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## Doctoral Thesis

Website user experience: A cross-cultural study of the relation between users' cognitive style, context of use, and information architecture of local websites

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**Copenhagen  
Business School**  
HANDELSHØJSKOLEN

Website user experience

# Website user experience

A cross-cultural study of the relation between users' cognitive style, context of use, and information architecture of local websites

**Ather Nawaz**

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LIMAC PhD School  
Department of International Business Communication

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# Website user experience:

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**Ather Nawaz**



LIMAC PhD School  
Department of IT Management  
Copenhagen Business School

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Ather Nawaz

Copenhagen, 2013

## **Abstract in English**

Increasing globalization and technological development has led companies and people across the globe to connect through the global internet community. However, people with different cultural backgrounds may perceive the same information in different ways. One of the hurdles to use websites efficiently is the indifferent structures of information on website, and their relation with the characteristics of intended users and the context of use for the websites. The purpose of this dissertation is to assist Human-Computer Interaction (HCI) practitioners and researchers with better design of website structures for user groups with different cultural backgrounds.

This dissertation looks into issues related to website user experience (UX) and focus on how the structuring of information is seen from local users' perspectives. In particular, it attempts to look into the alignment between websites' information architecture (IA) and users' views of website information structure, by applying a cross-cultural and context of use perspective on the UX of websites in three countries: Pakistan, Malaysia, and Denmark. The researcher investigates to what degree users' cognitive styles and contexts of use are aligned with local websites' information architecture, and how this (lack of) alignment shapes the resulting UX.

This dissertation adopts a mixed-method approach to studying the UX association with users' cognitive styles, contexts of use, and website structures. In this regard a critical literature review of the existing HCI research on website UX in Asia was performed. Four UX studies were conducted on local university websites in Denmark and Pakistan, and local e-commerce websites in Pakistan and Malaysia. Empirical data was collected through questionnaires, card-based brainstorming, card sorting, information retrieval tasks, and retrospective interviews with 108 university students across four studies. Users' cognitive styles were captured through users' information classification (card sorting) activities with website contents. These data were analyzed through edit distance measures and hierarchical clustering through dendrograms. The context of use was captured by collecting data on domains of websites, interviews about the use of languages, background questionnaires, and information retrieval tasks. These data were analyzed through quantitative analysis and coding of retrospective interviews. The structures of the

websites were captured through analysis of website navigation and labels employed by each website.

The literature review revealed that HCI research into website UX in Asia is growing, in particular examining academic, e-commerce websites, and tourism websites. The literature review indicated that the use of cultural theories and frameworks for studying website UX is limited. The results of the four UX studies indicated differences in cognitive style and context of use across the three locations, Denmark, Pakistan, and Malaysia. The Pakistani users appeared to have larger within group variation in cognitive styles than the other user groups, as measured by differences in their information classification (card sorting). There was a lack of alignment between cognitive style and IA of local websites for Pakistani users, as they appeared to spend much time to retrieve information located deep in the website hierarchy. There was a closer alignment between cognitive style and IA of website for users in Denmark as users spend relatively less time to retrieve similarly placed information. The Malaysian users appeared to be more similar to Pakistani users in term of their cognitive style measured by differences in their information classification (card sorting), when compared with Pakistani users.

This dissertation concludes that website structures do matter for users with different cultural backgrounds. It concludes that a high degree of alignment of local users' cognitive styles and context of use with the website IA improves the website UX. The dissertation also discuss critical methodological issues in using local data in performing cross-cultural comparative analysis of website UX. This dissertation contributes to HCI theory with a model that combines context of use, cognitive style and information architecture that can be used to study and compare website UX across countries. The finding of study has implications for UX practitioners, as it sheds a new light on the need for alignment between website structures and users' cognitive styles and context of use. The study contributes methodologically by combining the activities of card-based brainstorming, card sorting, information retrieval tasks, and retrospective interviews in a cross-cultural comparative study of UX. The main contributions of the dissertation are reported through four articles and are directed at both academic HCI researchers and practitioners.



## Resumé på Dansk

Globaliseringen og den teknologisk udvikling har medført at individer og virksomheder med forskellig kulturel baggrund over hele verden bliver forbundet gennem det globale internet samfund. Information bliver dog ikke nødvendigvis opfattet ens af mennesker med forskellig kulturel baggrund. En af forhindringerne for at kunne bruge websider effektivt er uflexible informationsstrukturer, samt disse informationsstrukturers forbindelse med karakteristikkene af de ønskede brugere og deres kontekstspecifikke anvendelse. Formålet med denne ph.d.-afhandling er at bidrage til at praktikere og forskere i Human-Computer Interaction (HCI) kan designe bedre informationsstrukturer til hjemmesider rettet mod brugergrupper med forskellige kulturelle baggrunde.

Denne ph.d.-afhandling undersøger forbindelsen mellem brugeroplevelsen (User Experience, UX) og struktureringen af information på en hjemmeside ud fra et brugerperspektiv. Den undersøger i særdeleshed sammenhængen mellem en hjemmesides informationsarkitektur (IA) og brugerens syn på hjemmesidens informationsstruktur. Dette undersøges ved at anlægge et tværkulturelt og brugskontekst-orienteret perspektiv på brugeroplevelsen af hjemmesider i tre lande: Pakistan, Malaysia og Danmark. I forlængelse heraf undersøges i hvilken grad en hjemmesides informationsarkitektur er afstemt med lokale brugeres kognitive stil og kontekstspecifikke brug af lokale hjemmesiders informationsarkitektur, samt hvorledes denne (eventuelle manglende) afstemning påvirker resultatet af brugeroplevelsen af den lokale hjemmeside for de lokale brugere.

Ph.d.-afhandlingen anvender en kombineret (mixed-method) tilgang til at undersøge brugeroplevelsens forbindelse til brugernes kognitive stil, brugskontekst og hjemmesidens struktur. Indledningsvis blev der udført en kritisk litteraturgennemgang af HCI forskningen i brugeroplevelsen af hjemmesider i Asien. Der er gennemført fire brugeroplevelses-undersøgelser af lokale universiteters hjemmesider i Danmark og Pakistan, samt lokale e-handels hjemmesider i Pakistan og Malaysia. Der er blevet indsamlet empiriske data gennem spørgeskemaundersøgelser, kort-baseret brainstorming, kort-sortering, øvelser i informationstilegnelse og retrospektive interviews med 108 universitetsstuderende under de fire studier. Brugernes kognitive stil blev undersøgt gennem øvelser med klassifikation af information (kort sorterings-øvelse) fra

en hjemmeside. Disse data blev analyseret ved brug af et mål for afstand mellem kortsorteringer (edit-distance), og hierarkisk klynge-analyse (hierarchical clustering analysis) med en grafisk præsentation (dendrogrammer). Brugskonteksten blev undersøgt ved at indsamle data om hjemmeside-domæner, interviews om sprogbrug, baggrundsspørgsmål og opgaver om informationsøgning. Disse data blev analyseret gennem kvantitativ analyse og kodning af interviews. Hjemmeside-strukturer blev undersøgt gennem analyse af navigationen på hjemmesiden og de betegnelser der blev brugt for informations på hvert hjemmeside.

Litteraturgennemgangen viste at HCI forskningen om brugeroplevelsen af hjemmesider i Asien er voksende; især når det gælder akademiske, e-handel og turisme hjemmesider. Litteraturgennemgangen indikerede, at brugen af kulturelle teorier og - modeller til at undersøge brugeroplevelsen af hjemmesiden hidtil har været begrænset. Resultaterne af de fire brugeroplevelses- undersøgelser indikerede forskelle i kognitiv stil og brugskontekst på tværs af de tre lande: Danmark, Pakistan og Malaysia. De pakistanske brugere syntes at vise større variation inden for gruppen i deres kognitive stil sammenlignet med de andre brugergrupper, når dette blev målt ved forskelle i klassificering (kort sortering) af information fra hjemmesiden. Der var en ringe grad af afstemning mellem de pakistanske brugeres kognitive stil og de lokale hjemmesiders informationsarkitektur. Dette fremgik ved at de pakistanske brugere anvendte lang tid på at hente information der var placeret dybt i hjemmesidens struktur. Der var en bedre sammenhæng mellem den kognitive stil og hjemmesidens informationsarkitektur hos den danske brugergruppe, idet disse brugere anvendte mindre tid på at finde information placeret dybt i den lokale hjemmesides struktur. De malaysiske brugere lignede de pakistanske i deres kognitive stil, målt ved klassifikation af information (kort sortering).

Denne afhandling konkluderer at hjemmesidestrukturer har betydning for brugere med forskellige kulturel baggrund. Den konkluderer at en høj grad af afstemning af lokale brugeres kognitive stil og brugskontekst med den lokale hjemmesides informationsarkitektur forbedrer brugeroplevelsen af hjemmesiden. Afhandlingen diskuterer også kritiske metodologiske spørgsmål ved anvendelse af lokale data i tværkulturel komparativ analyse af brugeroplevelsen af hjemmesider. Denne afhandling bidrager til HCI teori med en model der kombinerer brugskontekst, kognitiv stil og

informationsarkitektur, og som kan bruges til at undersøge og sammenligne brugeroplevelsen af hjemmesider i forskellige lande. Afhandlingen er vigtig for UX praktikere idet den kaster nyt lys på behovet for afstemning af hjemmesiders struktur, brugeres kognitive stil og deres brugskontekst. Afhandlingens metodiske bidrag ligger i kombinationen af aktiviteterne kort-baseret brainstorming, kort sortering, informationssøgningsopgaver og retrospektive interviews. Afhandlingens hoved-bidrag er kommunikeret gennem fire videnskabelige artikler rettet mod akademiske HCI forskere og praktikere.



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## Abbreviations and acronyms

AMM	Actual Merger Method
BMM	Best Merger Method
DK	Denmark
HCI	Human-Computer Interaction
IA	Information Architecture
IS	Information Systems
IT	Information Technology
PK	Pakistan
My	Malaysia
PC	Personal Computer
UCD	User-Centered Design
UX	User Experience

## List of Articles

- Article 1:** Nawaz, A., Clemmensen, T. (2013). Website Usability in Asia 'from Within': An Overview of a Decade of Literature. *International Journal of Human-Computer Interaction (IJHCI)*, 29(4), 256-273.
- Article 2:** Nawaz, A., Clemmensen, T., and Hertzum, M. (2011). Information Classification on University Websites: A Two-Country Card Sort Study. In J. Molka-Danielsen and K. K. Kimppa (eds.), *Selected Papers of the Information Systems Research Seminar in Scandinavia 2011*, pp. 109-122. Tapir Academic Press, Trondheim, NO.
- Article 3:** Nawaz, A and Clemmensen, T. (draft). Information Classification and Acquisition on Websites: Users Interaction on E-commerce Websites in two Asian Countries.
- Article 4:** Nawaz, A. (2012). A Comparison of Card-sorting Analysis Methods. *Paper presented at 10th Asia Pacific Conference on Computer-Human Interaction* (pp. 583-592), Matsue, JP, August 28-31).



# COVER CHAPTER

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## **1 Introduction**

From a historical perspective, the number of website users in emerging countries, particularly those in Asia, is growing (Pingdom, 2010). At the same time, websites that people in one country use may have been designed, developed and evaluated by people in another country, in another part of the world (Sahay et al., 2003). In this dissertation, I present and discuss findings from a systematic investigation into the user experience (UX) of a website as the outcome of the interaction between the user's view of the information on the website and the website's information architecture in three countries: Denmark, Pakistan, and Malaysia. The dissertation thus provides insights into how a website is used in different countries, and makes available knowledge that can be used to better understand how to localize website design to a specific country.

Advances in technology have made a positive impact on website use, and people increasingly use websites as a source of information dissemination, knowledge sharing, and information retrieval. With a growth in internet users, website use has evolved. It has become an integrated part of different domains such as e-commerce, e-government for information dispersion, and information sharing (ElSaid & Hone, 2004; Minocha et al., 2006; Patel & Jacobson, 2008). Organizations are utilizing website technologies for various purposes, including promotions of products and services, exchange of information, and connecting with stakeholders (Punchoojit & Chintakovid, 2012). Organizations are spending resources to improve and appropriate websites for their stakeholders across the globe to make them accessible to everyone. In developing countries, particularly in Asia, the internet infrastructure has skipped a generation and gone straight to broadband, with much of that being mobile (West, 2011). Asia accounts for nearly 45% of worldwide internet users with an estimated 19% of the total Asian population using the internet (Nisbet et al., 2012). These advancements have made it convenient for end users to access information on websites in their daily life. Public and private companies are using websites not only as a way to broadcast and disperse information but also to get commercial products to the population.

On the other hand, people in different countries and regions of the world may perceive information on websites in different ways. Studies from HCI and related fields indicate that people in different regions of the world may tend to apply different ways of thinking about information and how it is organized, which are related to their cultural backgrounds (Yeo & Loo, 2004). Such differences in perception of information may come from differences in the values, attitudes, communications, social practices, and cognitive styles of users (Nisbett, 2003; Plocher et al., 2012). These cross-cultural design concerns also exacerbate issues that already pose challenges in single-culture design. While differences exist in single-culture design between subgroups of users, and between designers and (subgroups of) users, such differences become more profound in cross-cultural design.

This thesis focus on users' cognitive styles and contexts of use, and how these are aligned with the information architecture of a local website, and how this shape the website UX. *Cognitive style* refers to the different ways in which people think about and remember information. This view of cognitive style is in line with Nisbett (Nisbett, 2003, Ji, Peng and Nisbett, 2000, Na, etl. ,2010) and Witkin's (1967) view of relating cognitive style with analytical and holistic cultures. People living in Analytic cultures tend to "detach a focal object from the perceptual field, categorize objects taxonomically and ascribe causality to focal actors or objects". People living in *Holistic cultures* tend to "pay attention to the entire perceptual field, especially relations among objects and events, categorizing objects on the basis of their thematic relations, and attributing causality to context" (Na, et., 2010, p.6192, see also Nisbett, Peng , Choi , Norenzayan, 2001; Nisbett, 2003).

*Information architecture (IA)* refers to the structure of the website, or in more tangible terms, the wireframes of websites. Wireframes helps HCI researchers and designers to determine where to place certain contents of the websites. This dissertation uses a more narrow view than the broad view of IA given by Morville and Rosenfeld (2006). According to Morville and Rosenfeld (2006), three things make up information architecture: context, content and users.

*The context of use* refers to the characteristics of intended users, the tasks users perform, tools users use and the environment in which users use the system (ISO 9241-210, 2010; See also Hertzum, 2010). For example, context of use can include the domain of a website,



the users' skills in navigating a website, and other issues related to the users' cultural background, such as the users' everyday language use (Nantel & Glaser, 2008).

UX is a subjective measure of the quality of a website as seen from users' perspectives. UX of websites plays an important role in users' use of government and private sector websites. Researchers have described UX as the major factor in the adoption of websites services by its users (Patel & Jacobson, 2008; Smith et al., 2007). Users' interactions with websites, along with design and page layout are among the most important UX issues, particularly for websites that are used in developing countries (Abanumy et al., 2005).

The dissertation aims at adding to knowledge in the field of human-computer interaction (HCI) and information systems (IS). HCI is a field of research that studies, plans, and designs the interactions between people (users) and computers (Sears & Jacko, 2007). Information systems (IS) is a field of research that studies networks of hardware and software that people and organizations use to collect, filter, process, create, and distribute data (Jessup, Valacich, & Wade, 2008; Zhang & Li, 2004). HCI and IS are partly overlapping. HCI within IS, while maintaining a focus on the individual differences among users in human-computer interaction, is also concerned with business, organizational, social, and cultural aspects of the interaction between humans and computers. This dissertation take a cross-cultural perspective on the UX of websites, and thus follows the tradition of HCI within IS related research.

My research vision in this dissertation is to conduct a systematic investigation into the UX of websites as the outcome of the interaction between users' views of the information on the website and the website's information architecture in three countries: Denmark, Pakistan, and Malaysia. Thus this dissertation is a cross-cultural study of website UX. Within the broad topic of website UX, I focus on relating the context of use and users' cognitive styles to websites' information architecture. I argue that the relationship between a website's information architecture and its context of use, and users' cognitive styles when classifying information, shape the resulting user experience. Thus there are four concepts that I want to relate together: 1) cognitive style, 2) context of use, 3) information architecture topics, and 4) user experience (UX). By the UX of a website, I refer to the current standard definition of UX as "a user's perception and responses that result from the use or anticipated use of a product, system, or service" (ISO 9241-210,

2010). For the purpose of the research presented in this dissertation, I subsume the concept of usability within the concept of UX. The ISO standard ISO 9241-11 describes usability as the extent to which the product can be used by the specified users to achieve specified goals with effectiveness, efficiency, and satisfaction in specified context of use” (ISO 9241-11, 1998, p.2).

This is cross-cultural study that aims to understand the relation between users’ cognitive styles, context of use, and local websites’ information architecture, when users look for information within a website that is mainly intended for use within a given country or geographic region, hereafter called a *local website*. This is important because the shared knowledge and common practice of a particular local user group in a particular location may shape their UX of a local website.

### **1.1 Rationale and focus for the research**

This research addresses the relevance of users’ cultural backgrounds and context of use in relation to a website’s information architecture, and the resulting UX. There are two reasons for doing this.

First, there is an extensive range of research addressing the issues of cross-cultural and multicultural websites, i.e. websites that are designed explicitly for an international audience or supposed to be used in many countries (Evers & Day, 1997; Marcus & Hamoodi, 2009). Much of this research literature focuses on interface design issue and website aesthetics (Evers et al., 1999; Marcus, 2003). In contrast to this, there is at present little cross-cultural research with a focus on users of local websites (Clemmensen & Roese, 2010). In order to design and develop websites for use, website designers must have an in-depth understanding of the relation between users’ cognitive styles, context of use, and local websites’ information architecture. This dissertation takes such a cross-cultural perspective on the issue of local websites.

Second, the process of localization is supposed to generate culture-dependent components of websites for target cultural user groups (Yeo, 1996). On the other hand, development practices are globalizing information structures to make them theoretically accessible to a wide range of users. These conflicting and often confused development practices draw upon a fundamental question about how a target audience’s cognitive processes relative to

website structures impact on those websites' information architectures, and what role the target users' context of use play in the construction of the information structure. For example, research on 'cultural markers' has addressed the issues of both localization and globalization of website design (Barber & Badre, 1998). Cultural markers are preferred patterns and features for each local user population that are followed in the design of a website. Cultural markers may include the use of national symbols, specific colors, and information space in web design. Cultural markers research addresses localization by taking a number of countries, and defining markers for users from those countries. Cultural markers research thus supports both localization and globalization of website design. However, cultural markers do not address the information structure of websites, do not cover important aspects of localization, and do not take into account how people perceive local websites.

Sun (2001) argued that it is possible to distinguish between culturally different user groups that each have their own norms, which again lead to different perceptions of websites. Although industry practices might be pushing website designs towards standardization and internationalization (Singh & Boughton, 2005), designers may inevitably follow local cultural norms when designing websites. This may be the case even when designers are designing websites for clients in other countries. Websites designed and developed in a conventional way in one country may still be influenced by the specific common knowledge and practice shared by the local population from which the designers are drawn, such as the hierarchical structure of society and workplaces within society, rhetorical strategies, and strategies for processing information (Sun, 2001). The local contexts of use of a website, and the local users' cultural background may, however, shape the design and the use of the website, and crucially its information architecture.

