interface.Though we have raised the issue of background music, we think a more in depth study of this area is required.

Findings that we have reported can be used extensively in the field of HCI while designing interfaces not only for Indian youth but for Indians as whole.The results can also be used to compare influencing elements between India and rest of the world.

Acknowledgement
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EVALUATING INTERFACES OF WEBSITES FOR EAST AND WEST

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Abstract

East and West have their different cultures and so are their needs. Website interfaces have been analyzed to find out what makes them eastern and western. We intend to find the factors, variation of which will result in interfaces that can be adequate or inadequate to any culture. Our study is converged to the Indian and western culture only, as western culture has got great impact on the Indian culture.

Interface made for the websites in one corner of the world are being used by users all over the world. But these are not able to cater the needs of the user to its full extent, as users of different regions have their different expectations, as each person has its own visual appetite and taste. Presently research is being conducted to facilitate the users to change the interface of the website depending upon their needs (www.start.com).But these are still at experimental level.

In this paper various factors and features which make the website, software and operating system interfaces well-suited to the users belonging mostly to eastern (Indian Subcontinent) and western culture (Europe & US) have been studied.

Keywords
Culture, websites, visual appetite, interface, needs.

Introduction

In computer science and human-computer interaction, the user interface (of a computer program) refers to the graphical, textual and auditory information the program presents to the user, and the control sequences (such as keystrokes with the computer keyboard, movements of the computer mouse, and selections with the touch screen) the user employs to control the program.[1]

The interface is the main system component through which the user interacts with the software and is followed by functionality and logic application. Website or software application suffices to the customer needs through its interface**.** Cultural factors are extensively considered while designing the interfaces to make them efficiently compatible with the customers. These cultural factors tend to impart interface a localized countenance abating the expression of globalization. The interface should be culture-dependant as it has been observed that the users' culturally specific design preferences influence their beliefs about the system usefulness. Moreover, users with different cultural background follow different cognitive process to decide on accepting the interface, and incase of negligence towards these cultural biases may lead to confusion or frustration.

Culture or civilization, taken in its wide ethnographic sense, is that complex whole which includes knowledge, belief, art, morals, law, custom, and any other capabilities and habits acquired by man as a member of society.[2]
Whereas according to UNESCO culture is set of distinctive spiritual, material, intellectual and emotional features of society or a social group, and that it encompasses, in addition to art and literature, lifestyles, ways of living together, value systems, traditions and beliefs.[3]
So it follows from the above references that culture is the main factor which allows for the interpretation of actions and events and distinguishes the group of people. It can also be defined as plethora of symbols delineated by people; it is a structure of meanings, beliefs and values that condition human behavior allowing for its interpretation and purposefulness.

Most web developers are based in western culture, so the interfaces are also western habit biased. So a user from East would find it contaminated with respect to his locale. The vice versa would be the situation if the interface has been developed by an east developer and the intended user is from the west. Moreover the concept of globalization and international understanding made the developer to adapt to the new way of product development i.e. developing a global product. The user, on the other hand always feels forced to receive disturbing outputs and unexpected results.

The learning and adaptability to the system takes time and consequentially money, so most of the companies are investing on researches to make interfaces culture-independent by removing all the peculiar features that make them belong to a particular region or culture. Knowledge about the target culture is necessary in order to provide for cultural metaphors and real world representation of artificial objects as well as to eliminate culturally incompatible material.

Cross-Cultural Differences and Interfaces
Classifying any design or graphic user interface (GUI) as good or bad is difficult. It is individual’s perception and cognitive ability to judge and, support or discard any interface. Everyone have some culture orientation and no one can escape from it. Every person develops some traits, values and most importantly visual need based on their early childhood and the environment of their habitat. But, there are no set of checkpoints or rules, which precisely describe or encompass any cultural pattern. Still there exist some similarity and congruence in entity of that cultural family, which give rise to the cross cultural differences. Now it’s not to take these differences as unhelpful and negative typecast, but should value and respect the variation in thoughts and approach to problem. In a world, where a lot of cross cultural differences sustain, we need to pool resources and assist each other to accomplish the practical goals without requiring everyone to believe, act and think identically.

Many web usability problems may arise due to the variations between cultures. Such differences may be found in color, graphics, phrases, icons, character sets, pictures, symbols, date and time format, etc. Users from different cultures may understand the same websites in totally different ways. Some metaphors, navigation, interaction, or appearance might be misunderstood and might confuse, or even offend those users.

Web developers should consider their own cultural orientation and, must also have an understanding of the structures and interfaces which suits the visual needs of other cultures. Some factors, such as date, calendars, weekends, time, telephone numbers, address formats, character sets, units of measurements and currency are well-defined and can be easily analyzed by the website developer. Other factors, such as mental processing and perception, graphics, colors, sound, metaphors and mental models are harder to analyze and to take care of, and so require special consideration as they are usually hidden or vague.

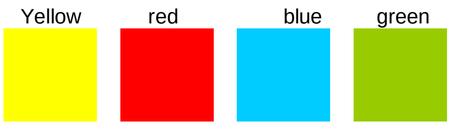
Factors

Observe that many colors, graphics, symbols, icons, and words that are suitable for the western culture may have different meanings and on the other hand it might even confuse users from other cultures. Let's discuss some of the prominent factors playing important role in the GUI of websites.

Color

Colors can highlight emotions. The same colors could have different meanings in diverse cultural backgrounds.
Red: It indicates emergency, danger in the US whereas in Asian Countries specifically in India red color has its own sacred importance; it is used as a 'bindi' by Indian women. This factor is used in designing web interfaces in India as most of the websites developed in India use this color factor as it would be pleasing for the Indian users. Similarly, black is considered a mournful color or the color of the evil in India whereas it is considered as a style statement in Western countries.

www.designindia.net



Color triad circle given by Johannes Itten

The following significance of each colour is based on the study of Marek Moskor.[4]
Green: In ancient Greece, green symbolized victory.In the highlands of Scotland, people wore green as a mark of honor. Green is the national color of Ireland. A "greenback" is slang for a U.S. dollar bill. In India, green signifies prosperity.
Blue: In China, blue is for little girls. In Iran, blue is the color of mourning. The pharaohs of ancient Egypt wore blue for protection against evil.In ancient Rome, public servants wore blue. Today, police and other public servants wear blue.

Yellow : In Egypt and Burma, yellow signifies mourning. In India, yellow is the symbol for a merchant or farmer. Also in the Middle Ages, actors portraying the dead in a play wore yellow.

Icons & symbols:

Icons form the visual language of a culture. The application must match the user's cultural characteristics. This goes beyond simply avoiding taboos and offensive icons.[5] An envelope graphic may replace the mailbox graphic that is used as an indication for "email". The mail box is easier to recognize for users in the East than the envelope .The icon for the messenger in yahoo is different from the icon used in rediff. The symbol of a bird is used in rediff since the metaphor of talking is a parrot in the Indian context. This you can observe in the images placed below. The mail icon used in yahoo is an envelope, where as most of the Indian websites have a post box as their mail icon. Comprehension of Western or English-based icons, symbols, clichés, slang, acronyms, and abbreviations may be difficult for local user groups.

www.rediff.com

www.yahoo.com

www.perso.wanado.fr

www.google.com/talk

Menus

They are mostly used to cluster large amount of data in a single page to reduce the need to browse through multiple pages. Most of the Indian websites tend to avoid this display method. They prefer display of all the data and do not want to hide any information. The reason being Indians are not so curious and inquisitive. They have concern in their mind that they might miss items in the drop down menus or slide back menus. So they prefer to scroll down the entire page to search for the required data. Thus western user is provided with limited choices.

www.rediff.com

http://www.visions-of-hope.com/2006/

Indians have more adaptive capacity than the western people and they can adjust to complex environments. The following factors are generally found in most of the Indian websites:

- The complexity is increased by increasing the information and choices.
- Less control over navigation like every links open in a new window.

- Colour coding, font etc are added to increase the number of cognitive elements thus increasing the complexity.