So what happens when a user from one country, such as India, Pakistan or China attempts to use a website that is based on an information structure developed and designed based on principles and software from another part of the world, such as Denmark, Sweden, or Germany? Or inversely, what happens when users from countries like Denmark, Sweden or Germany attempt to use websites developed by software developers from countries such as India, Pakistan or China? I hypothesize that it will affect the UX of the website, because the user will sense that information is organized in an unfamiliar way.

Figure 1 shows a literature map that outlines localization and IA literature, and points out the need for studying context of use, IA, and cognitive style. It relates usability and UX with culture and information architecture<sup>1</sup>. The arrows on the map indicate the direction from the starting point of the issue of localization of website IA, through topics of current literature theories and frameworks, and ending with the main concerns related to the need for performing cross-cultural research on website UX that is presented in this dissertation.

One technique that offers interesting possibilities for eliciting cross-cultural aspects of website information structure is card sorting (Hurd, 2002; Nielsen, 2004; Rugg & McGeorge, 1997). Card sorting has been successfully used to elicit webpage quality and users' understandings of websites' structures. Card sorting generates rich data about users' categorization and structuring of the domain under investigation. Therefore, one of the purposes of this study is to investigate what different card sorting analyses can tell (and not tell) us about local website UX in a cross-cultural study, and how the use of this method may influence the design of local websites.

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<sup>1</sup> The concept of information architecture is explained in section 3 of the cover chapter; Information architecture (IA) is the field of study and information structure is the product that is an outcome of IA.



Figure 1: Literature themes of study



## **1.2 Research Question**

The investigated research questions are the following:

RQ: To what degree are users' cognitive styles and contexts of use aligned with the information architecture of a local website, and how does the (lack of) alignment shape the UX?

RQ 1.1: Which issues, related to websites and types of websites, are prominent in website UX research done in Asia?

RQ 1.2: How do local users' cognitive styles relate to their context of use when using local websites?

RQ 1.3: How do local users' cognitive styles and context of use relate to the information architecture of local websites?

RQ 1.4: How may do different card-sorting analyses influence the design of the information architecture of a website?

The dissertation thus investigates the alignment between the information architecture of a local website and its local users' cognitive styles and contexts of use, and how the degree of alignment may influence the resulting UX for local users in Denmark, Pakistan, and Malaysia.

## **1.3 Disposition of the dissertation**

In the rest of this cover chapter, I present the background, theory, theory of science, empirical research, results, discussion and conclusion. After the cover chapter, I present the four articles that are part of the dissertation. The appendices contain materials for the reader to fully understand the research procedures.

The cover chapter is structured according to the eight sections described below.

### *Section 1: Introduction*

The first section of the chapter outlines the different concepts that I use in the dissertation. These concepts are cognitive style, context of use, information architecture (IA), and user experience (UX). This section outlines the relevance of and motivation for using these

concepts, outlines the primary research question and four sub-questions in relation to the primary research question, and presents an initial overview of relevant literature for the study.

### *Section 2: The setting*

Section two of the cover chapter provides the background of the study. This section provides a discussion of standardization practices of website designs from two perspectives: internationalization and localization. It also introduces the differences in the background of the users of websites and differences in their use of languages.

### *Section 3: Theory and related work*

This section provides the theoretical background of the dissertation and related work. It presents multifaceted perspectives of the notion of a cultural group and its complexities. The presented theories and approaches to culture encompass a broad set of theoretical concepts from sociocultural, anthropological, and cognitive psychology approaches. The section explains cognitive styles, context of use of websites, UX, and information architecture. This section also provides a critical reflection on these concepts. This section opens up the discussion of the conceptual challenges surrounding the concept of culture.

### *Section 4: Theory of Science in this dissertation*

Section four of the cover chapter discusses some relevant research foundations for engaged scholarship, and identifies the research foundation of this study. This section describes different philosophical standpoints and general foundations that are followed in human-computer interaction and information systems research. At the end of section, I explain the philosophical standpoint of this dissertation.

### *Section 5: Empirical research*

This section explains the method, research design, participants, instruments, procedures, and data analysis approach of the empirical studies performed. In this section, the study argues in favor of a pluralist approach to the research (Creswell, 2009). It reflects upon how research results are richer and more reliable when methods are routinely combined together. It describes the role of a test leader in conducting a UX study. This section



describes the selection of participants in studies and the recruitment procedure. It also explains the relationship between empirical studies, describes the demographics of the users, and explains different data analysis techniques that have been used during the studies.

#### *Section 6: Results*

This section presents the four studies conducted and provides critical reflection on them, including an explanation of the results. To provide a full picture of the research done, it also includes additional data that have not been presented in the four articles attached.

#### *Section 7: Discussion*

This section provides a discussion on the main results of the study and their relation to the existing theories presented in the theory section. Furthermore, I reflect on the different methods used during the studies. Limitations of the studies are also explained in this section.

#### *Section 8: Conclusion*

Section 8 concludes the cover chapter by answering the research questions and outlining the theoretical and practical contributions. This section explains the contribution of this dissertation as well as the future work. Finally, this section explains how this research helps to build better websites.

### **1.4 Introduction to the empirical research**

The perspective of local users of local websites was studied in a literature review and four empirical studies that are presented in sections 5, 6, and 7. As this dissertation explores the research topic mainly from the empirical point of view, I will briefly introduce the empirical research before proceeding to explain the background, theory, method, findings, and results. Table 1 gives an overview of the empirical research.

In the first two empirical studies (study 1 and study 2), I compared users' perceptions of the structure of the information on the website through UX experiments at two different locations (Pakistan and Denmark). These studies explored the users' understanding of information classification by applying a variety of UX methods, such as card sorting, task

exploration, respondents' feedback on their use of a local website, and analysis of the information structure of the website. I conducted the first study in Pakistan between December 2009 and January 2010. The study looked into the users' perception of classification of information, and the resulting UX, of a local university website in Lahore, Pakistan. I conducted the second study in Denmark in August 2010. The second study, similarly to the first study, looked into the users' views of the information, and the resulting UX, of a local university website in Copenhagen, Denmark. Study 1 was conducted with 14 participants in Pakistan. Study 2 was conducted with 14 participants in Denmark. These two studies are reported in the second paper of the dissertation (Nawaz et al, 2011). I compared the findings from the first two studies, and found a number of differences in how local users viewed local websites at these two different locations. The comparison of study 1 in Pakistan and study 2 in Denmark suggested that the findings from Pakistan were different from what could be expected from the current literature on website UX in Western countries (such as Denmark). For example, in Pakistan there were issues related to the context of use in the form of the multiple languages used by local users and on the local university website. These first findings indicated a need for a deeper exploration of issues related to the users' views of local websites in Pakistan and in other countries that could be assumed to share a similar socio-cultural background and other properties.

I conducted my third study in Pakistan in May 2011 and the fourth study in July 2011 in Malaysia. These studies examined whether the found differences in studies 1 and 2 were due to differences in cultural background and context of use, and how these findings might relate to methodological issues in my research. For studies 3 and 4, I chose to use local home appliances websites, since these would allow users to be in other and perhaps more typical roles than that of a university student. Furthermore, my literature review indicated that a possible explanation for the found differences between local users' views of local websites in Denmark and Pakistan could be differences in users' cognitive styles, so I chose to focus on cognitive style, and in particular users' patterns of classification and information retrieval. Studies 3 and 4 thus applied the same methods as studies 1 and 2, but with different types of users, and with a clearer focus on users' cognitive styles and context of use. The methods included having participants organizing information through

card sorting tasks, information retrieval on websites, evaluation of websites, and the retrospective interviews. Study 3 was conducted with 30 participants in Pakistan. Study 4 was conducted with 38 participants in Malaysia. The findings from studies 3 and 4 did indicate, as expected, that the local users in Pakistan and Malaysia share a similar view of local websites. For example, users in both Pakistan and Malaysia had problems with multiple language use, lack of internet literacy, and to some degree preferred a different way of classifying information from the taxonomy made by designers of the websites' information architecture. There is a relatively large distance between the users' classification of information on the website and the actual information architecture in Pakistan and Malaysia, as compared to that in Denmark. These findings suggested that the issues related to website UX in Pakistan and Malaysia are systematically different to the issues that local users in Denmark face. Surprisingly, however, the findings indicated that local users in Pakistan and Malaysia do not have similar, but rather different issues with local websites, including different language use issues and different views of what information should be considered central. Overall, however, studies 1-4 indicate that there are systematic differences between local users' views of websites' IA in Denmark on the one hand, and in Pakistan and Malaysia on the other, and that these differences may influence the UX of local websites. These findings from the two studies (studies 3 and 4) are reported in the third paper in the dissertation, entitled "Information Classification and Information retrieval on Websites: Users Interaction on E-commerce Websites in two Asian Countries".

Since card sorting was used throughout as the main method for data collection and analysis, a deeper analysis of card sorting results may provide a critical reflection on the use of card sorting in cross-cultural studies of website UX. The data from study 4 was used for an analysis of the card sorting method itself. The card sorting analysis explored how the choice of card sorting analysis affected the suggested information structure for websites. In the card sorting technique, a variety of methods are used to analyze the resulting data. The analysis of card sorting data helps designers to discover patterns in how users make classifications and thus to develop an optimal, user-centered website structure. Analysis of card sorting thus drew attention towards how the same data for card sorting can lead to different assessments of user-website alignment, since the agreement

level between users can change for similar data based on the choice of analysis. This analysis of card sorting is reported in the fourth paper in this dissertation, entitled “A Comparison of Card-sorting Analysis Methods” (Nawaz, 2012).

Data	66 articles from four databases for literature in website UX in Asia between 2001-2011	<u>Participants</u> 14 participants in Pakistan 14 participants in Denmark - Brainstorming - Card sorting - Task exploration - The retrospective interviews	<u>Participants</u> 30 participants in Pakistan 38 participants in Malaysia - Brainstorming - Card sorting - Task exploration - The retrospective interviews	<u>Participants</u> 38 Malaysian participants card sort data <u>Tool</u> W Card Sort Analyzer (tool for analyzing edit-distance) Optimal workshop (tool for discovering test models)
Results	- Limited use of Hofstede's cultural model in UX studies - Increase in UX studies in last decade in Asia - UX studies of website information structure are limited	- Differences in organization - Information depth varies - Variation in task completion time - Variation in taxonomical classification and thematic classification	- Expect no difference in users' view of classification - Expect similar information retrieval behavior - Expect similar language preferences between local language and English language	The choice of analysis technique for card sorting studies can impact on the resulting information structure for a website

*Table 1: Outline of the empirical research*

	Literature study	Study 1 and Study 2	Study 3 and Study 4	Card sorting analysis
Title	Website UX in Asia 'from Within': An overview of a decade of literature	Information classification on university websites: A two-country card sort study.	Information classification and acquisition on websites: users' interaction on e-commerce websites in two Asian Countries	A comparison of card-sorting analysis methods
Purpose	Which issues related to websites and domain of websites are important in website usability research done in Asia?	How users' cognitive styles relate to their context of use when using local websites	How do local users' cognitive styles and context of use explains information structure of local websites	Explaining the analysis and choice of analysis for card sorting methods
Theory/ Framework	Related work: literature studies of HCI and culture	<ul style="list-style-type: none"> <li>- Information classification</li> <li>- Culture and cognitive style</li> </ul>	<ul style="list-style-type: none"> <li>- Cognitive style</li> </ul>	<ul style="list-style-type: none"> <li>- Card sort analysis theory</li> </ul>
Method	Systematic Literature Review	<ul style="list-style-type: none"> <li>- Card sorting technique</li> <li>- Usability testing</li> </ul> Analysis of card sorting study 1 in Pakistan and study 2 in Denmark	<ul style="list-style-type: none"> <li>- Card sorting technique</li> <li>- Usability testing</li> </ul> Analysis of card sorting study 3 in Pakistan and study 4 in Malaysia	<ul style="list-style-type: none"> <li>- Analysis of study 4 in Malaysia through three different approaches</li> </ul>

## 1 The Setting

Understanding user groups' cultural backgrounds and their contexts of use is important for companies to improve the UX of websites in countries such as Pakistan and Malaysia. Pakistan and Malaysia are ethnically diverse countries (World Bank, 2012). Malaysia is a multicultural country comprised of different ethnic<sup>1</sup> groups, with a slim majority of the population belonging to the mainly Muslim Malay ethnicity (50.4%), the Buddhist Chinese ethnic group being the second largest (23.7%), followed by indigenous groups (11.0%), Hindu Indian ethnicity (7.1%), and the remaining 7.8% of the population consisting of other ethnic groups. In Malaysia the government has moved toward the internet as a key communications technology, with 17.7 million (60.7% of the population) internet users as of 2012 (World Bank, 2012). Like Malaysia, Pakistan is an ethnically and linguistically diverse country. Pakistan has a population of Punjabi (44.15%), Pashto (15.42%), Sindhi (14.10%), Saraiki (10.53%), Urdu (7.57%), Balochi (3.57%) and others (4.66%). However in contrast to Malaysia, Pakistan is country of almost homogeneously Muslim ethnicity<sup>2</sup> with Urdu as its national language. The internet has penetrated in Pakistan later in the development of information technology. As of 2012, Pakistan had 17.9 million internet users (9% of the population) and the number was growing (World Bank, 2012). For Denmark, figures from statistics Denmark 2012 show that 89.6% of country's 5.5 million people are of Danish descent whereas 10.4% are immigrants<sup>3</sup>. Nearly half of the immigrants are from Scandinavian countries or Germany. In comparison to Malaysia and Pakistan, Denmark has ethnic groups as very definite minority of the total population of the country.

The number of websites in general is increasing rapidly on the internet. According to a recent survey by Netcraft (2012), there are 633 million active websites on the internet with an increase of 51 million websites per year. The increase in the number of websites is expanding in the emerging markets of Asia and Africa. As the diversity of the users on the internet increases, there is an increasing demand for knowledge about human-computer

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<sup>1</sup>Ethnicity is the "...subjective symbolic or emblematic use of any aspect of culture [by a group] in order to differentiate themselves from other group" ( De Vos, 1975, p.16)

<sup>2</sup> The theoretical understanding of the concepts of ethnicity, religion and cultural group will be explained later in the theoretical session of this dissertation

<sup>3</sup> Denmark Statistics <http://www.dst.dk/da/>

interaction from local perspectives. Research initiatives regarding the local perspectives of users have started to emerge. In 2011, two workshops were held to understand the local perspective of users. The international workshop on internationalization of products and systems (IWIPS<sup>5</sup>) was held in Malaysia and another workshop, the IFIP INTERACT<sup>6</sup> workshop on local and indigenous perspective was held in Lisbon. These workshops aimed to present different local and indigenous perspectives around the world, and tried to lead toward an international dialogue on reframing concepts and models in HCI and interaction design. Recently, a special issue of the International Journal of Human-Computer Interaction emphasized the importance of addressing the diversity in HCI and understanding interaction through local perspectives (Abdelnour-Nocera et al., 2013). From a website localization view, it is important to look into aspects of website localization in a way that does not focus solely on surface level elements such as the use of colors, symbols, and languages. We need to look further in depth into users' interaction styles and their association with those users' cultural backgrounds. This is important because new markets are emerging in website use in Asia and Africa, requiring global industry and government to dig into emerging market practices at the bottom of the pyramid. Researchers have increasingly called for a consideration of more diverse subject populations. A recent INTERACT workshop "HCI should not be weird"<sup>7</sup> has focused on diversifying subject population. In the research literature on HCI and culture, localization practices of websites have not been studied in depth (Abdelnour-Nocera et al., 2013). With the diversity of users, information systems may lead to UX problems stemming from inappropriate design (Sun, 2006). Such information systems can be improved if localization practices are included for integrating cultural understandings of users.

One point of contention is that much of the UX literature originates in developed nations such as the United States and the United Kingdom. Countries in Asia such as Japan and China do not appear in the top countries performing research on website UX. Thus, the research literature may not be clear on how we should come to understand local users' perspectives, or, more specifically, the perspectives of users who live outside Western countries. Further, there is currently considerable variation in how culture is understood

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<sup>5</sup> <http://www.iwips.org/>

<sup>6</sup> <http://www.informatik.uni-trier.de/~ley/db/conf/interact/>

<sup>7</sup> HCI should not be WEIRD! , Workshop for INTERACT 2013, Link: <http://www.arolis.com/WorkshopInteract2013/>



(or not understood) and how it might inform how IT products are adapted in different cultural groups.

In everyday life, it is often a challenge to retrieve information from websites with large amounts of content. It is well known that designers' decisions about the structure of a system may not match how users think about the system (Del Galdo & Nielsen, 1996; Norman & Draper, 1986). The challenge may, however, not be the same in different countries. A central issue in good website design is the classification of information (Dumais & Chen, 2000; Parsons & Wand, 2008). If website information is classified in a manner that fits well with how users think, information retrieval will be efficient, and may even be experienced as satisfying (Bernard, 2000; Cole et al., 2007).

Many countries have only recently joined the global internet community. Most cross-cultural studies of websites have focused on cross-cultural UX (Chiu, 1972; Clemmensen et al., 2007; Clemmensen, 2012; Marcus and Gould, 2000; Mushtaha and De Troyer, 2009), including language biases (Alostath et al., 2011; Ji et al., 2004) in Asian and Western websites. Little work appears to have investigated users' cognitive style and structure of websites in communities that have recently joined the global internet community.

Users of websites may perceive them in different ways (Mvugi et al., 2008; Yeo, 2002). Developing websites to cater for different cultural groups at the same time is a complex process, as the target users of any given website may be diverse. Companies cater to users' interaction styles in a variety of ways. This includes spending resources to deal with user-centered design issues for those cultural groups whose users come from different socio-cultural background and use different languages. Companies spend these resources, for example, to translate their website in languages which fit better with the local users' language priorities. This issue becomes more important for developing nations, which frequently consist of multiple ethnic groups. The likelihood of websites having been developed for each of these ethnic groups is fairly low. Thus, the cultural-fit of websites includes the use of multiple languages, providing local content, and focusing on users' approaches to interaction within the target communities.

Although with advances in search engine technologies some users may arrive at their target information with well-formulated queries, for others web navigation itself remains

an indispensable method for locating unfamiliar information (Katsanos et al., 2008a,b; Marchionini, 1997; Spencer, 2006; Wu & Miller, 2007). In terms of the UX of local websites, the contents of a website are generally organized into different levels of hierarchies, which in turn affect users' response times and success in finding information.

## **2.1 Internationalization and localization**

The increase in diverse users and numbers of websites is fuelling the discussion of standardization practices through two angles: internationalization and localization. Internationalization and localization are development processes that have been used in software engineering to adapt products for use and sale across many countries. Carey (1998) describes internationalization and localization in information systems as follows:

Internationalization is the process of extracting the domestic, cultural context from a package. The end goal is to end up with a sort of generic product with an appendix or attachment that contains all the culturally specific items. In other words, it is the separation of product elements into culturally dependent and culturally-independent parts (...) Localization takes a generic product and adds features and elements to fit the target culture and market. (Carey, 1998, See also Kamppuri, 2006)

Yunker (2003) described the concept of localization of websites and defined it as the "process of modifying a website for a specific location" (Yunker, 2003, p.17). Localization of websites concerns two key issues: content localization and cultural localization. Content localization includes the localization of the data and information in a websites. This information is presented in the local language that suits the local cultural context of use. Cultural localization of a website explains the general local practices in websites design. Rau and Liang (2003) have argued that localization for designing websites for Asian users, particularly cultural localization, is relatively less developed.

Kamppuri (2011) has argued that although some papers discussing internationalization and localization are looking into HCI issues, their main interest often lies in finding the most convenient ways of making the development and maintenance of international software more efficient rather than considering UX. The concept of internationalization and localization is often criticized for focusing on surface level issues surrounding elements of the user interface (Angeli et al., 2004; Kamppuri, 2011).

## 2.2 Accommodation of local users' interaction style and language background in websites

Development and research in websites in emerging countries tries to address local users' requirements by looking into surface level differences such as color, icons, and language use. The UX of any website or software application may be associated with its users' personalities and cultural backgrounds (Choong, 1997). It has been noticed that in emerging economies, companies do not talk to their user groups directly (Shakir & Nørbjerg, 2013). Due to this, the only localization possibilities may be that website languages and symbols are translated into local language. Furthermore, the design of websites may be based on metaphors taken from everyday life in the specific country in which the website is developed.



Figure 2: The content organization of a leading newspaper in Pakistan

Figure 2 presents a screenshot<sup>8</sup> of how the website of one of the media companies in Pakistan shows information on its website. The website shows bilingual text with a number of categories. The panel on the right side of the web shows numbered contents in Urdu. The top element on the right panel in translation as “1) Meer Khalil-ur-Rehman Sculpture of decency and loyalty”. It refers to the founder and first editor of the newspaper. Other contents are translated as: “2) Today’s newspaper, 3) my city, 4) jang (name of newsgroup) classified, 5) column (editorial) and essays, 6) Previous digests, 7) jang blog, 9) picture news, 10) jang fashion, 11) magazine, 12) today’s column (editorial), 13) jang blog, 15) latest (latest news)”.

The website<sup>9</sup> ranks 14th in popularity in Pakistan according to commercial web traffic data taken from Alexa<sup>10</sup>. Due to the interchangeable use of English and Urdu language in the local community, the website contents are shown bilingually to fulfill the requirements of local users in Pakistan. The website shows a large amount of text on its first page and some pictures.

Figure 3 shows an example of the Danish news website Ekstrabladet<sup>11</sup> in Denmark. The contents are translated and numbered as: “1) Ekstra Bladet (name of website), 2) The panel on the top (number 2 and 3) shows the latest news, 2) 37 minutes ago, social democrats wait for a hopeless idea, 3) See prince Joachim in a wild crash, 4) (panel for weather), 5) Front, 6) News, 7) Sports, 8) Football, 9) Flash, 11) national, 12) more”.

The website ranks 13th in popularity in the country according to commercial web traffic data in the country taken from Alexa<sup>12</sup>. The website shows a modest amount of text on the front screen. The users of the websites are homogeneous in term of language use and priority for the country and as such the website contents are only shown in Danish, due to use of Danish language by the majority of the population.

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<sup>8</sup> Screenshot of website in Pakistan <http://jang.com.pk/> taken on March 22, 2012.

<sup>9</sup> The website in Pakistan, Jang, <http://jang.com.pk/> retrieved on August 10, 2012

<sup>10</sup> The web traffic data for jang.com.pk, taken from Alexa <http://www.alexacom/siteinfo/jang.com.pk>, retrieved on August 10, 2012.

<sup>11</sup> The website in Denmark, Ekstrabladet, <http://ekstrabladet.dk/>, retrieved on August 10, 2012

<sup>12</sup> The web traffic data for website in Denmark, Ekstrabladet, copied from Alexa <http://www.alexacom/siteinfo/ekstrabladet.dk> on August 10, 2012.

From this example of popular news websites, we see that in Pakistan the news website is addressing a diverse community of readers. Whereas in the example of Danish news website Ekstrabladet which tabloid medium and thereby opposed to broadsheet media such as Politiken, which speaks to a different segment of the population, i.e. a different Danish sub culture. In Denmark newspapers tend to be either tabloid or broadsheet, whereas TV channels may be a combination of the two (e.g., TV2). It appears that the Pakistani newspaper web site (Figure 2) does a better job of speaking to a diverse community of readers.



Figure 3: The content organization of a leading newspaper in Denmark<sup>13</sup>

Language is an important component of users' background and priorities when interacting with websites. Language preference among users thus has serious implications for information display on websites. Figures 2 and 3 shows that users' interaction preferences are prioritized in the information display of websites. Some people go to the right side of the website to read news in Urdu, whereas the other people go to the left side of website

<sup>13</sup> Screenshot of website in Denmark, Ekstrabladet, <http://ekstrabladet.dk/> retrieved on August 05, 2013

to read the news in English language. This experience seems to be in contrast to research that shows that users' perceived usability increases when a website is originally conceived in their native language (Kralisch & Koeppen, 2005; Kralisch et al., 2006; Nantel & Glaser, 2008).

Information about users' language proficiency may help to understand the relationship between the choice, availability, and use of language for information on a website, particularly for online retailers and e-commerce websites eager to enhance their sales by attracting national and international users. Thus, understanding the importance of language in destined locations can enhance the UX and accessibility of websites (Clemmensen, 2011).

The language background of the user groups in the countries studied in this dissertation is quite diverse. In Denmark, more than 98% of the population speaks Danish (Eurobarometer, 2006). German is also recognized as an official regional language in the Nord-Schleswig region that borders Germany where 23,000 people (0.4% of the total Danish population) speak German. The survey of the European commission (Eurobarometer, 2006) showed that 86% of the population of Denmark stated that they could speak English as a foreign language, with 44% of the population stating that they use their English skills, although not every day.

In Pakistan the language background of the users is quite diverse. Urdu is the national language of Pakistan although only 8% of the Pakistani population speaks it as their first language. The main languages spoken by population in Pakistan are Punjabi (44%), Pashto (15%), Sindhi (14%), Saraiki (10), Urdu (8), and Balochi (4%)<sup>14</sup>.

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<sup>14</sup> Information taken from the World Fact Book: <https://www.cia.gov/library/publications/the-world-factbook/geos/pk.html>, Retrieved on June 13, 2012.



Figure 4: The content organization of a leading newspaper in Malaysia

Figure 4 presents a screenshot<sup>15</sup> of how one news website in Malaysia displays its information. The website shows information in four different languages, with figure 4 depicting the Chinese language version of the website. The contents are translated as: “1) Chinese, 2) Contact us, 3) Name of the website, 4) Login, 5) IP Login, 6) Subscribe now, 7) Parliamentary seats, 8) Barisan national (In Malaysia), 9) People Alliance”.

Malaysia is home to speakers of 137 living languages<sup>16</sup>. Among these 137 languages, the Malay language is spoken by a majority (54%) of the population. Chinese is second most spoken language (23%) and Tamil is spoken by 7% of the population.

The information on websites in Malaysia might be presented in ways that suit Malaysian users’ interaction styles. For example, the information is presented to fulfill the requirement of users with different language backgrounds.. The website shows a considerable amount of text, with options to change the language between English, Malay and Chinese. The contents of the website are presented to the users in

<sup>15</sup> Screenshot of website in Malaysia, <https://www.malaysiakini.com>, retrieved on May 05, 2013.

<sup>16</sup> Information taken from World Fact Book: <https://www.cia.gov/library/publications/the-world-factbook/geos/pk.html>, Retrieved on June 13, 2012.

English, Bahasa Malaysia, Chinese and Tamil. The website ranks 10th in popularity in the country according to commercial web data taken from Alexa<sup>17</sup>.

In summary, local users from different geographical locations have different cultural backgrounds that are indicated in the design of the websites in each country.

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<sup>17</sup> The web traffic data for website in Malaysia from Alexa <http://www.alexa.com/siteinfo/malaysiakini.com>, retrieved on August 10, 2012.



### **3 Theory and related work**

This section of the dissertation reviews the concepts and theories related to cultural background, context of use, information architecture, and UX, and outlines the theoretical approach used in this dissertation.

#### **3.1 Cultural background of website users**

In this section, I introduce and explain the aspects of culture that will be covered and not covered in this dissertation. I look into the notion of culture from my knowledge about HCI and how culture is applied in the field of HCI. I address culture from a cognitive psychology perspective because I am interested in culture in regard to users' cognitive style and website use. My perspective and analysis of cultural aspects of website user experience is mainly inspired by that of Nisbett (2003). In Nisbett's view, culture profoundly influences the contents of thought through shared knowledge structures. Humans learn basic cognitive processes in their childhood. Children develop particular models of the world, including theories of mechanics, theories of natural kinds and a theory of mind. In my view, humans' particular models of the world must have some implications for their approach to interaction with websites. Understanding website UX thus requires an evaluation of websites that focuses on users' models of information when they are interacting with those websites in particular contexts of use.

This dissertation will not look into the aspect of culture as an anthropological phenomenon. This dissertation does not treat culture as a complete whole which includes knowledge, belief, art, morals, law, custom, and any other capabilities and habits acquired by man as a member of society.

My perspective of culture is pragmatic; I try to use the concept of culture to create knowledge within HCI. In this dissertation, I treat regional and national culture as relatively stable social phenomena that are great sources of inspiration for understanding human-technology relations such as website use and website design. I appreciate that culture is a complex phenomenon, but choose to focus on cultural difference by studying users from different geographic regions. I do not intend to claim that all or even most cultural differences are between geographical regions, but I believe that differences

between website users from different geographical regions can meaningfully be conceptualized as cultural differences.

I am using other researchers' work on certain psychological aspects of cultural practices to understand users' website interaction. I will be reflective and critical towards the use of culture as an explanatory and analytical concept in this research.

While looking into the background of the term "culture", for a long time it was simply not in the vocabulary of computer science. Culture is a complicated phenomenon with a checkered history. Williams (1985) states that culture is one of the most complicated words in the English Language. The concept of culture is not only complicated from a linguistic, historical perspective. The treatment and usage of the concept "culture" has also added to the complexity. The notion of culture as used within anthropology is widely in use, but the term 'culture' has historically been used in a variety of ways.

It is impossible to give an exhaustive description of the phenomenon of culture, or a complete account of the history of the concept of culture, for a number of reasons. First, the phenomenon is quite complex. Williams (1985) attributed the complexity of the concept to complicated historical developments in many European languages. Second, there is an overwhelming amount literature on the concept of culture, with more than 200 definitions of culture compiled in Kroeber and Kluckhohn's (1952) seminal work, for instance..

### **3.1.1 Ethnic group, Cultural Group or a National Group?**

This section will describe ethnic, cultural, and national groups and their relationship with the current research. It will outline the multifaceted perspectives of these notions and their complex nature. Culture in this section is used as an analytical tool to distinguish groups of people.

The relationships between cultural groups, ethnicity and national groups are quite complex. The goal of this section is not to answer whether the choice of using cultural group, ethnic group or national group as a unit of cross-cultural analysis is most appropriate. This section rather tries to address the nature of the complexity of these concepts. For example, taking the example of Pakistan, we find there are many ethnic groups inside that national group, including Punjabi (44.68 %) and Pashtun (15.8%). India

and Afghanistan also have a representation of Punjabi (4%) and Pashun (47%), (Central intelligence Agency, 2012) respectively in their ethnic population. In terms of conducting cross-cultural studies, what should be the unit of analysis in these kinds of situations? Should there be a cluster on the basis of ethnicity and not of nationality? Further, the Punjabi ethnicity in Pakistan is different from that in India. Even though both of them share most of the same cultural values across national boundaries, their religious beliefs are rather different. These religious beliefs have certain implications for their thinking style. On the other hand, taking the example of Pashtuns in Pakistan and Afghanistan, the Pashtuns share many shared values across transitional boundaries of the country. The ethnic Pashtun consider themselves as ethnic tribes across the boundaries between the two countries.

The term ethnicity is derived from the Greek word “ethnos” which is translated as “nation”. Ethnicity and ethnic groups have been considerably debated in cultural anthropology, sociology, and psychology (Baumann 2004). There is no single definition of how ethnicity or ethnic groups are formed. Ethnic groups are generally referred to as, but not limited to, people who have common ancestry, appearance, heritage, history, language, religion, and traditions (O'Neil, 2006). The Oxford dictionary defines ethnicity as a state of belonging to a social group that has a common national or cultural tradition (Oxford Dictionaries, 2013). This definition does not imply a difference in national and cultural tradition. While looking into the history of the term in English language, Hutchinson and Smith (1996, pp.4-5) argue that term ethnicity first appeared in the Oxford English dictionary in 1953, but that its English origin has been in use since the Middle Ages.

Ethnic identity can be defined as “a manner in which persons, on account of their ethnic origin, locate themselves psychologically in relation to one or more social systems, and in which they perceive others as locating them in relation to those systems” (Isajiw 1993, p.8). Therefore identity is an important aspect of ethnic groups.

Jones (1997) states that an ethnic group is classified as “any group of people who set themselves apart and/or are set apart by others with whom they interact or co-exist on the basis of their perception of cultural differentiation and/or common ancestry” (Jones 1997, p.13). Thus cultural difference is another aspect of the concept of ethnic groups.

In this regard, in Malaysia on a broad level we may think of three ethnic groups, Chinese, Indian, and Malay, that interact with one another on the basis of their differentiation and common ancestry, language, appearance, heritage, and traditions. While looking into Pakistan, the ethnic groups based on common ancestry are different. These ethnic groups (such as Pashtun, Punjabi, Balochi, and Sindhi) are formed on the basis of common ancestry, language, appearance, heritage, and traditions. In Pakistan, although the ethnic groups are different, their religion is a common factor across ethnic groups.

Cultural groups might be said to be made up of people who live in a particular location and who tend to think, feel, and act in a similar manner. Cultural groups are defined on the basis of their ethnic grouping, nationality, and geographical location. The term 'cultural groups' is generally used to refer to the ethnic groups in a country. In this regard, an ethnic group might transcend the geographical boundaries of countries whereas cultural groups include most of the properties of ethnic groups within a geographical boundary. Cultural groups are also sometimes defined on the basis of people's occupation, expertise, and work settings (Yeo, 1996). In many larger countries people refer to a national identity or ethnicity, but practice various regional and local customs. In this regard, a person can belong to multiple groups and is not bounded by a single group. Studies have used cultural groups and ethnic groups interchangeably in the literature. Therefore, it is not straightforward to define ethnic origin or cultural group in a singular manner.

For religion, there may be a general understanding in the scholarly community to treat religion as one of the components of identity. Religion, along with nationality, shared history, and language, might be associated with the basic 'building blocks' of ethnicity. Religion further increases the complexity of cross-cultural research into defining ethnic groups. Taking the previous example of Punjabi ethnic groups in Pakistan and India, most of the values are shared transnationally in Pakistan and India but the religious beliefs within one ethnic group are entirely different.

In conclusion, the concepts of ethnic groups and cultural groups will be used interchangeably in the research in this dissertation. I have chosen this approach to simplify the complex discussion of differentiating between cultural groups, national groups, and ethnic groups.

### **3.1.2 Socio-cultural differences in values and communication styles**

Anthropology deals with humanity and characteristics of human experience from a social and cultural perspective, but is generally equated with ethnography in HCI studies (Räsänen & Nyce, 2006). The sociocultural approach of anthropology deals with culture by examining diverse human societies and cultures (Punchoojit & Chintakovid, 2012). Generally in anthropology, culture refers to ‘socially transmitted patterns for behavior characteristic of a particular social group’ or to a ‘way of life among particular people’ (Livari, 2006; Kroeber & Kluckhohn, 1952).

HCI studies tend to use a single approach to sociocultural anthropology when dealing with culture: Geert Hofstede’s cultural dimensions (Hofstede, 1984, 2005).

#### **3.1.2.1 Hofstede’s Cultural Dimensions**

Hofstede’s cultural model is based on cultural values, which form the implicit core of culture. Hofstede (1984, 2005) views culture in terms of patterns of thinking, feeling and acting. He characterizes these patterns as mental ‘programs’. These mental programs vary as much as the social environment in which they are acquired. Hofstede created a five factor cultural model that is perhaps the most cited in cross-cultural web design articles (Kamppuri et al., 2006). These five factors are: power distance, uncertainty avoidance, masculinity/femininity, individualism/collectivism, and time orientation (Hofstede, 2005). Power distance (lower or higher) is a way to explain the handling of differences between groups existing in a system of inequality. For example, Denmark has a lower power distance. Managers and subordinates have egalitarian relationships with access to near equal levels of power. Uncertainty avoidance is the degree to which people in a country prefer structured to unstructured situations. In countries with low uncertainty avoidance, people believe there should be no more rules than are necessary and that if they are ambiguous or do not work they should be abolished or changed. Masculinity/femininity is the degree to which “masculine” values like assertiveness, performance, success, and competition prevail over “feminine” values such as quality of life, maintaining warm personal relationships, service, caring, and solidarity. Individualism/collectivism is the degree to which people in a country have learned to act as individuals rather than as members of cohesive groups. Finally, time orientation refers to how much a society values long-standing as opposed to short-term traditions and values.

Hofstede provides a large amount of data, employee values scores collected by IBM between 1967 and 1973, to show that geographical region captures differences we may meaningfully label culture in this dissertation. Hofstede's model of national culture has been extensively used as a measure in cross-cultural studies.

There is a lot of criticism of Hofstede's model of culture for taking culture as static and monolithic state. Researchers within information systems have pointed out three major concerns. The first of these concerns the notion that culture falls along national boundaries. In Mayer's (2003) view, understanding cultural differences in terms of national culture is an overly simplistic approach to dealing with this complex domain. The second concern is that national culture is supposed to be homogenous, discounting subcultures within a national culture. Pau Huo and Randall (1991) argue that exploring subcultural differences is as interesting as national cultural differences, and yet little focus has been given to this area. The last and most common concern which researchers find in the use of Hofstede's dimensional model is that dimensions of culture are described at a national level whereas most of the research studies apply it to an individual case or to a local group (Ford et al. 2003; Straub, 1994).

In order to support the idea of the nation as a unit of analysis, Minkov and Hofstede (2012) objected that the critique had little empirical support. They argued with empirical evidence that the nation as a unit of analysis is true even of countries like Malaysia and Indonesia, or Mexico and Guatemala, despite their shared official languages, religions, ethnic groups, historical experiences, and various traditions. In their view these countries do not intermix much when they are clustered on the basis of cultural values (Minkov & Hofstede 2012). In summary, Hofstede's model has got some criticism, however it has also provided value in the research done in HCI, marketing and information system.

### **3.1.3 Cognitive styles and cultural differences**

Cognitive psychology is the study of the processes underlying mental events. The cognitive psychology approach examines how people perceive, remember, think, speak, and solve problems (Feist & Rosenberg, 2010; Ross, 2003). Research in cognitive psychology has indicated that people have differences in their cognitive processing styles during problem solving and decision making activities. Cognitive processes are processes that work

together to form a thought. In this regard certain activities involves different cognitive processes. Ross (2003) states:

... all the mental processes that are (or can be) subject to social transmission, as well as other elements of human behavior, including material goods and all kind of institutions that help to establish and form our mental processes. These different elements (mental, behavioral, and material) can often be understood only as a set of interrelated features, one causing/forming the other, that are in constant relation with the social, historical, and natural environment. (p.57)

Researchers have recently shown that cultures vary in basic cognitive processes, and particularly along the analytic–holistic dimension in cognitive style. Some cultures tend to have a more *analytic* cognitive style: “detaching a focal object from the perceptual field, categorizing objects taxonomically, and ascribing causality to focal actors or objects.” (Na, Jinkyung, et al. 2010, p.6192), while other cultures tend to be more *holistic*: “paying attention to the entire perceptual field, especially relations among objects and events, categorizing objects on the basis of their thematic relations, and attributing causality to context” (Na, Jinkyung, et al. 2010, p.6192). The following section further explains cognitive processes and cognitive styles and their relation to culture.