The U.S. websites have simplicity in their approach and have less information on a page thus reducing the complexity. The factors found are:

- Simplicity with limited amounts of data and limited number of choices.
- Attempts to reveal the content before the user's action.
- Navigation schemes prevent from becoming lost.
- The arrangement and organization reduce the human errors committed.
- The number of pages will be very large in the western websites.

Images

The images used in the websites carry a meaning of belongingness to user's culture and increases the acceptance of the website interfaces by the local masses. The website (below) on the left uses an image of dharma chakra, which imparts a feeling of Indian ness and makes the people more attached to the interface. There could be a problem if, images and other graphics is not being identified by the audience of the particular cultural background which the website focuses on. Solution is to use graphics and images according to the propositions of the audience. Eg. What is routine in India could be very strange in Europe.

www.iishglobal.org

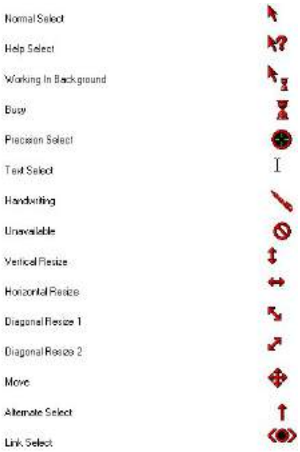
www.firstgov.gov

As Indian peoples are familiar with such symbols and graphic as they have confronted them before also. The usage of the flag makes the interfaces more localized. As we can observe in the right side website, the image of flag and statue of liberty has given it the feel of west specifically America.

Sound

Music is the most powerful medium through which the characteristic of a country or region could be made out. When such a powerful media is used in the websites then surely they can be classified as belonging to east or west. In east, when India is considered in particular, the music of traditional instruments like shehnai, tabla and sitar can be used in building interfaces but in the west websites use music relating to their background such as bagpiper in Scotland or closely related to rock as in the example mentioned below. Such websites creates a feeling of alienation for Indian browsers. (Example of some of the websites with background music are http://www.scottstapp.com and http://members.chello.nl/rg.bulten/fairytale.htm)

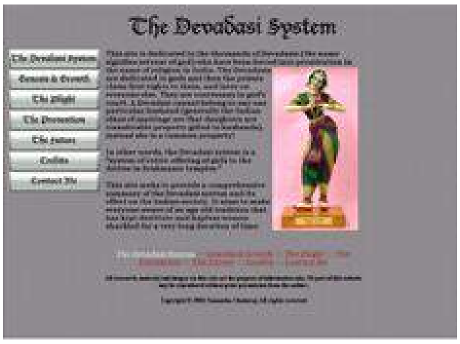
Cursors



The pointer is the most important component in a website which helps to achieve the required tasks and for easy navigation. If this element creates perplexity then the navigation is a bit complicated. In Indian websites the cursors are simpler and resemble stick. They are not so fancy and just serve the function of a stick to point something whereas; in west the story is totally different. They feel that cursor is the most important feature of a website or operating system. As cursor is the medium between the user & software and it's the source to interact with the virtual world. So they want their cursor to be shaped and designed like them. The result of which is, the loaded cursors in western countries are modern and look very much whimsical.

Font size and styles:
Website Interface is affected drastically by the typography. Depending upon the type of users the fonts must be decided in order to make it user interactive.

http://iml.jou.ufl.edu/projects/Spring02/Chattaraj/index2.html



http://en.wikipedia.org/wiki/United_States_Congress

The fonts typically used in eastern countries are characterized by large size than compared to the websites in western countries. As one can observe in the above figure depicting the difference in font size as the Devadasi system uses Georgia font of font size 12 point where as Wikipedia uses Times New Roman font of font size 10 point.
In India as many users from Rural Areas are not comfortable with English because English is not their primary language so small font size further increases the difficulty in understanding.

Metaphors
The essence of metaphor is to give an idea of some unknown thing or concept, by illustrating it with something else which is known and which originally has nothing to do with it.[6] The metaphors' role in the user interface is to facilitate learning, orientation, and the forming and maintaining of the concept about the program i.e. the mental model. They are comparisons that show how two things that are not alike

in most ways are similar in one important way. Metaphors are a way to describe something. These metaphors are used in most of the websites to convey the locale feeling. For example, in rediff the metaphor for talking in Indian context is a parrot.