### **3.1.3.1 Culture and Cognition**

The cognitive aspect of culture emphasizes that culture influences cognitive processes (Masuda & Nisbett, 2001; Nisbett et al., 2001; Norenzayan et al., 2002; Ross, 2003; Vatrapu 2007). Cognitive processes in psychology concern *knowledge* and the way people use this knowledge to make sense of the world (Masuda & Nisbett, 2001; Nisbett et al., 2001; Norenzayan et al., 2002). Cultural cognition theory frames the view that local culture profoundly influences the contents of shared knowledge structures. Local culture thus ultimately impacts on the design and development of websites (Faiola, 2005). It is also important to understand that this study does not take culture and cognition to be a static and monolithic state. It rather takes the stance that these cognitive processes and shared knowledge structure changes, but that this change takes time and changes do not occur

quickly. Since website use requires knowledge, we may assume that classification is also a cognitive process in addition to being a social, organizational, and cultural process. The cognitive processes that are involved in people's use of websites might be influenced by the shared knowledge in that user group's local culture.

In cognition, cognitive style describes the way an individual thinks and remembers information. Cognitive style is an individual's typical way of thinking about, processing, and organizing information, problem solving, and learning (Riding & Rayner, 1998). It is a way for an individual to consistently adopt a strategy to solve a problem. Witkin (1967) argues that people's cognitive styles are related to their family experience and the place where they grew up.

Following the same line of argument, Nisbett (2003) and Ji et al. (2000) readdressed the work of culture and cognition, which nobody continued after Witkin's death. Nisbett (2003) argues that an individual's cognitive style is either holistic cognitive styles or analytical. He further argues that there are considerable differences between the East and West in term of thinking patterns.

Ji et al. (2000) used Witkin's (1967) Rod-and-Frame test to analyze the cognitive styles of East Asians and European Americans. They argued that on East Asians and European Americans different field dependencies apply while looking into Rod-and-Frame test. Nisbett and Norenzayan (2002) and Nisbett et al. (2001) defined holistic and analytical perspectives in the following ways:

Holistic thoughts [involve] an orientation to the context or field as a whole, including attention to the relationships between a focal object and the field. [The] holistic approach relies on experience-based knowledge rather than abstract logic and the dialectical. It means that there is an emphasis on change and recognition of contradiction. Analytic thought involves a detachment of the object from its context, a tendency to focus on the attributes of the object in order to assign it to categories. Furthermore, analytic thoughts have a preference for using rules about categories to explain and predict an object's behavior. (Nisbett & Norenzayan, 2002, p.21)



Nisbett and Norenzayan (2002) claim that most psychology concerning cognition in the 20<sup>th</sup> century strongly held the assumption that:

- "Basic cognitive processes are universal: every normal human being is equipped with the same set of attention, memorial, learning, and inferential procedures
- The basic cognitive processes work in much the same way regardless of content they operate on
- General learning and inferential processes provide the growing child with all it needs to learn about the world. Content is supplied by these cognitive processes operating on an environment
- Since political and economic worlds of different people are different, the content of human minds – theories, beliefs values etc. is indefinitely variable" (Nisbett and Norenzayan 2002, p.561).

Nisbett and Norenzayan (2002) argue that most psychologists in the 20th century held these incorrect assumptions about the relationship between culture and cognition. The misconceptions were carried from the theoretical position of learning theory as well as formalist theory. These theories assume that cognitive processes are universal and that all normal humans are equipped with same set of cognition. In HCI, similar assumptions may hold, promoting UX as universal. However Frandsen-Thorlacius et al., (2009) has challenged this assumption. These assumptions in HCI are challenged by the research presented in this dissertation.

The idea that culture shapes the contents of thought (shared knowledge) is central to modern cognitive anthropology. Recent empirical results have shown that culture and cognition are not as disassociated as traditional psychology has assumed (Ross, 2003). Nisbett and Norenzayan (2002) have stated that only some cognitive processes are universal. For example, babies are born prepared to develop particular models of the world, including theories of mechanics, theories of natural kinds, and a theory of mind. On the other hand, in Nisbett and Norenzayan's (2002) view, some of the fundamental cognitive processes are in fact highly susceptible to change even for adults. They stated:

- "Cultures differ markedly in the sort of inferential procedures they typically use for a given problem.

- The cultural differences in cognitive processes are tied to cultural differences in basic assumptions about the nature of the world that the traditional distinction between content and process begins to seem somewhat arbitrary.
- Cultural practices and cognitive processes constitute one another. Cultural practices encourage and sustain certain kinds of cognitive processes, which then perpetuate the cultural practice” (Nisbett & Norenzayan, 2002, p.562).

This idea of culture shaping cognition, and their interdependence on each other has implications for website use. Users’ views of websites are shaped by their cognition. For example, when thinking about information on websites, users may be influenced by cognitive practices and traditions prevalent in their environment.

Regarding cognition, critics of cross-cultural research argue that the cross-cultural psychology tradition often assumes that variation in cognition exists only across cultures (Hermans & Kempen, 1998; Hong & Chiu, 2001), often ignoring variation within cultures, which shares the same cognitive psychological properties. In their view, variation within a cultural group is more important to study and research. Others critics of cultural psychology states that the idea of cultural cognition is purely based on cultural stereotyping and faulty methodologies in the studies.

Hermans and Kempen (1998) argue that despite widespread interest in cross-cultural distinctions, cultural dichotomies do not and cannot meet the challenges raised by the process of globalization. In their view, the process of globalization is drawing people from cultural origins into close relationships.

### **3.1.3.2 Cultural differences and HCI**

In HCI studies, cultural models are used extensively to explain the subjective features of cultural differences in groups (Fitzgerald, 2004; Plocher et al., 2012). There is a growing literature on cross-cultural software and website design discussing both the ‘objective’ features of cultural differences, such as the scripts, fonts, and date formats people use (Nathan & Yeow, 2009, 2011), and the ‘subjective’ features of cultural differences, such as how people react to color, and so forth (Marcus & Hamoodi, 2009; Wallace & Yu, 2009, Nawaz et al., 2007). Cultural studies use cultural dimension models, cultural marker models, and cultural behavior models. Thus, cultural dimensions have been used to

distinguish between countries (national cultural user groups), cultural markers models have been used to identify culturally specific elements on websites, and cultural behavior models discuss the cultural differences in online behavior between the users of websites in different countries.

### **3.1.3.3 Cultural Demographics and Two Schools of Thought**

To understand the phenomenon of how much cultural and demographic background affects the evaluation of websites, research must be done. There are two camps that frame this discussion of cultural understanding in interface design. First are those supporting the internationalization of websites, who argue that their strategy helps companies not only to save money, but also to help users to remember the positioning of information in different locations. These researchers, such as Nielsen (1993), use Hofstede's dimensions to make websites that can be used across countries. However, there are also researchers who support localization practices and who are of the view that websites should present information that matches users' cognitive models in order to be understandable to local users. Some of these researchers use Hofstede's dimensions as the primary criteria for measuring the cultural UX of a website in a local setting. Other researchers in this second school of thought use cultural cognition theory. These researchers are more interested in the details of the interaction, rather than the national values (Chang, 2011; Clemmensen et al., 2009; Faiola, 2005; Faiola & Matei, 2005; Isa et al., 2009c; Shi, 2008). These researchers support their position by stating that culture is a discernible variable in website design and content organization and thus that culture should accommodate global users who access online information or products (Faiola, 2005). In regard to cultural UX studies, most research discusses cross-cultural website design and culturally preferred interface design (Evers & Day, 1997; Marcus & Hamoodi, 2009; Mushtaha & De Troyer, 2009; Sheppard & Scholtz, 1999; Sun, 2001). These studies discuss the relationship between culture and interface design, and to some degree take into account the design of websites in different cultural groups.

Cultural demographics and these two schools of thought are related to this dissertation as they will help in reflecting on users' views of websites and will assist in understanding if users' views of websites are similar or different.

Summing up on this section, there are two schools of thought on cultural demographics within HCI: one that focuses on internationalization, and the other that focuses on localization. Within the localization school – the most relevant school for this dissertation – Hofstede (1984) has been used by many HCI researchers to address issues related to national culture, whereas other researchers have focused on the cultural cognition aspect of HCI (Chang, 2011; Clemmensen et al., 2009; Faiola, 2005; Faiola & Matei, 2005; Isa et al., 2009c; Shi, 2008).

#### **3.1.3.4 Related work on cultural marker models**

Another set of studies related to the research in this dissertation are studies of cultural markers. Cultural markers are preferred patterns and features for each local user population that are followed in the design of a website. Cultural markers may include the use of national symbols, specific colors, and information space in the web design. Cultural marker models explain the preferred patterns and features in each culture that can be followed in the design of a websites (Barber & Badre, 1998).

Following on from the studies of Barber and Badre (1998), Sun (2001) described a noticeable cultural marker pattern being followed in multilingual web page design. Sun argued that due to certain preferences, certain elements of cultural makers such as visuals, colors, and page layout are followed in the multilingual web page design of different cultures. One question that may arise from this is whether elements of cultural markers may also vary over a period of time as culture changes. Recent research by Mustaha and Troyer (2009) identified the settled and moving cultural markers involved in the design of website. Their study found five levels of cross-cultural markers: context-dependent markers, settled markers, broad markers, variable markers, and vista markers. *Context dependent* cultural markers are shared between users who use the same website category frequently. Mushtaha and Troyer (2009) expressed that users' frequent visits create semantic meaning for website elements related to the website. *Settled* markers are those markers that are confirmed by studies over a period of time. The cultural markers resulting from the study of Mushtaha and Troyer (2009) were described as *broad* markers, whereas those markers discovered in previous studies but not appearing in the study of Mushtaha and Troyer were labeled *variable* cultural markers. Mushtaha and Troyer called

cultural markers that appeared on a national level *via* cultural markers, but did not provide further details.

Sheppard and Scholtz (1999) showed how users from the Middle East (Arab countries) and the U.S performed better when the interface design was adapted to their own culture. Sun (2001) ran an exploratory study that suggested that users prefer websites with cultural markers from their own cultures.

*Table 2: Preferences of cultural markers (Sun, 2001)*

<i>Preference for cultural Markers</i>	<i>Cultures of Origin</i>	<i>Context</i>
Hierarchical and structured page layout	Germany	Low context
Attractive colors, more pictures	Brazil	High Context
Visual related to local culture	China	High context

Table 2 shows the cultural preferences of users from high and low context cultures. High context and low context refer to a culture’s tendency to use high context messages over low context messages in routine communication. By looking at different subjects’ preferences in terms of visuals, colors, and page layout for cultural markers on the cultural level, the study found a clear connection between their preferences and their cultural contexts. The users from high context cultures shared a strong preference for visuals. This is related to this dissertation because the ways in which users tend to think about the layout and structure of webpages and their preferences for information structure may vary within and across cultures.

### **3.1.3.5 Cultural behavior model**

A cultural behavior model looks into the differences of behavior between the users of websites in different countries. A user’s individual behaviors are partly determined by the values of their culture or cultures. Thus a user’s positive or negative attitude and intention toward a product can be explained better if information regarding their background culture is available. Chau (2002) investigated differences in user behavior on websites in the U.S. and Hong Kong. The study found four factors of online behavior: social communication, e-commerce, hobby, and information retrieval. The study suggests that paying attention to these factors is important. For example, an e-commerce site targeted

towards Hong Kong users may be more successful if it provides opportunities for social communication.

Users' adoption of websites can be assessed through cultural marker issues. Cultural markers not only advocate the localization of language by translating the websites in and adding local graphics, the local content itself is also central to the positive behaviors of users adopting websites.

User behaviors are related to this dissertation as the literature indicates that users behave differently in different cultures this will reflect upon users' behavior relative to information structure. It will further assist in reflecting upon information retrieval behavior.

#### **3.1.4 Critical reflection on the concept of culture**

The position of *culture as discourse* challenges the common assumptions in cross-cultural research that cultural characteristics (e.g., individualism and collectivism) are global constructs that invariantly characterize members from different national groups (Hong & Mallorie, 2004). The dynamic approach to culture rests on two premises. First, culture is conceptualized not as a general, monolithic entity, but as a loose network of domain-specific cognitive structures (including theories and beliefs). Second, an individual can hold more than one cultural meaning system, even if the systems contain conflicting theories (Hong & Mallorie, 2004). Due to globalization, culture cannot be seen as homogenous but rather as something changing constantly. In this way, whatever people construct within a society is considered a culture. The common understanding which people construct within their societies can also be constructed in a different way. So there is never one way of looking into culture, but rather there are different discourses of culture that people create. Hong and Mallorie (2004) argue that cross-cultural differences may appear or disappear depending on the availability, accessibility, and applicability of cultural theories.

Representation of a particular way of information organization can make its own culture. Bourges (1998) describes that possessing a representational system can create a culture, and that culture is partly constituted by that system (Bourges-Waldegg & Scrivener, 1998). In this dissertation, my use of the concept of culture has been inspired by the both the

dynamic situation specific approach to culture and the representational approach to culture.

### **3.2 Context of use of websites**

In HCI, context of use is important. First, it allows interfaces to provide information based on the special nature of context, for example through the choice of languages, information presentation style, and the use of cultural markers. Second, it helps us to reflect on the common understandings of a group of users shared in a group. The context of use includes characteristics of intended users, the tasks users perform, tools users use, and the environment in which users use the system (ISO9241-11, 1998). In my view, the context of use or context of use is related to users' local culture. This includes users' cognitive style, as users might tend to approach the website in systematic way or they might look for information in a random way. The context of use may also include the language proficiency of the users, access to the internet, and their frequency of internet use.

In context of use, language is generally considered a characteristic of a cultural group. In view of Kralisch (2006), the role of language goes beyond a characteristic of a culture. Within a cultural group, language is used as a system of communication and exchanging information. Language serves as a system of symbols that contains particular meanings for the users of the language. Users' use of language is context dependent in the view of Sapienza (2008), who suggests that users might maintain their own distinct languages. Users might select default options on computers rather than elements localized according to language.

#### **3.2.1 Defining context of use**

Within a standard definition of usability, the context of use consists of the users, tasks, equipment (hardware, software, and materials), and the physical and social environments in which a product is used. Context of use is also incorporated into the ISO9241-210 standard on human-centered design. This defines the process of understanding and specifying the context of use as one of the main stages within the human-centered design process (Maguire, 2001). The context of use is related to the local users' culture. The elements of context of use include systems, tasks, languages, and frequency of use of the internet, as well as physical, technical, and organizational environments. Websites can be thought of as being part of some specific domain, such as academic websites or e-

commerce websites. Tasks are the activities that are undertaken to achieve goals (Maguire, 2001, p.460). The technical environment also impacts on users' ability to navigate websites. For example, users of a local culture are inclined to use a specific type of system. The website should be able to support the technical environment of the system (for example web browser on a Linux or Windows system). Language fluency is also an element of context of use as it impacts on the information design of websites. Frequency of internet use may also be stated as an element of context of use. Some users may not use the internet frequently, and this may affect their information retrieval. Physical environment is also an element of context of use. The physical environment includes the design of the workspace, the conditions in which users access information online.

The context of use of websites can be explained through the goals of the users in the local environment. For example, academic websites may focus on stakeholders such as students, teachers, administrative staff, parents, and other others directly related to the website. The context of use of an academic website may include a variety of users from different sub-cultures and therefore information should be included to address users' requirements. The description of the activities is related to goals achieved by the users of the system. The use of the context also looks into the technical, physical, and social environment in which the system is used.

Marion and Vera (2003) draw attention to the fact that context of use also includes computer literacy. They state that most of the cultural phenomena of websites discuss cultural background and diversity in cultures, but do not pay much attention to the educational aspects of cultural dimensions. They illustrate how literacy activities in the educational system have had a direct influence on the perception and use of the web in South Africa. The study also found that the categorization of information on a websites was also one of the most frequent causes of error for students.

### **3.3 Information Architecture**

Information architecture (IA) refers to the structural design of a shared information environment. According to Morville and Rosenfeld (2006), the term 'information' is used to distinguish information architecture from data management and knowledge management. The data in databases is highly structured and produces specific answers to specific questions. On the other hand, knowledge is the information in people's heads.



Information architecture concerns with the ability to express and model concepts that require explicit details of a complex system. It is a means of organizing information in such a way that users can efficiently manipulate it (Morville & Rosenfeld, 2006; Toms, 2002).

On an abstract level, IA is a structure or map of information that allows others to find their personal paths to knowledge (Toms, 2002; Wurman, 1989). Historically the term is attributed to Richard Wurman (1997), who explained IA as a creation of structural and orderly principles. The Information Architecture Institute defines IA as the art and science of organizing and labeling websites, intranets, online communities, and software to support usability.<sup>18</sup> The term 'information architecture' has been applied in different domains of study, but has often been loosely used and it is largely unsubstantiated. IA may be considered as a field, but it has not reached the status of discipline (Haverty, 2002).

From the perspective of UX research, IA is the art and science of shaping information in a way that will assist users to navigate better and will enhance their experience of UX. IA is understood sometimes as the skilled process of making wireframes for websites. A wireframe is the screen blueprint and visual guide that represents the skeleton framework of a website. However, IA is a field of study and explaining IA through wireframes only covers one aspect of the larger field.

### **3.3.1 Morville and Rosenfeld's model of Information Architecture (IA)**

According to Morville and Rosenfeld (2006), IA is made up of relationships between the three areas of users, context, and content. The diagram in figure 5 shows the IA model of Morville and Rosenfeld (2006).

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<sup>18</sup> <http://iainstitute.org/>

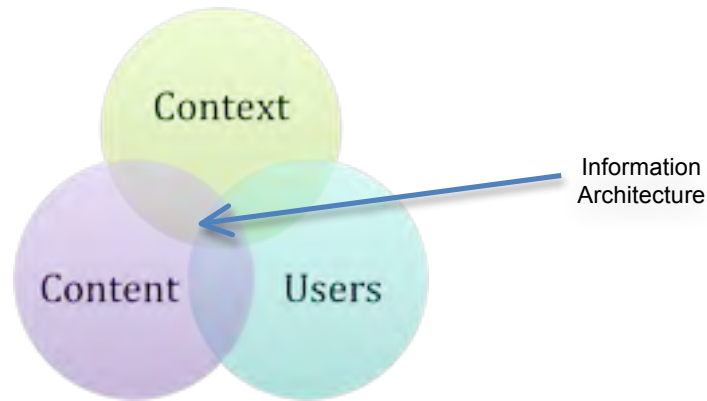


Figure 5: Morville and Rosenfeld's (2006), model of information architecture

The context of a website is related to the business context in the view of Morville and Rosenfeld (2006). This view of context is quite broad as Morville and Rosenfeld (2006) include political environment, budgets, schedules, technology infrastructure, human resources, and corporate culture in context.

Figure 6 outlines a simplified navigational structure of a bi-lingual website in Pakistan. It focuses on the context of use of the website for a variety of people with different language preferences. A concrete example of the multi-lingual website is shown in section 2.2 (figure 2).

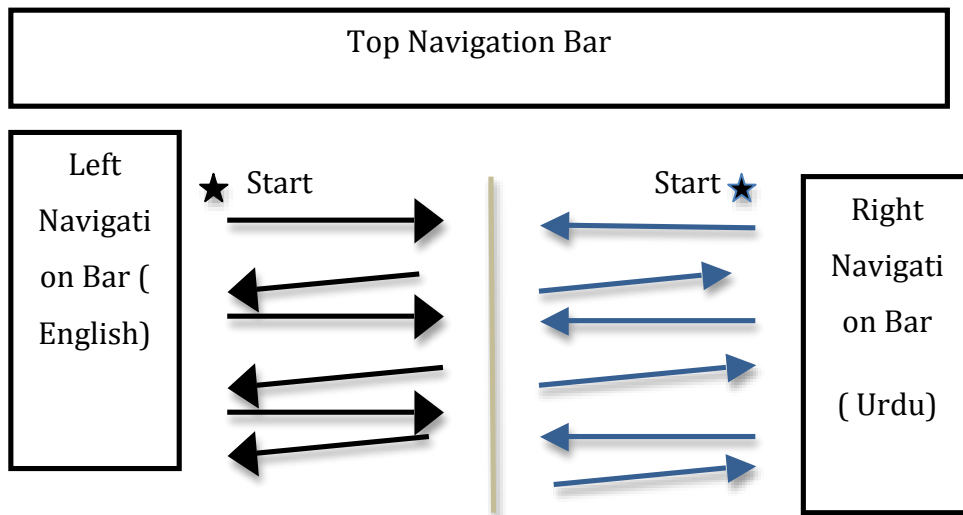


Figure 6: Typical elements of navigation on Bilingual Pakistani website

The contents of IA in website design comprises documents, services, schema, and metadata that people use to find information (Morville & Rosenfeld, 2006). Naturally, the

contents of the websites vary from one domain to another. On a university website, for instance, the contents are mostly focused towards students' and staff's needs and requirements. Generally, such institutional websites provide information to those who have a direct or indirect interest in obtaining information. In the case of a university, such groups could include students, teachers, parents, and administrators. Provided information might include exam results, news updates, study schedules, and other such information. The contents of an e-commerce or auction websites might typically include contents regarding product information, the privacy of buyers, and the conditions of buying and selling. In summary, the content of a website is a mix of structural, descriptive, and administrative data. Ideally, all the data should be associated with the local users' needs and requirements.

The user is the third and most important component of the IA model. According to Morville and Rosenfeld (2006), users include respondents, visitors, actors, employees, customers, and more. Users in this model of IA are a very broad category. Morville and Rosenfeld do not discuss much about the cultural background of the users, however. Kamppuri (2011) discusses the cultural background and illustrates that cross-cultural UX research has studied users differently over time, identifying three waves of UX studies. In the beginning of 1980s, during the first wave of human-computer interaction, researchers recognized that there was a need to *"look at users in a different light ... [in which] the centre of a system is a user"* (Kamppuri, 2011, p.16). Thus, in this first wave of human-computer interaction, engineers looked at users in a different light with the computer as the major tool of investigation. The second wave of human-computer interaction started to gain hold in the late 1980s, with a focus on research turning towards understanding users as individuals with different tasks and backgrounds. Now, during the third wave in the new millennium, when web access and computer use have become available to a far more diverse group of people, the basic challenge remains the same: how can users' cognitive styles relative to information be transformed into meaningful information that can be used to enhance web accessibility.

### **3.3.2 Denn and Maglaughlin model of information architecture**

The model of Denn and Maglaughlin (2000) articulates the elements of IA in a somewhat similar way to that described by Morville and Rosenfeld (2006). This model represents IA

as the intersection of content, applications included in the architecture, the users using the content, and the context in which the system is used.

This model is based on the feedback of people who were involved in the study of modeling IA. The model of Denn and Maglaughlin (2000) provides a general framework of IA. Figure 7 illustrates the aspects of context, contents, and users, provided by Morville and Rosenfeld (2006). Contents not only refer to the data but also the knowledge users gain from the information. The left side of the figure shows users and users' relations to the information. The right side of the figure shows the IA of the website. The right side of the figure explains how the design of IA such as structure, tags, classification, and models and their implementation helps to present information in terms of data and knowledge.



Figure 7: Model of IA by Denn and Maglaughlin (2000)

The models of Morville and Rosenfeld (2006), and Denn and Maglaughlin (2000) describe IA as a field of study. By engaging in studies of IA, a website gets its structure. The structure of a website is thus the product of an IA process. One question that needs to be asked, however, is how much these models take into consideration the cultural context of

IA. Morville and Rosenfeld highlight cultural context in the user component of their model, arguing that users from different cultures prefer different modes of information representation. Denn and Maglaughlin (2000) explain IA as intersection of contents, applications, and users. This model opened some discussion and communication between academics and practitioners, but there was no follow up work.

### **3.3.3 Critical reflection on the concept of IA**

In HCI, researchers have discussed the IA of websites in a variety of different ways (Allen & Boynton, 1991; Danaher et al., 2005; Dong et al., 2001; Duncan & Holliday, 2008; Isa et al., 2006, 2007, 2008, 2009b, 2009c; Kim et al., 2005; Mvugi et al., 2008; Petrie et al., 2011; Rahim et al., 2006; Rau & Liang, 2003; Toms, 2002). Issues addressed include the use of information system architecture for organizational support (Allen & Boynton, 1991), information interaction (Toms, 2002), designs of information structure for behavior change websites (Danaher et al., 2005), understanding mobile context (Kim et al., 2005), and the design and evaluation of library websites (Duncan & Holliday, 2008; Mvugi et al., 2008). Other aspects of IA studied include the issue of internationalization versus localization (Rau & Liang, 2003), and frameworks and models for IA (Isa et al., 2009c; Rahim et al., 2006). Gullikson et al. (1999) talk about IA from an interface design perspective and state that IA refers to the *how* factor in that it concerns how information is categorized, labeled, and presented, and how navigation and access are facilitated.

Companies that intend to conduct international business on the web should consider the impact of culture on the understanding and use of web-based communication, content, and tools (Marcus & Gould, 2000). The growth of the internet and improvements in the design of web content have also led to changes in the structuring of the web. The information structures of websites are no longer solely hierarchal but are also hybrid (Danaher et al., 2005). In the hierarchical design of information architecture, the information is organized in a top-down manner so that the user can review increasingly detailed contents. A hybrid design is composed of multiple information structure designs that best fit content and purpose (Danaher et al., 2005).

Gullikson et al. (1999) have argued that users do not come to websites for an experience, yet these websites arguably invest more into the look and feel of their contents than into

the architecture structuring how the contents are presented. The labeling of web contents has a major impact on the UX of websites. Gullikson et al. (1999) have pointed out that users often cannot find the answers to common questions on a website when it is not well structured. The lack of navigation and labeling of concepts on a website clearly impacts on its UX. Duncan and Holiday (2008) believe that the IA of websites requires a rigorous process that involves interaction and redesign to improve UX and user satisfaction. Such interaction and redesign is helpful only if the information is complex and cannot be conceptualized by the users in a card sorting experiment.

In terms of information structures, three key web-matrixes are important and must be considered for the efficiency of websites: depth, centrality, and connectivity of information (Wang et al., 2007). In term of structure of pages, Walton et al. (2002) questioned whether the Western hierarchical tree, as seen in traditional file structures, web structures, and databases, is suitable for South African users. The study found that there were considerable differences in the hierarchical file structure of files on computers and websites. Their study suggested that although South African students did not have problems navigating such tree structures, its hierarchical meaning caused them difficulty. The visual conventions used to express tree structures in the layout caused problems, for example.

Studies have used different approaches to evaluating the information hierarchy of websites. Such approaches include hyper link analysis (Henzinger, 2005), Markov Chain analysis (Kitajima et al., 2005; Sarukkai, 2000), card sorting analysis (Curran et al., 2005; Hudson, 2005; Hurd, 2002; Liang & Yang, 2008; Nielsen, 1995; Petrie et al., 2011; Rugg & McGeorge, 1997).

Reflection on the IA literature tells us that researchers, UX analysts, and designers agree that the IA of the web influences performance. In order to improve the performance of websites' IA, knowledge of demographic diversity should be acknowledged. In conclusion, my concept of IA in this thesis mainly focuses on the structural design of information on websites and how it is related to users' cognitive styles and the context of use.

### 3.4 UX of websites

In the last decade, UX has emerged as an umbrella term to describe the usability and quality of use of interactive products and systems. Empirical research and practitioners have started using UX as a grounding concept instead of usability. Early researchers in UX viewed existing usability research as overly focused on effectiveness and efficiency and felt a need to place more emphasis on the quality of experience. UX thus looks more into hedonic qualities of use and is concerned with, for instance, aesthetics and self-actualization (Bargas-Avila & Hornbæk, 2011). The International Standards Organization (ISO) defines user experience as: “a person’s perceptions and responses that result from the use or anticipated use of a product, system or service” (ISO 9241-210, 2010). Kurosu and Kashimura (1995) initially pointed towards the aesthetics aspects of usability and found that apparent usability was more strongly affected by the aesthetics than inherent usability. Since then, researchers have investigated that a system’s aesthetics may also affect post-use perceptions of the system’s usability, whereas its actual usability may have no such effect (Tractinsky, 2004; Tractinsky et al., 2000). UX is the totality of the effect or effects felt by users (Hartson & Pyla, 2012). While looking into the aesthetic and emotional aspects of UX, this aspect is not completely new as it was to some degree traditionally covered under the heading ‘user satisfaction’ in the ISO usability definition.

There are further aspects of UX that have been critiqued. One of the major points of criticism of the use of the UX concept is that UX considerably depends on subjective experience. I use UX as an umbrella term to discuss different cultural usability issues that includes aspects of users’ emotions and aesthetics related to the information structure and information classification of website contents. Garrett (2010) proposed that UX in its totality has five main elements. These elements are strategy, scope, structure, skeleton, and surface. The *strategy* incorporates what the institutes or companies want to get out of the website and what the users want to get out of the websites. The *scope* defines feature and function the website holds together. The *structure* includes the placement of information on websites. The *skeleton* includes the placement of buttons and tabs. The *surface* includes the placement of texts and images. These elements of UX are ordered from abstract to concrete.

Usability has been studied for the last three decades (Carroll, 1997). The idea of usability came into discussion when information systems and terminal work-stations began to be used by end-users and it were no longer considered as a product only for designers and engineers (Shackel & Richardson, 1991). This change in the nature of computing brought changes to practice as well. Now, designers and practitioners in industry employ the definition of usability in ISO9241-11 as standard practice. The standard defines usability as “*the extent to which a product can be used by specified users to achieve specified goals with effectiveness, efficiency and satisfaction in a specified context of use*”.

*Effectiveness* refers to the accuracy and completeness with which users achieve specified goals. *Efficiency* refers to the resources expended relative to the accuracy and completeness with which users achieve the goals. *Satisfaction* is users’ comfort and positive attitude towards the use of the product. *Context of use* includes many factors such as users, their goals, tasks, equipment used for goals and tasks, and the physical and social environment in which the product is used. (Bevan, 1995; Frøkjær et al., 2000; Hertzum, 2010; Nielsen, 1993)

The term ‘usability’ has become so general that it is generally used without definition in HCI studies. Therefore Hertzum (2010) states that rather than one meaning of usability, there are multiple images, comprising universal usability, situational usability, perceived usability, hedonic usability, organizational usability, and cultural usability. He further argues that in order to address multiple images of usability, there is a need for supplementary methods to address long-term aspects of usability. From an “images of usability” perspective, I focus more on the image of cultural usability, as cultural usability is aligned with the topic of research in this dissertation. Cultural usability focuses on the usability of systems aligned with the cultural background their users (Clemmensen et al., 2007; Clemmensen, 2011, 2012). The cultural usability also takes users’ background information into account therefore cultural usability suits with my view of argument for usability. For example, use of symbols and language that is meaningful to users from a specific culture. The image of cultural usability portrays important issues subject to users’ cultural background. For example, the image of usability for Islamic websites may vary for a Muslim user. An Islamic website’s usability tends to focus more on content validity and the source of the contents rather than emphasizing the interface design itself.



In summary, I will relate website UX with users' cognitive styles, contexts of use, and the information structure of local websites. This will help to explain how a good fit between a website's IA and a user's view of website structure can lead to better UX. I focus on the image of cultural usability, as cultural usability is aligned with the topic of research in this dissertation.

### 3.5 My theoretical approach

Figure 8 presents a theoretical approach of the relationship between IA and UX. This framework demonstrates the ideal situation of website UX in which users' cognitive style and context of use are aligned with the information architecture of a website. In relation to the ideal situation of UX of local websites, the critical practice of UX for local websites demonstrates that information architecture may not be aligned with the users' cognitive style and context of use.

Cognitive style is an individual's typical way of thinking, processing and organizing information, solving problems and learning. It explains individuals' habitual approach to organizing, thinking, and remembering information (Dong & Lee, 2008; Ford et al., 1994). For example, an East Asian may often explain an event with reference to its context (Masuda & Nisbett, 2001) and thus may expect to take the context of the information into consideration in order to remember the information structure of a website.

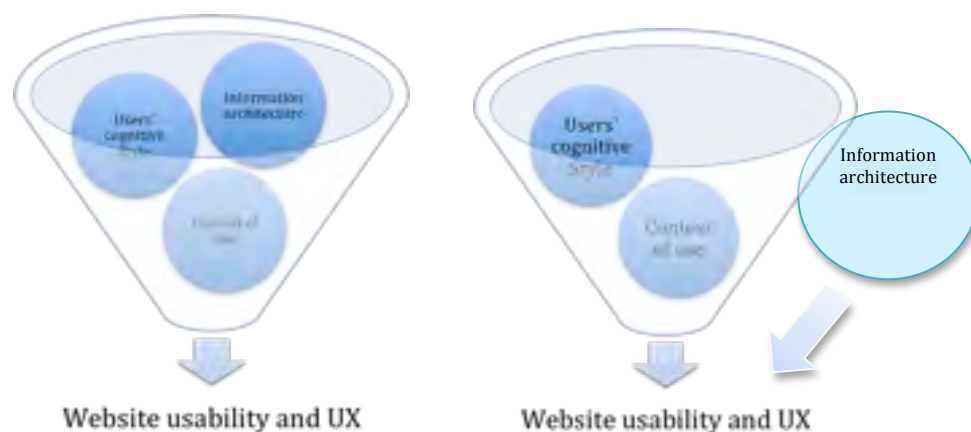


Figure 8: The ideal situation of UX in local websites (*left*) and the critical situation of UX in local websites (*right*)

The context of use may also contain shared knowledge. Shared knowledge consists of patterns generally practiced in the local cultural setting and reflects the knowledge

structures that are common in a particular part of the world. The shared knowledge practiced in a society is generally shared but the degree may vary within a geographical boundary. For example, cultural groups maintain systems of meaning that are understood within that group. This shared knowledge includes the maintenance of group identity. In terms of website structure, it may include items that are considered related to each other in a cultural setting.

## **4 Philosophy of science in this dissertation**

This section discusses the research foundation of this dissertation. Research of all kinds follows some school of thought that entails a set of assumptions and beliefs about its legitimacy and reliability. Specific schools of thought lead towards particular research foundations and methods that are considered appropriate to the examination of a particular phenomenon. It is therefore important for researchers to understand, acknowledge, and justify the philosophical assumptions underlying their research and methods.

### **4.1 Research foundations**

The discipline of information systems adopts theories from different fields, such as organizational behaviors, psychology, anthropology, computer science, and marketing (Vessey et al., 2002; Weber, 1999). Baskerville and Myers (2002) share the view with other IS researchers that information systems is an applied discipline drawing upon other, more fundamental, reference disciplines. In a similar way, the field of HCI takes theories from psychology, anthropology, computer science, ergonomics, and linguistics (Carroll, 2003; Lazar et al., 2010), and it is also an applied science. To some degree there is an overlap between HCI and IS.

Van de Ven (2007) provides four alternative philosophies of science applicable to research. He describes these foundations as: positivism, relativism, pragmatism, and realism. The foundation of positivism comes from a group of mathematicians and scientists who were called the Vienna Circle (Van de Ven, 2007). Guba and Lincoln (1994) called mathematics the 'queen of sciences' in their famous article about competing paradigms. Positivists assert the existence of a physical and social world independent of humans and state that researchers can discover this world through measurement and observation. The role of the researcher is to be neutral and objective while conducting observations in the positivist paradigm as facts can and should be discovered independent of the researcher's personal values and beliefs (Oates, 2006). Logical positivism, within positivism, constructed the role of philosophy as the analysis of science from a logical perspective using a language of verifiable propositions. According to Suppe (1977), logical

positivism adopted instrumentalism, which denies that theoretical terms have any referential value.<sup>19</sup>

There is much discussion of the inadequacy of logical positivism and Suppe (1977) provided an extensive summary of criticisms. Reichenbach (1948), who is also one of the pioneers of logical positivism, argued that it could not solve the problem of induction and consequently explain the predictive nature of science. Hanson (1958) argued that causation, which is an important component of positivism, is not a property of the physical world, but is rather a way that people make sense of the world.

Alternate philosophies of science emerged in reaction to positivism. Van de Ven (2007) called these approaches *relativism*. All perspectives in the broad category of relativism break away from the positivist assumption that knowledge is a cumulative, unmediated, and complete representation of reality. Broadly speaking, an ontological perspective of relativism holds the view that reality is socially constructed (Van de Ven, 2007). There are many alternative philosophies within relativism, including historical relativism, social constructivism, post-modernism, critical theory, and hermeneutics. Toulmin (1953) and other historical relativists argue that scientific knowledge is socially constructed (see also: Alexander & Colomy, 1992). One of the historical relativists, Kuhn (1962), claims that scientific knowledge undergoes periodic 'paradigm shifts' rather than progressing in a linear and continuous way, and that these paradigm shifts open up new forms of understanding that scientists would never have considered valid before. Kuhn argued that the notion of scientific truth at any given moment cannot be established solely by objective criteria but rather that scientific truth is defined by a consensus of a scientific community (Kuhn, 1962).

An alternative philosophical foundation emerged in late nineteenth century from American philosophy. Peirce (1905) introduced pragmatism, a term which can be traced back to the Greek word for 'action' (Peirce 1905, pp.161-181). Pragmatism sought to reconcile rationalism and empiricism by showing that knowing and doing are part of the same process (Van de Ven, 2007). It describes a process by which theory is extracted from practice, and then reapplied to practice. Within pragmatism there are different positions

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<sup>19</sup> Referential value refers to the existence of unobservable entities in physical world, which are represented using theoretical terms in science.

such as radical empiricism and realist pragmatism. The realist stance of pragmatism states that there is no reason to believe that a mind-independent reality does not exist.

Finally, Van de Ven (2007) explains realism as a fourth alternative research foundation. Realism contends that there is a real world existing independent of our attempts to know it. There was a major criticism of scientific realism by relativists who questioned the belief in absolute truth and approximation. In response to this criticism, several variations of realism developed. These alternative views included conjectural realism, pragmatic realism and critical realism. I further include instrumental realism as a fourth alternative research foundation. Instrumental realism is at the most general level the view that the world described by instruments is the real world and is independent of what we might take it to be. The view of instrumental realism is different from instrumentalism. Instrumentalists do not regard the existence or unobservable. The instrumental realist regards the existence of un-observables phenomenon (Ihde, 1991).

#### **4.2 Ontological standpoint of this dissertation**

Generally, an ontological perspective is an explicit formal specification of how to represent objects, concepts, and other entities that are assumed to exist in some area of interest. On a broad level, ontology explains the nature of phenomena. The question of the ontology of a website's structure is an interesting phenomenon because website structures are not visible to humans. At the same time, users' views and conceptions of website structures are present in their minds.