Conclusion

Now this cross cultural differences and variation in cognition level of entity has opened a new domain to solve the issues regarding the UI design. We have explored a number of UI design differences through sample Websites and tried to point few of the factors on which the GUI depends. Some variation in those factors can bring an enormous change in the product. As stated earlier, our study aims to point out the factors which are present in website and at the same time vacillate for different cultures.

Those factors could be summed up as colours including the background colour and text colour, icons & symbols, menus either drop down or the sliding, images including the background and the images for validation of text and sounds which we use for button clicks or the background music, cursors, metaphors, attention gained through poetry, visual aesthetics, and appeals.

These factors could form a strong basis to answer the questions by Aaron Marcus [7], which are

- In crafting Websites and Web applications how well are ambiguity and uncertainty avoidance received?
- How much conflict can people tolerate in content or style of argumentation?
- How much advertising hyperbole could be tolerated in a collective culture focused on modesty?

Finally, if these factors are accepted to be the tools to overcome the cross cultural differences, then we need to change our current practices and develop new tools. We need to make it possible to develop multiple versions of Websites and operating systems. But we have to also consider the productivity, costing and the adaptability of each version .One more solution is that we can find out some specification or statistical values of factors, which cater visual appetite of all the cultures and thus all the Websites will be globalize.

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Indianised Design of Automobile Dashboard Interfaces
A Case Study

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Automobile Dashboard, Cognitive Prototype, Cultural Dimensions, Metaphors, Cultural Populace

Abstract:

During the last two decades, the automobile has made the transformation from an analogue machine with mostly mechanical and hydraulic control systems to a digital car with a rapidly growing volume of computer-based control systems. This transition will continue for another decade or two as drive-by-wire or x-by-wire systems emerge and eventually proliferate. The addition of sensor-based intelligent vehicle functions will further advance digital technologies in future automobiles.

Some of the most visible recent innovations in automobiles, such as telematics, have little to do with the automobile's operation itself. The inclusion of hands-free kits and multimedia systems have less effect on the automobile's operation and more effect on improving the drivers' and the passengers' ability to do no driving activities, such as having a cell-phone conversation or watching a movie.

Automobile designers have always been aware of incorporating external features that target specific market/geographical segments tastes many of which are culturally motivated. However the Dashboard inside, continues to be based on a universal design template and is well standardized. Regardless of the geographic region or market segment dashboard more or less are similar.

In India, the dashboard and interior of an automobile has always been modified or decorated to reflect local cultural identity and tastes. This paper makes a study of current adaptation of dashboards in automobiles such as cars and trucks. It attempts to derive heuristics for a completely digitized, hands free, multifunctional dashboard in the form a large LCD/Plasma display. Design concepts are suggested to highlight the attributes of a culturally oriented dashboard.

What is A Dashboard?

In information technology, a dashboard is a user interface that, somewhat resembling an automobile's dashboard, organizes and presents information in a way that is easy to read. However, a computer dashboard is more likely to be interactive than an automobile dashboard (unless it is also computer-based). To some extent, most graphical user interfaces resemble a dashboard. However, some product developers consciously employ this metaphor (and sometimes the term) so that the user instantly recognizes the similarity.

Automobile dashboards provide a significant amount of data about the current state of the automobile. Typically what is presented is exactly what is needed and at a glance it is possible to see the state of the automobile. The other function of the dashboard is to provide for control of the automobile. Dashboards facilitate almost attention-less (once learned) control of the automobile.

Dashboard History

The history of automobile Dashboard design has been one of incorporating nonessential features that subsequently became indispensable especially when broadcasting became commonplace, for example, the built-in radio was the feature few car owners wanted to be without. Today, that feature is the car cup holder. Now this feature is considered to be so essential that many consumers wonder why it took so long to arrive.

Riding in the earliest automobiles must have been a bone-jarring experience. Not only were suspension systems crude by today's standards, but also roads were much more unforgiving. The possibility of drinking from a cup while driving may never have entered the consciousness of early touring parties. Liquids were kept tightly corked in the thermos bottle, which was secured in the picnic basket until the car stopped and a blanket was spread out beside the road.

Earlier Dashboards in 1940’s usually consisted of a sheet metal piece on which basic equipments like speedometer, fuel meter were mounted as separate unit. One of the safety enhancement of 1970‘s was the adaptation of padded dashboards. In the 1990’s driver side airbags become mandatory and passenger side airbags became widespread.

Digital Dashboard

The notion of an automobile dashboard is directly applicable to the concept of a digital dashboard. It provides the information needed and the controls to operate the "machine." In this case, the "machine" is the business. If the metaphor were completely applicable it would actually be possible to control a business from the digital dashboard. In reality the "out" communication may be very limited.

Microsoft's Digital Dashboard is based on Office 2000 technology. They currently have available a Digital Dashboard Starter Kit which allows experimentation with some sample Digital Dashboards. In order to install the starter kit, you will need to have Office 2000 installed.

The dashboard interface is built on Internet technology. The dashboard window consists of a number of frames, and each frame contains a particular "information nugget." An "information nugget" is the term used by Microsoft to discuss pieces of valuable information. Each frame contains a different "information nugget." The "container" for the frames that make up the digital dashboard is Microsoft's messaging interface.

Indian Culture and Dashboard – *an analysis by observation*

Following study included various users ranging from those in normal household to taxi drivers based on which the study was conducted in two stages. In the first stage the users were observed without being noticed by the user. Then all the critical factors were charted out based on which the questionnaires were prepared to solve further queries that were unable to be made through observations.

If we talk about India, The relation of the new technology to culture is especially vivid and pressing. For of all modern states, India is the one which has most successfully preserved, and even enhanced, multiple languages and cultures, plural literatures and traditions, extraordinary cultural diversity. The official recognition of eighteen languages is only an outer manifestation of a far deeper heterogeneity, of the co-existence of multiple cultures, each with ancient literatures, valued traditions and historic arts and monuments. The question that arises is whether these rich multiple cultures of India can survive the Information Age. And by the Information Age, It is particularly the age brought about by the new technologies of computation and computer mediated communication, but also television, film, radio, and all of the new media.

Given the widespread fear of a kind of cultural imperialism spread through the new media, one would expect that there would be rich and thoughtful discussions of this question. Yet if we search through books, conference proceedings, and meetings about the Information Age, we find precious little on the subject. The technological challenges of rapidly developing information and communication technologies are so fascinating, so intellectually demanding, that they alone are worth lifetimes of individual effort, to say nothing of countless international meetings. The economic implications of a world of global networks, of instantaneous communication, of electronic commerce, of households "wired" at a rate that doubles every year, of international monetary markets and economies linked electronically. These implications, too, are worthy of and receive intensive study. And not least important are the legal problems of reconciling the standards for the Information Age of more than one hundred countries, of determining what is right, proper, secret, public, pornographic, militarily dangerous, privately owned, obscene, subversive and so on.

There can be no question about the sophisticated Indian's Indianism or his desire to preserve this precious heritage at all costs. Therefore while designing digitized dashboard interfaces for India cross cultural issues play an important and critical part. Also, Increasing competitions emerging between the automobile industries make these factors a necessity to be included in these interfaces. Some of the many factors that must be considered while developing GUI's for automobiles are:

1. *Right hand drive in India :*

   India is one amongst the few countries that has implemented Right hand drive system in all the vehicles rather than left hand drive which is prominent in US and European countries. This factor mainly affects the navigation system and the alignment of symbols or text into to screen. The GUI must be designed to be easily operated by left hand and also the text that will appear as alerts to the screen must be placed in a position thoroughly checked by user survey to be easily readable just by the movement of the eye to the left without moving the head which is unsafe.