This research is approached according to a *realist* view of the world and more specifically adopts a *conjectural realist* position. Conjectural realism is a moderate realist position, which was developed by John Worrall (1982). The conjectural realism is based on the historical facts that scientific theories have changed radically and revolutionary in the course of their development. This approach acknowledges the chances of wrong interpretation and understanding of the world. The conjectural realist argues that our current theories might not be absolutely true. We are, however, still interested in finding a truth that is general. The approach of the conjectural realist is a variation of the historical realist standpoint, which states that there is a real world that exists independently of our attempts to know it (Van de Ven, 2007). The conjectural realist approach came after major

criticism of scientific realism’s assertion of the existence of unobservable entities beyond human perception. “*These unobservable ontologies can be linked to three schools of thoughts such as Instrumentalism, Realism, and Approximations (historically known as conceptualization)*” (A. Van de Ven, 2007, p.58). The first school of thought, instrumentalism, does not accept the existence of anything unobservable and does not regard such entities in scientific theories as a means to explain observable phenomena. In contrast, realism accepts the existence of unobservable entities and that scientific theories can reference such entities.

In contrast to positivism and relativism, scientific realism contends that science develops statements that are true at both the theoretical and observational levels of phenomena. While looking into users’ cognitive style and comparing it with UX of websites, it is argued that users’ cognitive style is embodied in the culture of the users and is developed from the anthropological and psychological theories of culture. These theories of culture argue that users’ understandings of the world are influenced by their education and environment during their childhood. This dissertation contends that there is a reality that exists in term of users cognitive style in a culture. This reality, regarding users cognitive style, may change over a period of time from one to another. A certain instance of a website structure in a user’s view is the reality of users cognitive style at that moment. This reality is at an abstraction level which changes over a period of time for everyone.

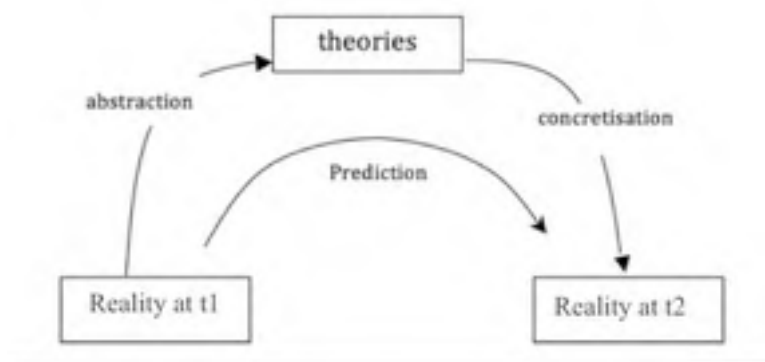


Figure 9: Realistic perspective, adapted from Rauterberg (2000)

Figure 9 is adapted from Rauterberg (2000) who explains the reality of a situation from one time to another time. At one time scientists might have a good reason to believe the nature of the world is a certain way, but this might not exist at another time (Sellars,

1963). The research in this dissertation takes the conjectural realist’s perspective, because despite of having a good reason(s) for belief in the existence of an entity or in the truth of a scientific law, our interpretation of reality might be wrong. In this regard, users cognitive style in a country or cultural group represents the reality of websites within that group. This reality is reasonably stable for some time. On the other hand, our goal is to always strive for reality.

### 4.3 Epistemological Consideration for Studied Phenomenon

How do we understand a user’s cognitive style? I argue that users’ cognitive style is a complex phenomenon and that it is necessary to look into different aspects that might explain it. Information classification activities such as card sorting can assist in understanding some aspects of the cognitive style. Further, users’ activities of information retrieval and feedback can help to understand their cognitive style. In order to understand the extent to which users cognitive styles can be explained, I argue that users’ classification activities (card sorting) and information retrieval activities can help to understand users cognitive style. Information classification is a way of asking people to do something instead of stating how they think.



Figure 10: Philosophical positioning of dissertation, adapted from Van de Ven (2007, pp.53) and communication with Suprateek Sarker<sup>20</sup>

<sup>20</sup> Suprateek Sarker ([http://www.cb.wsu.edu/directory/profile.cfm?emp=sarker\\_suprateek](http://www.cb.wsu.edu/directory/profile.cfm?emp=sarker_suprateek)) is professor of information Systems. Figure adapted in a communication in a PhD course on philosophy of science.

The positioning of the dissertation from a philosophical perspective explains the epistemological and ontological standpoint of this dissertation. Figure 10 shows that this dissertation has been approached through objectivist and inductive dimensions, along with some interpretation. This situation is well aligned with Deetz's (1996) view where he discusses the traditional epistemological version of paradigms developed especially by Burrell and Morgan (1979). Deetz (1996) argues that representation, in a single quadrant, is too rigid and representational. It is too founded in an objective/subjective distinction, and too easily taken as being "true" (or perhaps "false") rather than simply more or less stimulating or interesting.

In summary, the conjectural realist is the ontological position of this dissertation because components of my theoretical understanding explain the temporary snapshot of users cognitive style through information classification activities.. In my view, this reality, in term of users cognitive style, remains consistent for a stable period of time. At the same time, our understanding of reality can be wrong, but we always strive to get to the reality. The epistemological position of the dissertation has been approached through objectivist and inductive dimensions, along with some interpretation and epistemological position. Applying Witkin (1967) and Nisbett (2003) view of cognitive style, I assume that cognitive style is stable for some time, this allows me to study my topic as an empirical phenomenon.



## 5 Empirical research

### 5.1 Research design

Choosing an appropriate method is context dependent and each method has its own strengths and weaknesses. This dissertation approaches the issue of UX in website use from several angles simultaneously, adopting a mixed-method (Creswell, 2009) or methodological pluralism (Sankey, 2008) approach. Such an approach is desirable and feasible in this research because it allows for the investigation of different dimensions of a real situation, including the social and personal (Mingers, 2001). *“In methodological pluralism, scientists apply a number of scientific methods and rules for alternative theories and acceptance of results”* (Sankey, 2008, p.110).

In order to achieve the research goal and answer the research questions, a two-step experimental design methodology was developed. The first part of the research investigated whether participants' views of the UX and structure of websites were consistent or different across two different countries, Denmark and Pakistan. In the second part of the research I wanted to confirm what I found in Pakistan by comparing it with Malaysia with the expectation that both participants groups would behave similarly when using local websites. Brainstorming, card sorting experiments, information retrieval tasks, and the retrospective interviews were conducted throughout the research. In total, 108 participants were recruited in four studies. Three participants were used in pilot studies in each study.

In order to address different theoretical aspects of this study, a range of activities were used. Figure 11 provides an overview of the data-collection model. Information regarding different concepts was attained through number of activities.

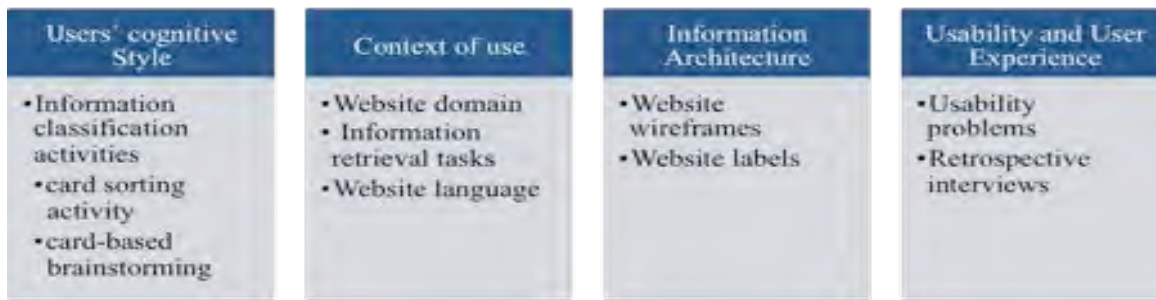


Figure 11: Data collection model

### 5.1.1 Cognitive style: information classification activities

Cognitive style is an individual's typical way of thinking, processing, and organizing information. Cognitive styles of users are primarily captured through activities of information classification through card sorting.

I see classification activities as way to understanding users cognitive style in a given culture. In my view, cognitive style may change over long periods; I assume it remains stable for a reasonable period within a culture. The psychology studies use personality questionnaire and interviews to understand the cognitive style (Kozhevnikov, 2007). This study acquires users cognitive style through information classification activities. My perspective of acquiring cognitive style makes it important to perform empirical research on website UX and, in my view, classification activities such as card sorting, and user interaction studies can be used as way to understand cognitive style. My perspective of cognitive style will use classification activities as a way to explain empirical data resulting from users' card sorting.

In order to initiate the process of understanding cognitive style, different data collection activities were designed in four studies (see section 5.2). The data collection activities were those such as open card sorting, in which participants are provided with the contents of the webpage and are asked to group it into suitable categories, and a card-based brainstorming activity (see section 5.5) in which users are provided with a scenario about a website and then asked to write the contents of the website and group names on pieces of blank card.

In this thesis, the concept of classification is used as a way to capture users' cognitive styles, i.e. as an empirical concept that covers the data collection with card sorting

methods. However, the concept itself may require some introduction, since it has been used as a theoretical concept in many areas of study, including information management, medicine, anthropology, psychology, and mathematics. It stands at the crossroads of the sociology of knowledge and technology, history, and information science. From a traditional information science perspective, the general goal of classification research has been to create a single best classification system that suits everyone everywhere (Miksa, 1998). Contemporary classification research focuses on contextual information as a guide for the design of information schemes (Mai, 2004). My perspective on classification is more aligned with this new research tradition. It focuses on studies of participants' information interaction. It takes classification models as a base to explain classifications that users make during their interaction with websites, and it relates these to users' cultural groups.<sup>21</sup> Classifications and categorization are sometimes distinguished from each other. Classification is "an act to organize a set of entities; a set of rules is therefore set up to determine when an entity goes into a particular class" (Mai, 2011, p.712). Therefore classification activities may be rigorous concerning whether an entity either is or is not a member of a particular class. Categorization, on the other hand, is the "process that involves named entities in the world and the process of grouping them into categories" (Mai, 2011, p.712); the process of categorization is performed without any framework. There are however many similarities between classification and categorization, and there are examples of literature using these two terms "...indiscriminately to refer to the same process" (Jacob, 2004, p.527), which is what I do in this thesis.

### **5.1.2 Context of use: domain of website, information retrieval, website language**

The context of use consisted of users' tasks and equipment (hardware, software, and materials), and the physical and social environments in which a product was used. In order to focus on the context of use, all the participants were provided with facilitating conditions for UX studies.

The domain in the first two studies was university websites. The domain in studies 3 and 4 was e-commerce websites. Studies 1 and 2 were conducted at the same university and

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<sup>21</sup> The discussion of and differences between cultural group, ethnic group and regional group are explained in section 3.1.1.

the content for that same university were used in the studies. For studies 3 and 4, the appropriate local e-commerce website of each country was used (See Appendix 4).

English language contents of the university website in Pakistan were used for study 1. The website only provided content in English. English language content was also chosen for the second study of a university website in Denmark. The university website showed the same information in both English and Danish. English language contents were chosen because the researcher had limited knowledge of Danish. The e-commerce websites in studies 3 and 4 provided information only in English. The contents were not presented in native languages on either website. The contents were also presented in English because users of the studies had different native language. English language could have been commonly understood and in most cases it was not possible for all users to understand more than one native language.

Information retrieval tasks were set for the participants in the studies to understand their approach to finding targeted information. During these tasks, participants were asked to search for information in different parts of a website. These tasks thus tested the navigation design and structure of the website. The evaluator made notes while participants looked for information, summarizing the participants' activities as well as noting their success rate. Information retrieval tasks provided an understanding of a participant's path to the required information. Creating a task list is one of the more challenging parts of studies. A task list is needed for usability studies. An example of such a task:

*Please find the contact information of the person/secretary who can provide you further information about Hostels. Please notify the instructor when you finish.*

There were between four and five information retrieval tasks in each of the studies. The order of the tasks was changed each time to control and minimize the learning effect. A time of three minutes was provided to the participants to complete each task. The approximation of time was calculated through a pilot study by exploring all information on the website.

### **5.1.3 Information architecture: Website navigation and website labels**

In websites, the simplest way to organize information is according to a sequential website structure. In such a linear design, pages and other information are organized in a sequence and accessed in a sequence as well. A sequence structure might be arranged in alphabetical order or numerical order for example. Danaher et al. (2005) called this type of design a 'tunnel design'. Such simple sequence designs are often used in educational websites or other websites that follow a linear sequence of information. In a complex linear sequence design, navigation is facilitated through links to other linear sequence designs, which are related to the first design. Lynch and Horton (2009) called this type of sequence a 'linear digression sequence'.

In a central or hub structural design, all webpages are linked to a single, central webpage. Central or hub design is followed in websites when all the abstract information is placed on a single webpage and users can go to the next level for detailed information. Navigation is centralized and the hierarchy is simple. In terms of depth of hierarchy, we find only the first level of sub-categories of information.

In websites with a single homepage, a hierarchical design is general practiced to organize information into different orderings. In a hierarchical design, the contents of a website follow a certain hierarchy. Information is placed at the different levels of hierarchy. Hierarchical design of websites is commonly applied in website practice because many of the users are familiar with it.

Most websites use a matrix design. In a matrix design, information is organized in different categories and most of these sub-categories are interlinked through web-links. Danaher et al. (2005) explain hybrid design as a combination of the previously discussed designs. Hybrid designs allow the users to use information interactively without the strict navigational patterns that can result from some of the other designs. Figure 12 shows different types of website structures.

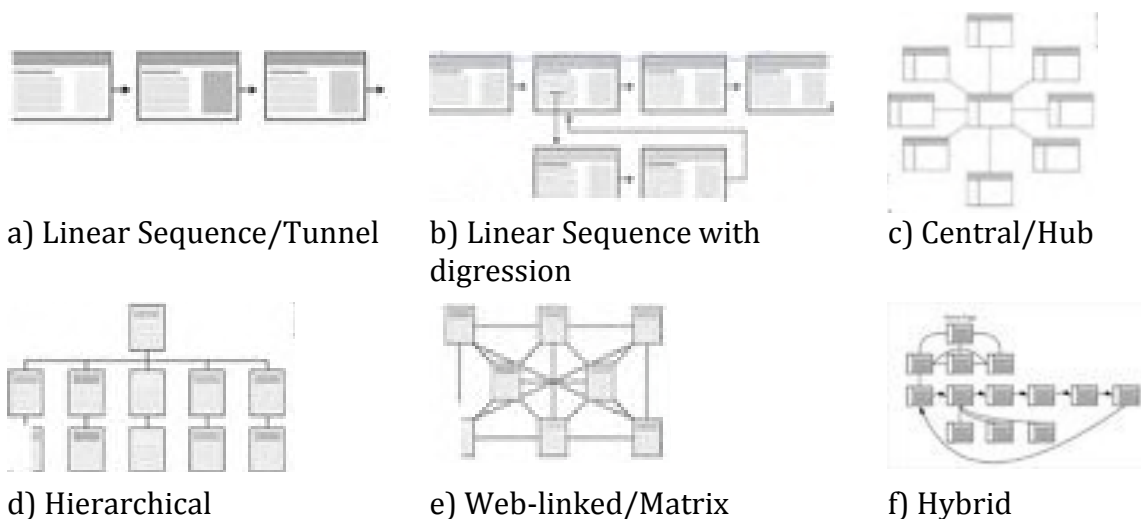


Figure 12: Different types of website structures

Website labels are descriptive text used to explain the contents linked to the label. Labeling is a form of representation of information. For example, "Contact Us" is a label that represents a chunk of content, often including a contact name, an address, and telephone, fax, and email information. Information on websites cannot be presented quickly and effectively without providing labeling. In order to make information easily understandable for users, information architects should speak the same language as website's users do while reflecting its content.

#### 5.1.4 UX issues

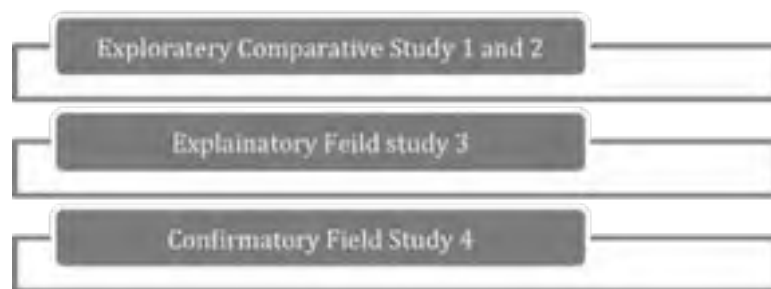
Participants were asked to rate the usability of the websites on a Likert scale to find general problems for a usability assessment. The UX issues included: ease of use, attractiveness of design, ease of finding information, information accuracy, and usefulness of the website. The participants also provided their feedback in feedback sessions regarding the general UX issues of websites. The feedback sessions provided an ability to go deeper into the logic of providing usability assessment rating.

#### 5.1.5 Relationship between empirical studies 1, 2, 3, and 4

The relationship between studies 1, 2, 3, and 4 is of a longitudinal nature. Each of the studies provides an input to the next study, building upon the learning from one study to the next.

Studies 1 and 2 of the research were designed to understand the study area in depth through a comparative study in two geographical locations. Study 1 had a more exploratory nature. In study 1, I started to explore the nature of website structure through

card sorting methods. Studies 1 and 2 emphasized emergent factors related to website IA. The participants' feedback was analyzed through activities of brainstorming, card sorting, and usability testing. Two locations, Copenhagen, Denmark and Lahore, Pakistan were used to understand the nature of emergent factors. The selection criterion for location and groups in the study was initially based on the cultural cognition theory. Study 1 uses the analytical framework outlined in section 3 to understand the factors within and across studies 1 and 2.



*Figure 13: The sequence of the four studies*

Studies 1 and 2 showed that there were cultural preferences in website IA. The language choice was another emergent factor raised in the comparison of study 1 and study 2. The between-groups analysis of studies 1 and 2 showed differences in information finding during the task analysis of the study. The studies also raised an important methodological issue in the study design itself. It used two groups of participants with two websites for pragmatic reasons, because selecting a single website would make it biased toward one of the two groups. The local websites were selected to understand the factors mentioned by the participants of each group. Study 1 showed interesting results using local websites for the information structure and information retrieval tasks. The themes found in studies 1 and 2 were used to conduct two further studies. Studies 3 and 4 used local e-commerce websites. A sample image of each of the website is provided in appendix 4. In studies 3 and 4, participants' language preferences were included. In addition to the usability tasks such as card sorting, information retrieval, and brainstorming, participants were interviewed at the end of every session to understand general website usability issues.

## **5.2 Participants**

Figure 13 shows the number of participants, the number of information retrieval tasks, and the domain of websites in our studies.

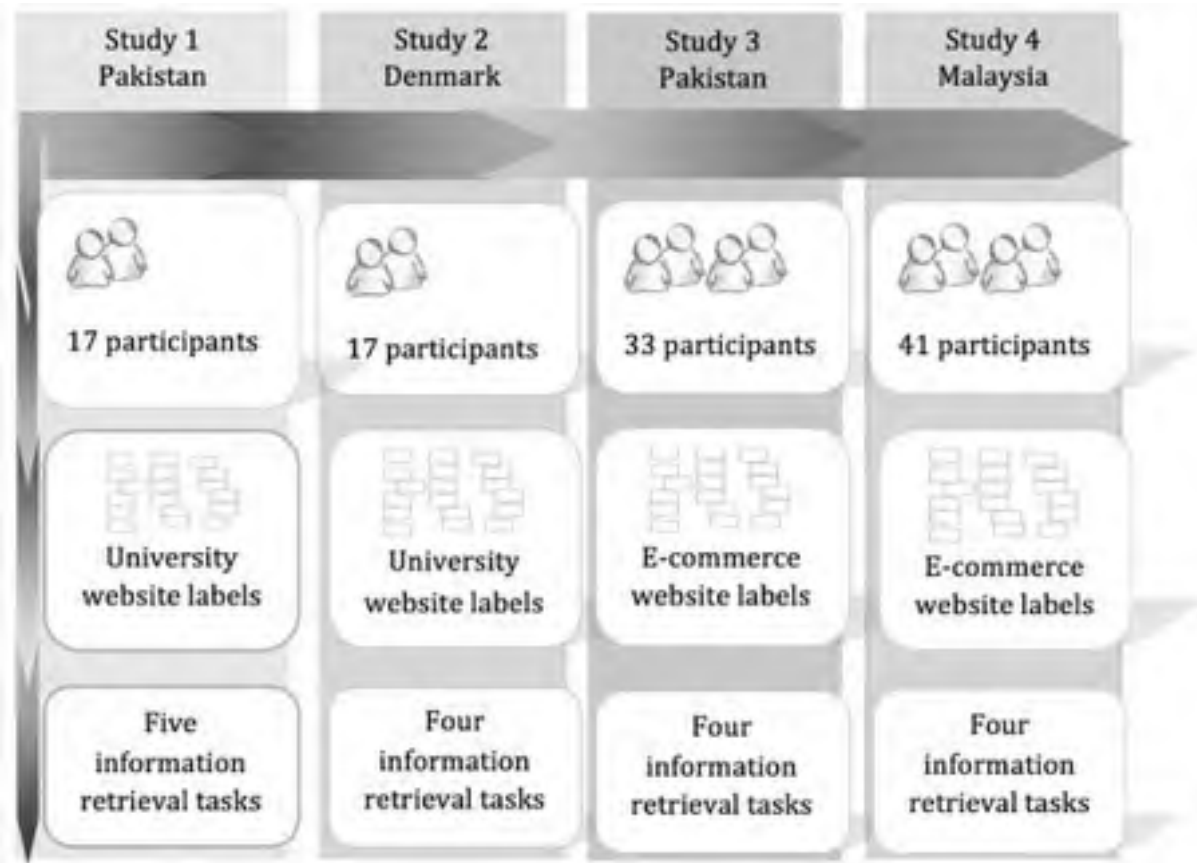


Figure 14: Participants and their activities in studies 1-4

### 5.2.1 Selection of Participants

Students were recruited as the main participants of the study because young people such as university students commonly use the internet for a variety of purposes.

Determining the number of participants to recruit for research is subject to a trade-off between the information requirements of the study and the cost of conducting it. In studies of card sorting, participant numbers have varied from 5 to 90 (Tullis and Wood, 2004). The studies in this research used between 17 to 41 participants, and included participants used for pilot studies. Thus, the studies presented here are comparable with other studies conducting similar kinds of research. Nielsen (2004) argues that five users are generally enough to test the usability of a website. Nielsen (2004) states that for card sorting, test at least 15 users - 3 times more than you would in traditional usability tests.

Tullis and Wood (2004) argue that for a card sorting study, collecting data from 5 users do not provide good result. However conducting study with 15 participants yields good result.



Studies with as few as 12 participants are common in HCI, but results with 20 or more users are more convincing (Lazar et al., 2010).

### 5.2.2 Recruitment of participants

Participants were recruited four times in the three locations in Denmark, Malaysia, and Pakistan. Data was collected each time on participants' gender, ethnic groups, age, and internet use. Additionally, information regarding language proficiency and language use on the internet was collected in studies 3 and 4. The details of the recruited participants and their background information are provided in results section.

### 5.2.3 Website navigation and website labels

The website labels were taken from local websites in each study. Each website contained many labels on each webpage, and therefore a section of each website, a number of pages, was selected and all labels in that section were noted down. Table 3 provides a sample of labels that were used in study 2 of the university website in Denmark. A complete list of cards is included in Appendix 3.

Table 3: An example of labels used in study 2

<i>Sample of labels used in study 2</i>		
Quality	Campus Facilities	FAQ
Find Us	Jobs at University	Opening hours
Summer University	Accommodation	Students going Abroad
Photos	Scholarships	For Companies
Study Help	Study place and rooms	Library cards

The websites in the four studies used a variety of labels. The usability studies used the same labels that were used by websites in all four studies. These labels were extracted from the websites and provided on cards to be arranged by the users.

## 5.3 Instructions and tasks

Creating task lists is an important part of a UX study. Tasks were chosen on the basis of goals (Dumas & Fox, 2009). The goal of information retrieval tasks was to understand how much time participants needed to find information and what strategy was used to do so.

For example, participants were asked to “*find the wireless remote control doorbell on the website*”. They were asked to notify the instructor when they finished the task.

The goal of card-based brainstorming was to provide an opportunity for the participant to create the contents and then organize it into different groups. For example, participants were asked to think about the home-appliances section of an e-commerce website, and to determine what kinds of categories they could think of, and how do they would order them. On the basis of a scenario, users wrote contents related to that scenario and sorted it into categories.

The experiments were held individually and each participant took between 100 and 130 minutes to complete all activities. A total of approximately 230 hours was spent with the 108 participants in three countries in four studies. The data included open card sorting activities, information retrieval tasks, card based brainstorming, a questionnaire on the UX of websites, and interviews with the participants. In each study of the four studies, a pilot test with three participants was conducted to look into all the aspects of study design. A review of the study design was conducted after the pilot study to address the issues uncovered.

### 5.3.1 Stages in UX study

UX studies require considerable advance planning. Different authors describe different steps and stages of a UX study. A UX expert or test leader may take the role of the UX moderator and manage this process. Table 4 provides a list of stages that the author used in the UX studies.

Table 4: Stages of UX used by author

<i>Stages of UX in studies</i>	
1. Decide what type of data to	6. Conduct the test sessions
2. Develop a test plan	7. Debrief the participants
3. Prepare test material and	8. Analyze data and observations
4. Select representative users	9. Report findings and recommendations
5. Setup the test environment	

The studies used a combination of the UX stages described in table 4. The studies did not use the strict ordering of the UX stages, but rather changed them to our convenience. For example, after developing the test plan, test material was prepared before setting up the

example, after developing the test plan, test material was prepared before setting up the test environment. The data analysis of the tests was conducted in two stages. In the first stage, the initial data was analyzed for further studies as well as reporting in papers. In the second stage, the data was analyzed during the writing of this dissertation.

### **5.3.2 Role of test leader**

A test leader or moderator is a person who helps with the conduction of experimental research. Thus, a test leader might conduct a card sorting experiment and an interview afterwards. There are some specifications a person should comply with in order to be a moderator or test leader of a study. They should be familiar with general user interface design concepts, should have conducted or been a part of UX experiments before, and should be fluent in both local languages and in English in order to explain difficult concepts across languages. In the experiments described here, I acted as test leader throughout the data collection.

## **5.4 Card sorting in HCI**

Currently, card sorting is used in HCI studies to sort and group objects and concepts in order to both test and aid in the design of products. Cards typically contain information such as screen shots of webpages, contents taken from web systems, or relevant concepts for users or experts to group. Card sorting can be conducted either physically or by using online card sorting applications and systems. Card sorting helps to understand the terminology people use, to identify categories and their commonalities and differences, and to understand relationships such as distance and proximity between the items sorted.

This study used card sorting as the main activity of UX evaluation during data collection. UX testing generally involves studying representative participants performing representative tasks in a representative environment (Lazar et al., 2010). While relating approaches in UX studies with traditional research methods, Lazar et al. (2010) describe these approaches as closely related to other research methods. That is, the approaches followed in UX are often the same as or very similar to those used in classical research. It is also important to point out that in UX testing qualitative data is often just as important as quantitative data. Such data is collected through activities such as brainstorming, card sorting, information retrieval tasks, and retrospective interviews. The combination of

these activities provides rich data and can lead to a deep understanding of different aspects of cross-cultural UX for websites.

One of the primary reasons for choosing card sorting as a method for data collection is that it provides an insight into how participants classify information. Card sorting is also widely used as a user-centered design technique in HCI studies because it is simple method and can be easily be understood by users (Deibel & Anderson, 2005; Donna Spencer, 2009; Rugg & McGeorge, 1997). Further, focusing on methods such as surveys, questionnaires, interviews, and focus groups would not necessarily provide such a direct insight into users' cognitive styles. It is difficult to observe what is in a user's head in a particular culture using other methods. Card sorting provided a way to understand users' mental models of content structure, which otherwise is difficult to capture.

#### **5.4.1 Card Sorting**

Card sorting is a technique aligned with Kelly's (1992) personal construct theory. It assumes that people make sense of the world through classification and that people can describe their own classifications with reasonable validity and reliability (Kelly, 1992; Rugg & McGeorge, 1997). The protocol of card sorting is to ask participants in interviews or workshops to sort labeled paper cards into piles. Card sorting can be applied to any of a wide variety of activities that involve grouping and naming objects or concepts. Card sorting is useful and suitable in cross-cultural research because it does not involve a complex system of information that participants need to learn before participating in experiments. Card sorting was primarily used for this research because it is simple and easy to understand for participants while also providing rich data regarding their cognitive styles.

Card sorting has a long history in social science research where it is known as pile sorting, free sorting, classification, and grouping. Ancient Greeks are attributed with early development of categories (Hudson, 2005, 2012). For instance, Aristotle provided the foundation for our modern scheme of categorizing plants and animals. In the nascent field of psychology, printed cards were used for a variety of experiments (Hudson, 2012; Jastrow, 1898). Jastrow (1898) used the approach to investigate characteristics such subjects' speed at sorting cards into categories. This was then used as an indicator of users' mental processes and reaction time for the activity. Card sorting began to be used in

human-computer interaction in the late 1980s to evaluate menus and to capture users' point of view (Mehlenbacher et al., 1989; Palmer et al., 1988).

Card sorting is a widely used technique in UX studies for assessing users' perceptions of website UX, navigation, and structure (Hinkle et al., 2008; Hurd, 2002; Liang & Yang, 2008; Nielsen, 2004; Petrie et al., 2011, Spencer, 2009). Data collected through card sorting can be analyzed with both quantitative and qualitative techniques.

Card sorting is often related to affinity diagram (or the "KJ method"), which is primarily used in user, business, and marketing research (Spool, 2004; Tague, 2005). A Japanese professor, Jiro Kawakita, devised the notion of affinity diagrams in the 1960s (Kawakita, 1991). Affinity diagrams are a simple way of organizing concepts by finding a relationship between them. In this method, a designer or expert writes down ideas on a set of cards and then organizes the cards by grouping them and by placing closely related concepts close to each other.<sup>22</sup>

#### **5.4.1.1 Open Card Sorting**

In this research, open card sorting was used. In open card sorting, participants are provided with the contents of a webpage and are asked to group it into suitable categories. Open card sorting thus establishes a user's own views on the groupings and hierarchies of the information. As this research suggests that participants in different locations may have different understandings of the groupings, card sorting was intended to help to reveal these localized meanings and understandings.

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<sup>22</sup> Usability first <http://www.usabilityfirst.com/glossary/affinity-diagram/>, retrieved on November 11, 2013.



Figure 15: Participant engaged in the open card sorting activity in study 3

#### 5.4.1.2 Card-based Brainstorming

Card-based brainstorming is an attempt to understand users' understandings of the structure of information when provided with a scenario in the web domain. In card-based brainstorming participants are asked to provide contents and group them. They are provided with a scenario of a website and then write the contents of the website and group names on pieces of blank card. The situated nature of card-based brainstorming provides valuable information about the participant's patterns of knowledge expressed through terminology, perceived relationships between different categories, and views of higher order categories.



Figure 16: Participant engaged in the open card sorting activity in study 4

#### 5.4.2 Retrospective Interviews

Participants in each study were asked after each task to express both their thought processes during the task and their views on the task itself. Participants' views were recorded and notes were taken. During the retrospective interviews at the end of each session, participants were asked about general UX related issues that were noticed during the tasks. They were also asked about other issues that arose during the sessions. The retrospective interviews provided an ability to go deeper into specific areas of interest and helped in understanding the participants' logic of completing a task in a certain way.

#### 5.5 Data analysis

Data was analyzed through qualitative and quantitative measures throughout the studies. I will explain the data analysis for each of the activities performed in the studies.

For scenario-based card sorting activities, data was analyzed through a qualitative assessment of labels provided by the users. The number of categories constructed by each were counted. For studies 1 and 2, scenario-based card sorting was qualitatively assessed in taxonomical and thematic categorizations (Nawaz & Clemmensen, 2011). In the first

study, the use of language was also observed in the organization of information about the university website.

For the open card sorting I used the edit distance method to analyze the activity and labeling of users' structures. Edit distance is a measurement of difference between two sequences. Edit distance was used to measure the similarity of categories in different sorts. The methodology of edit distance is explained in the following example.

*Table 5: Measuring edit distance from Sort A and Sort B*

Sort A	Sort B
$A_1 = \{1, 2, 3, 4\}$	$B_1 = \{1, 2, 3\}$
$A_2 = \{5, 6, 7\}$	$B_2 = \{4, 5, 6\}$
$A_3 = \{8, 9, 10\}$	$B_3 = \{7, 8, 9\}$
$A_4 = \{\}$	$B_4 = \{10\}$

Table 5 shows the example of two sorts A and B, where 10 numbered cards are used. These cards are sorted into four groups:  $A = [A_1, A_2, A_3, A_4]$  and  $B = [B_1, B_2, B_3, B_4]$ . In Sort A, an empty group  $A_4$  is included so that both sorts have same number of groups. Sort A can be converted into Sort B by moving cards in the same sort from one group to another group. Minimum sets of move are shown in Table 6. By moving 4 from  $A_1$  to  $A_2$ , 7 from  $A_2$  to  $A_3$ , and 10 from  $A_3$  to  $A_4$ , edit distance analysis will help examine the difference in two sorts. Table 6 provides a step-by-step conversion of one sort into another sort. In the current example, table 6, the edit distance is three because three steps are taken to change one sort into another sort.

*Table 6: From left to right, stages of converting one sort into another sort*



Original Card Sort		1 <sup>st</sup> Stage	
Sort A	Sort B	Sort A	Sort B
A <sub>1</sub> = {1, 2, 3, 4}	B <sub>1</sub> = {1, 2, 3}	A <sub>1</sub> = {1, 2, 3, 4}	B <sub>1</sub> = {1, 2, 3}
A <sub>2</sub> = {5, 6, 7}	B <sub>2</sub> = {4, 5, 6}	A <sub>2</sub> = {5, 6, 7}	B <sub>2</sub> = {4, 5, 6}
A <sub>3</sub> = {8, 9, 10}	B <sub>3</sub> = {7, 8, 9}	A <sub>3</sub> = {8, 9, 10}	B <sub>3</sub> = {7, 8, 9, 10}
A <sub>4</sub> = { }	B <sub>4</sub> = { 10 }	A <sub>4</sub> = { }	B <sub>4</sub> = { 10 }

2 <sup>nd</sup> Stage		3 <sup>rd</sup> Stage	
Sort A	Sort B	Sort A	Sort B
A <sub>1</sub> = {1, 2, 3}	B <sub>1</sub> = {1, 2, 3}	A <sub>1</sub> = {1, 2, 3}	B <sub>1</sub> = {1, 2, 3}
A <sub>2</sub> = {4, 5, 6, 7}	B <sub>2</sub> = {4, 5, 6}	A <sub>2</sub> = {4, 5, 6}	B <sub>2</sub> = {4, 5, 6}
A <sub>3</sub> = {7, 8, 9, 10}	B <sub>3</sub> = {7, 8, 9}	A <sub>3</sub> = {7, 8, 9, 10}	B <sub>3</sub> = {7, 8, 9}
A <sub>4</sub> = { }	B <sub>4</sub> = { 10 }	A <sub>4</sub> = { }	B <sub>4</sub> = { 10 }

Destined Stage	
Sort A	Sort B
A <sub>1</sub> = {1, 2, 3}	B <sub>1</sub> = {1, 2, 3}
A <sub>2</sub> = {4, 5, 6}	B <sub>2</sub> = {4, 5, 6}
A <sub>3</sub> = {7, 8, 9}	B <sub>3</sub> = {7, 8, 9}
A <sub>4</sub> = { 10 }	B <sub>4</sub> = { 10 }

In edit distance, for each matched pair, a number of mismatches can be tolerated. In the view of Diebel et al. (2005), an increase in the number of groups (for example A1, A2, ... A15) results in more discrepancies between the groups, which increases the overall distance between the sorts. The current example, table 6, has two sorts, Sort A, and Sort B. With a measurement of edit distance with of four sorts (for example A1, A2, A3, and A4), a distance of 7 or 8 might be appropriate because users have more options to place a single card which results in increasing the edit distance. For edit-distance, a ration scale is used to calculate the result of card sorting. The higher number shows that there is higher disagreement between the users. The agreement of the users is not only measured in the form of edit distance. The agreement of the users between each other is also shown in the form of a dendrogram. A dendrogram is a branching diagram that represents the relationships of similarity among a group of entities. The output of the dendrogram is based on a similarity matrix (Katsanos, Tselios, & Avouris, 2008a,b).



## 6 Results

This section provides the results of the studies conducted during the research. Table 7 provides a summary of results and how the papers attached are based on one or more one of the studies.

Table 7: A summary of reported studies in papers

	<i>Literature Review</i>	<i>Study 1 PK1</i>	<i>Study 2 DK2</i>	<i>Study 3 PK3</i>	<i>Study 4 MY4</i>	<i>Card-sort Analysis</i>
<i>Paper 1</i>	X					
<i>Paper 2</i>		X	X			
<i>Paper 3</i>				X	X	
<i>Paper 4</i>					X	X

### 6.1 Literature review study

The literature review study looked into the nature of website UX in Asia (Nawaz & Clemmensen, 2013). The results of the study are presented in the first paper – Website User Experience in Asia ‘From Within’: An Overview of a Decade of Literature. This study conducted a systematic literature review of website UX research in Asia from 2001-2011 and looked into the nature of website UX studies in term of topic, use of theory, and research methods (Nawaz & Clemmensen, 2013).

The analysis of the literature review shows that website use is becoming a normal part of daily life in the region due to developments in IT infrastructure. However, the majority of research studies in HCI have been limited to studying users in the United States, Canada, and European countries, or presenting a comparison between one of these countries and countries in Asia (Clemmensen & Roesse, 2010).

The review revealed that in Asia, the studies of website UX have been increasing. Figure 17 illustrates that there was indeed an increase in publications on website usability in Asia during the investigated period of time, as mentioned in propositions of the study. From the beginning of the period with 0-3 articles published per year, to 10 articles published per year at the end of the period. Figure 17 shows that publications on website usability in Asia only began to appear from 2003.