2. *Navigation by Language :*

   If the dashboard is made to be operated hand free by giving voice commands the language also plays an important issue. Though English form the link language of India It is limited only to educated part of the society but the driver who is kept on a pay scale by certain families is often illiterate and is not well versed with the use of English. In India though there is a tendency to adapt to cultures outside in India but there is very less and limited tendency to adapt to other culture within India. For Example a student in UP is ready to learn English but he show reluctances toward learning Assamese or Telugu. Often it is the driver who drives the car and seldom is he well versed with the use of English. But he is fluent with his own mother tongue and also Hindi (not in all cases).If such a thing Occurs the vehicles interfaces must be made customizable in eighteen different software.

   Also while considering the Indian context the concept of operating with voice commands cannot be applied in every vehicle and in every place. In certain cases for example school bus, or a taxi or even a vehicle belonging to a family where there are conversation going on every now and then, a voice sensor may malfunction. In such cases another device (may be a hand worn hardware) has to be designed separately which form an integral part of the interface.

   Also in cases like this to avoid the cost of making a different controlling device UI designer can simplify the problem by going against what has been written in the first paragraph by playing with diversity of Indian Culture. He can put up two languages for interacting with the interface. One language is his mother tongue or user selective in which his family member converse which he can use while operating the system and other is a common language (English or Hindi as applicable) which is essentially different from previous one. The main Idea behind this is the user can give commands in different language while his family member converse in different language. Such Interface may also be accompanied with tutorials.

The tutorials must not only be aimed to make the driver accustomed with the commands but It must also be making the system accustomed with the user volume and his/her accent.

3. *Contents :*

The contents of the dashboard interface must be done after studying the user experience of the dashboard. An Indian vehicle dashboard is identified by the deity symbol in form of photograph or small statue paced on the dashboard. Also there are categories of people mainly taxi drivers who are accustomed of pasting stickers related to bollywood stars. Such things must be included and displayed on the interface in the stand by mode.

Apart from these the content must also be formalized by analyzing the need of the user. The content may be user specific. For example a businessman will definitely want to have a car with the current news of stocks while others may just require the current cricket scores.

The content must also be at par with the recent innovations. For example the lane departure warning system which alerts the user if the turn is made without giving indicator, night vision and blind spot detector whose output is beneficial for the user has to be accommodated in the same interface.

4. *Analog features in existing vehicles*

This section covers measures that should be taken in digitizing the existing analog devices in current vehicles that consist of Speedometer, Odometer (that records total distance covered, Fuel meter etc). Recent researches that have done to make these features failed as people did not readily accepted the electronic odometer.

The purpose of Speedometer is to alert the driver of the speed of the vehicle. Converting Odometer into digital one may not be a good option as people are already accustomed to the analog version. Also in India each culture has a vision in which they blame technology for any fault. This problem can be solved by replicating same analog feature in digitized form by displaying the same on a LCD/Plasma Screen.

Recent researches has been done to make the speedometer dynamic that is using a visualization similar to that of the tachometer by visually distinguishing the regions of the speedometer which are higher than the current speed limit . As the speed limit changes, the visualization on the display updates accordingly. This relieves the driver of the task of waiting/searching for a speed limit sign on the road to determine the current speed limit in effect. In such cases these cultural issues are important as driver can better be notified by using metaphors and colors after studying user perception of danger.

5. *Music:*

Playing of music in the car can't be ignored. While driving with the family one likes soft music at low volume as all of them want to pay attention to the conversation which is going on between the family members and when it comes to individual he likes to hear music at little high volume. Youth prefers music at much high volume. While the taxi drivers and truck drivers maintain constant volume during their journey. Volume must be different for different types of music and must be automatically adjustable. This is because different types of music grab different level of attention.

So while designing GUI's these things has to be kept in mind which mainly affects the difference that system has to made between sound of music and voice commands given to it by the user.

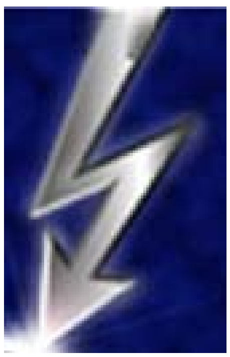
Also while making the including features in GUI for controlling play list following thing has to be kept in mind that Indian culture has adapted to the nuclear family system. So often in a family there are four members out of which one is the head, another his wife and then their children who drive together in the car and in the absence of the driver it is the head who drivers the car. But despise of he being the head it his not he who selects what music rather it is his wife or even children who make choices of the songs that are to be played. So while designing GUI's for the car it has to be made equally convenient to operate by other passengers as the driver.

6. *Metaphors:*

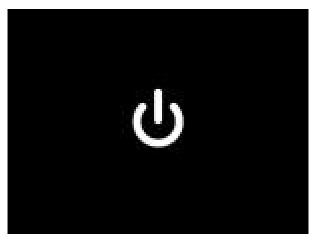
According to Marcus (1998), metaphors provide a visual meaning concepts through words and images. Duncker (2002) emphasizes that metaphors have to match the target user's mental model of physical objects. When users feel a sense of representation they are able to benefit from and feel comfortable using metaphors.

Interface Design relies on metaphors that ultimately must include the culture factors. Also use of metaphors is much more important in automobiles as a message has to be instantly conveyed to the driver without getting much of his/her attention. So text which takes much time to be understood has to be replaced by metaphors which have to be cultural dependent to be more efficient.

To decide what metaphors have to be used in user survey cognitive prototype test has to be used in place of “choose one of these options” questions. This is due to diversified nature of Indian culture a individual tend to accept what looks attracting which may not be the best choice. For example in user survey when it was asked to depict the word “power” when the survey was made without giving any of the options option 1 was preferred than in the other case both options 1 and option 2 was given equal attention as option 2 which is a geek symbol has already been adopted by human culture and when it was asked that which one of these is better option 1 got highest priority.



Option 1
Indian power Symbol



Option 2
Geek power Symbol

Option 3
Reiki Power Symbol

Customization of Dashboard Interface – *some suggestions based on Heuristics*

Customization is another important feature that has a key role in designing interfaces for automobiles. Though the user survey shows that nearly each of the driver wants customization in some part or the another in his car but the question arises that is it efficient?

When people were asked whether customization is necessary in dashboard interface or not they usually think about their PC’s and then decide whether to opt for it or not. But such is not the case in dashboards. India is not a country where an average household has the financial resources to buy a car for each individual in the family. In most of the cases a person drives the same car that his wife is driving. In such cases customization will become inefficient as the changes done in the interface (themes, background etc.) will make it difficult for wife to realize the messages on the interface.

Customization may not be efficient for an individual but definitely it matters when it comes to a cultural populace. For example in contents we said that an Indian car is identified by a photograph of deity or holy signs (Swastik or Om) made with red sindoor. Also there is a tendency in the Indian Culture to procure his cultural heritage. So people inside a populace will accept this new technology easily only when it incorporates their culture. To incorporate the cultural features in a country like India with wide diversity and having different religions like Jainism, Christian and even orthodox religions like Hindu and Muslim Customization provides the only feasible option. If the dashboard is not made customizable it will result in discrepancies as a Hindu will never like theme of his dashboard to be consist of mainly green color opposite to that of Muslim. Even within the same religion a Shavian (Worshipper of Lord Shiva) shows some resistance towards keeping a background of Lord Vishnu. Each populace will definitely like their dashboard customized according to their culture.

So Customizability may be related according to the needs of the family as each member in an Indian family follows the same culture but not according to an Individual. For ex The screen in standby mode may be made customizable but not the overall theme.

When it comes to taxi drivers or bus/truck driver individual customization is more applicable as there are no problems as it is an individual who always drive the vehicle.

Conclusion

India is a place where inclusion of cultural variables is sensitive. While deciding these factors it has to be seen that they does not hurt the religious sentiments of people. In such cases customization can solve the problem.

We contend that while accounting the cultural variables we cannot forget safety issues that constitute one of the most important function of driving the vehicle. It is therefore necessary to think about safety while incorporating cultural factors.

Result of this case study indicates that care must be taken while designing GUI's for vehicle dashboards for India. Though an automobile with digitized dashboard is new in the developed countries and will take much time to reach India, guidelines can be laid for designing a culturally oriented GUI. Though this paper has attempted to lay such guidelines only for the basic features but it may be extended to address other advanced features like GPS as and when the need arrives.

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