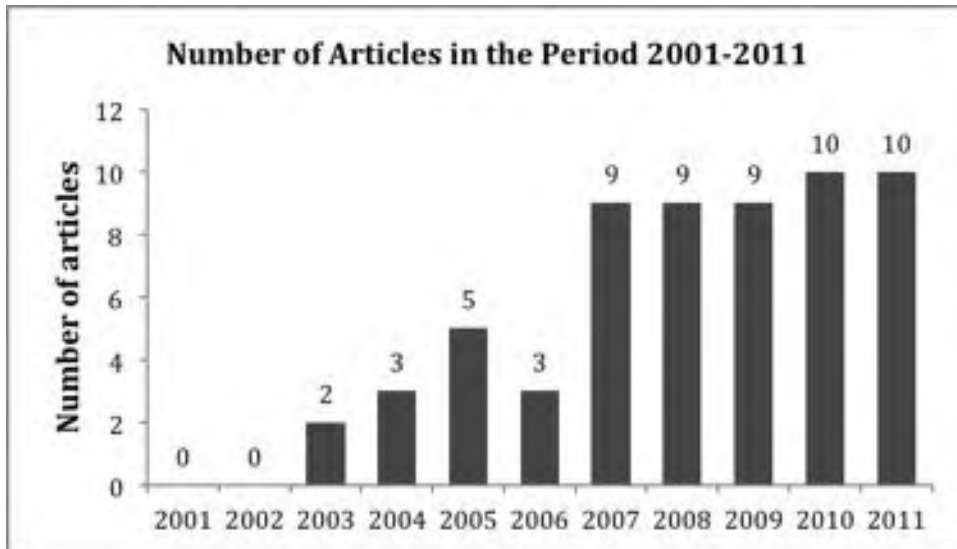


Figure 17: Website usability research articles in the period 2001-2011

A majority of the research articles could be expected to come from China, Japan, Indonesia, Bangladesh and Pakistan due to the population size of the countries and their greater number of academic researchers. Figure 18 shows the distribution of articles on website usability in Asia across different Asian countries. Figure 18 illustrates that a majority (25%, 15 of 60 articles) of the “website usability in Asia” articles were from China (and Hong Kong), and nearly as many website usability articles were retrieved from Japan (20% or 12 of 60) and Taiwan (18% or 11 of 60 articles). In contrast, little research on “website usability in Asia” has been conducted in Western Asia. To our surprise, there were not many articles retrieved from India, whereas many of articles were retrieved from China and Japan.

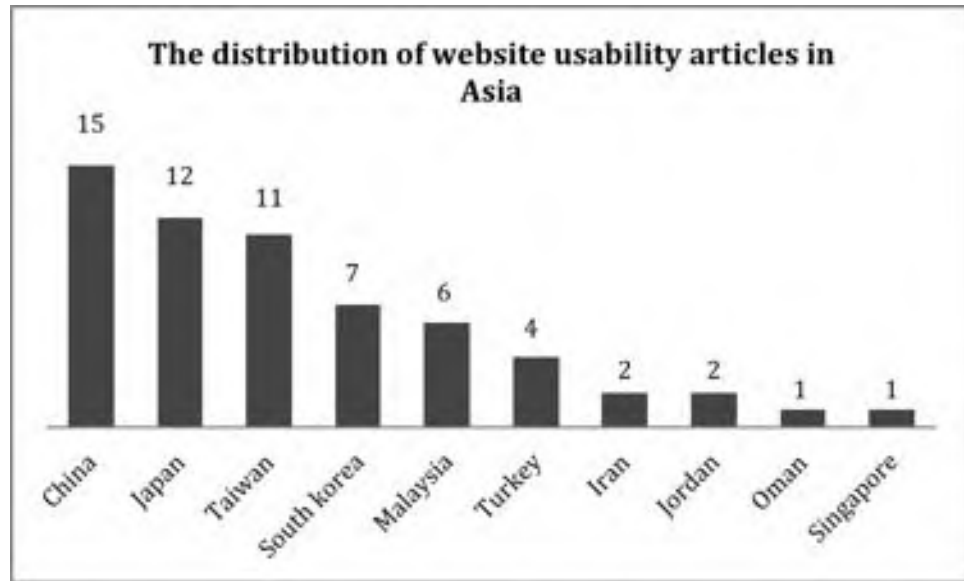


Figure 18: The distribution of the 60 articles on Website Usability in Asia across countries

From previous research it could be expected that the use of theory would be limited, and that cultural theories would be perhaps the most frequently used frameworks for studies of website usability in Asia. This first of these propositions was true - the use of theory was scarce, if at all present, in many of the investigated articles. A little more than half of the articles (37 of 60, or 61%) mentioned any identifiable theory. Table 8 provides an overview of theories in relation to a particular topic. While looking into the theories related to culture, only some of the studies mentioned cultural theory for usability studies. Within cultural theories, Hofstede's cultural dimension model was mostly adopted.

Table 8: Theories used in articles on website usability in Asia

<i>Theories</i>			
Aesthetic	P34	Information Desire	P17
Ant colony optimization	P60	Information Foraging Theory	P11
Behavioral Intention	P7, P19, P37, P44, P48	Information Learning	P6, P20, P23, P55, P4
Cognitive Aging Theory	P13	Information Management	P5, P21
Cognitive Theory	P22, P27, P47	Mental workload	P16
Cultural Dimensions	P2, P8, P36, P56	Theory of Gestalt psychology	P3
Disconfirmation Theory	P22, P52	Theory of Globalization	P10
Empirical law	P35	Trust	P39
Graph Theory	P31, P32	Visual	P15, P30, P33, P58

Another subset of the articles used website usability as the general framework of the study, without mentioning any specific theory. Table 9 shows the articles that used website usability as a framework, and also the different focuses within website usability (i.e., information navigation), if any.

*Table 9: Articles using website usability as a framework theory*

<i>Website usability as a framework theory</i>	
Website usability	P1, P9, P14, P18, P25, P26, P28, P29, P43, P45, P53 P54, P57, P59
Information Navigation	P40, P41, P42, P50, P51
Quality	P38
Active control	P24
Others	P12, P46, P49

Table 9 illustrates the articles used website usability as a general theory/framework of study and did not emphasize on one particular characteristic of website usability. For a few articles, the website usability framework appeared to have a focus on a particular issue. For example, information navigation studies focused on the navigation burden, information retrieval and mining web structure, evaluation of website metrics for navigation, and general user interface navigation.

I expected that the commonly studied domains of websites would be university websites, religious websites, and government websites. This proposition turned out to be only partly true, as there was a great variety in the studied website domains. The domains of the websites included academic websites, e-government websites, e-portfolios, library websites, and tourism websites. In terms of the number of studies, the academic domain and the tourism and e-commerce domain were the most studied domains of the websites.

## **6.2 Study 1: UX study of an academic website in Pakistan**

The first study was conducted between December 2009 and January 2010 in Lahore, Pakistan. A total of 17 participants were recruited for this first study. The first three participants were recruited for a pilot study while the data from a further 14 participants were used for main results of the study.

Table 10: Participants' background information

<i>Background Information</i>	<i>Value</i>
Average age	21 ( $SD \pm 3.3$ , low 19, high 23)
Gender distribution	7 Males, 7 Females
Average internet access	Every day
Weekly time spent on university website	12 minutes ( $SD \pm 3$ , low 0, high 32)
Years of study completed	15 years ( $SD \pm 1.6$ , low 13, high 17)

Table 10 shows the participants' backgrounds. There were an equal number of male and female participants in the study. Participants were using internet on average once every day (10 of 14 participants). Some of the participants (3 of 14 participants) were using internet several times a day. Study participants did not spend much time on the university website in the week before study. Half of the participants spent five minutes or less on university websites during the week. Participants had completed an average of 15 years of education.

### **6.2.1 Activity 1: Scenario-based brainstorming through card sorting**

All the participants of the scenario-based card sorting used their own approaches to organize information into categories. Initially there were three main factors that were prominent in participants' organizations. The first factor in the organization of information about their university website was the use of language. Despite the fact that all participants spoke Urdu, Punjabi, or some other local language, all the participants used English when constructing the contents of the university website in the scenario-based brainstorming. The other important factor was the tone in the use of language. The participants' use of lingo specific wording was prominent in the websites structure. The use of lingo specific wording was found across different participants. The categories such as "Extra Curricular Activities", "Student behavior", "Fee submitting dates", "Complaints", "Pick and drop service", "installments" are some of the examples. A majority of participants were keen to see a university ranking or university status on the university

website. It appeared that university students wanted to see the status of the university as compared to other universities in the country.

*When we [students] go to some university, we first check what [the] university holds in ranking, it is an approach of students that we want to check on PEC [Pakistan Engineering Council] and HEC [Higher Education Commission] ranking that where [a] university [ranks] in relation to other universities in the country. (Participant-12)*

Table 11 provides an example of how participants structured information into first level categories and what participants wrote during the brainstorming activities. Three of fourteen participants categorized information into second level categories (i.e., Study → Bachelors → Exam dates). Most of the participants provided information up-to first level category.

Table 11: Information classification in brainstorming session

<i>An example of labels and hierarchies provided by participants</i>	
<b>University Information</b> → Course of study	<b>Calendar</b> → Holidays → Fee Schedule
<b>Updates</b> → Holidays → Events → Seminars	<b>Communities</b> → Islamic Society → War against Terrorism → University Online forum
<b>Results</b> → Old Results → New Results	<b>About University</b> → History → Achievements → Ranking
<b>Study</b> → <b>Bachelors</b> → Exam dates	

The third main factor in the scenario-based card sorting was the order of information. Not many participants provided a deep hierarchy of information. Only some participants (3 of 14) made sub-categories when creating contents in brainstorming activity.

### 6.2.2 Activity 2: Open card sorting

The average participant of the experiment placed 8 out of 50 cards into a category with the name 'Other' or 'Miscellaneous'. The taxonomy of the cards and categories were directly taken from the university website of the participants, but a number of them did not know



about the category 'Alumni' and placed different cards in this category. The general agreement of cards in a single category was very low and participants' categorization schemes changed enormously when comparing it with other participants of the study.

Table 12: Distance of participants' sorts from one another

Participants	10	11	12	13	14	2	3	4	5	6	7	8	9
<b>1</b>	24	24	27	29	28	31	33	27	23	26	25	28	23
<b>10</b>		30	26	32	30	29	31	30	30	27	22	23	26
<b>11</b>			24	28	25	<b>20</b>	31	29	22	22	22	31	30
<b>12</b>				28	29	28	32	27	28	25	28	29	26
<b>13</b>					25	30	32	33	28	27	33	34	31
<b>14</b>						27	32	32	29	28	28	34	27
<b>2</b>							32	33	25	26	21	32	29
<b>3</b>								33	30	33	32	32	33
<b>4</b>									31	27	32	31	26
<b>5</b>										27	26	32	30
<b>6</b>											26	26	26
<b>7</b>												28	29
<b>8</b>													25

Table 12 shows the edit distance of all participants from one other. Edit distance is a measure that explains the similarity or difference between the sorts of two participants. The number in the table shows the minimum number of steps required to convert one participant's sort into another's, where one step comprises of moving one card from one group to another group. Participant sorting varied significantly, with the smallest distance being 20 steps between participants 2 and 11.

For each card I determined a majority of the participants who classified the card in the same way. If more than half of the participants (7 participants or more) agreed on the placement of a card in one category, it was taken to mean that the placement of the content on that card was highly agreed on between the participants. If less than half of the participants (6 participants or less) agreed on the placement of a card in single category, it was taken to mean that agreement on the content of the card between the participants was low. There was high agreement between participants for 19 cards. In other words, there was low agreement between the participants on the placement of the information in categories or participants tend to think differently within a group.

I compared the difference between participants' sorts and the way this information was sorted on the actual university website. The distance between participants' sorts and the actual university website's contents (actual sort) was quite high as well (*Distance = 26.1*). There were 26 moves taken to make participants' sort similar to the contents as it was appearing on university website.

### 6.2.3 Activity 3: Information retrieval

Participants were provided a set of activities and were asked to find information on the university website. The information was placed in different levels of the website. A level was defined on the basis of minimum clicks required to reach the information.

Table 13: Goal achievement times and success rate

<i>Goal</i>	<i>Optimal Path (clicks)</i>	<i>Successful participants' average goal completion time (seconds) (M ± SD)</i>	<i>Success rate</i>
<i>Goal A</i>	1	55.9 ± 39.3 (13 of 14)	92.7 %
<i>Goal B</i>	1	49.1 ± 38.5 (13 of 14)	92.7 %
<i>Goal C</i>	2	72.7 ± 49.3 (12 of 14)	85.7 %
<i>Goal D</i>	3	138.2 ± 30.7 (6 of 14)	42.7 %
<i>Goal E</i>	3	75.1 ± 53.1 (9 of 14)	64.3 %

Table 13 provides participants' average time spent to find information and their success rate. The table indicates that participants spent more time on finding information placed deep in the hierarchy. Many of the participants could not find the information that was placed deep in the hierarchy of the website.

### 6.2.4 Results from interviews in study 1

During the interviews with participants, a number of issues related to website UX were discussed, such as purposes for visiting the university website and their opinions of the UX of the website. Table 14 provides a summary of participants' feedback on the university website. Participants mentioned a number of reasons for using the website, such as accessing university e-mail, registration of courses, checking exam results, fee installments, calculating grade point average, and checking event pictures. Only a few of the participants expressed positive (+) views, while others provided neutral (0), or relatively negative (-) views towards the UX of the website.

Table 14: Summary of participants' interview and feedback for the university website

<i>Issue</i>	<i>Explanation</i>
Purpose	Email, registration, exam results, library, course schedules, fee installments, grade point calculations,
Opinion of the UX of the university website	+ Good and impressive 0 Even-steven 0 Nice but complicated 0 Do not use much - Dull and not attractive
Design of university website	+ All-right, 0 Normal - Absolutely poor and not colorful - Not special - Absolutely poor - Boring - Font is small
Appearance of university website	0 Normal - Should be appealing - Very blue and small font - Not creative and not innovative
Issues with website	- Complicated, appearance not good, not properly categorized - Not updated - Menu and subtitles are not standard, problem with navigation, confusing - Important information should be displayed with big text - Information is not updated - Information map is bad - Navigation problem

Participants rated the website UX on a Likert scale, as shown in table 15. In participants' view, information was not clearly presented on the website, and the website search was not useful for finding information.

Regarding the design and appearance of the website, participants stated that the design and appearance was boring and unappealing.

*Design is absolutely poor. It is not all that colorful and the font used is too small to see things clearly.*

(Participant 9)

Many of the participants expressed that they did not frequently use the university website because its information was not up to date.

*I use university's website for my academic schedule, teacher's contact numbers-mail id ..... I don't use university's website [because] it does not uploaded all the information on time and we can get the same information from other sources like friends and notice boards etc. (Participant 7)*

Local power structure and administration handling is an aspect that impacts on the design of information and how information is displayed on a university website.

*I think it's the discretion of the designer that provided this and this information at that place. Frequent change of the management does not allow them to [update] this. When you enter the university you will come to know that deans are changed every day so one day if dean thinks that events should be updated on daily basis they are and if other thinks that they should be no editorial on the webpage there will be no editorial.*

(Participant 4)

Table 15: Summary of participants' feedback for the university website

<i>UX assessment (1.Very poor ... 5.Very good)</i>	<i>(M ± SD)</i>
Ease of Use	2.4 ± 0.51
Attractiveness of design/appearance	2.4 ± 0.63
Ease of finding information services	2.5 ± 0.52
Information that was clear and easy to understand	2.1 ± 0.62
Accurate and up to date information	2.5 ± 0.65
Usefulness of site search	2.2 ± 0.58

Regarding the use of language, some of the participants agreed that information on websites should be displayed only in English, because it helps them to practice the language, which is important in the job market and for professional development. There were some participants who mentioned how use of English language can also become a barrier to understanding the contents sometimes.

*Most of the university students are not equipped with English language because they belong to backward areas that is why web in Urdu will be much helpful for them. As when I was in graduation I don't know the meaning of Alumnae it really makes a great difference to me also.*

(Participant 6)

*The thing is most of the students of the university have come from other rural areas and they find it difficult to find the information. This is a nice kind of idea if some information is provided in Urdu it will be good and helpful.*

(Participant 14)

The interview shows that participants of the websites were less satisfied with the UX of the website.

### 6.3 Study 2: UX study of an academic website in Denmark

The second study was conducted in August 2010 in Copenhagen, Denmark. The participants were provided similar activities as in the previous study, but a local university website was used to conduct the assessment. A total of 17 participants were recruited for this study, with the first three participants were participating in the pilot study and 14 participants joining the main study.

Table 16: Participants' background information

<i>Background Information</i>	<i>Value</i>
Average age	23 ( $SD \pm 1.3$ , low 21, high 25)
Gender distribution	7 Male, 7 Female
Average internet access	Several times per day
Weekly time spent on university website	113 minutes ( $SD \pm 135$ , low 5, high 180)
Years of study completed	16 years ( $SD \pm 1.9$ , low 13, high 17)

Table 16 provides participants' backgrounds. There were an equal number of male and female participants in the study. Most of the participants used the internet several times a

day (9 of 14 participants). Some of the participants (2 of 14 participants) used the internet once a day. Study participants spent considerable time on the university website in the week before exam. Half of the participants spent an hour or more during the week on the university website.

### 6.3.1 Activity 1: Scenario-based Brainstorming through Card Sorting

After study 1, I decided to use English in study 2 and all following studies, for brainstorming through card sorting due to translation issues and a lack availability of experts for evaluation in Danish.

Table 17: Information classification in the brainstorming session

<i>An example of hierarchies provided by participants</i>	
<b>Education → Masters → Courses → Schedule</b>	<b>Information → BSc → How to apply</b>
<b>Education → Bachelors → Exam → Marks</b>	<b>Study line → Bachelors → Admission Requirements</b>
<b>International students → Exchange students → Courses for exchange students</b>	<b>Study → Program → Bachelors → Courses</b>
<b>Library → Account loans → Reservation</b>	<b>Education → HA (it) → Rules → Time table</b>
<b>Study → Bachelors → Exam dates → Dates</b>	

Table 17 provides an example of how participants organized information into deep hierarchies. Many of the participant of the scenario based card sorting sorted information in this way. Participants were provided the same amount of time (15 minutes) as those in study 1 to come up with concepts and categories for the university website. Half of the participants (7 of 14) provided information in deep hierarchies.

### 6.3.2 Activity 2: Open Card Sorting

The distance between participants' sorts and the actual university website's content organization (actual sort) was 22.4. That is, there were on average 22 moves needed to make users' sorts similar to the content as it appeared on the university website. For each card, I determined majority of the participants who classified the card in the same way. If more than half of participants (7 participants or more) agreed on the placement of a card

in one category, it was taken to mean that the placement of the content on that card was highly agreed between the user groups. If less than half of the participants (6 participants or less) agreed on the placement of a card in single category, it was taken to mean that the agreement on the content of the card between the participants was low. There was high agreement between participants for 34 cards. In other words users tended to think differently, but that difference was smaller between the Danish participants in study 2 than the Pakistani participants in study 1.

Table 18: Steps taken to make sort (participant sort) look identical to the university website (actual sort)

<i>Participant</i>	<i>Distance from Actual sort</i>	<i>Neighborhood participant</i>
	<i>D</i>	
Participant id-1	21	Participant id-3
Participant id-2	23	Participant id-7
Participant id-3	21	Participant id-5, 10
Participant id-4	21	Participant id-6
Participant id-5	25	Participant id-12
Participant id-6	22	Participant id-7
Participant id-7	22	Participant id-6
Participant id-8	19	Participant id-7
Participant id-9	25	Participant id-7
Participant id-10	22	Participant id-3
Participant id-11	25	Participant id-14
Participant id-12	19	Participant id-1, 5
Participant id-13	25	Participant id-10
Participant id-14	24	Participant id-11
Average: (M):	22.42	

Table 18 shows the minimum distance each participant had, in term of sorting contents, from the actual website content. It also shows also show which other participant was closest to the each participant in term of distance.

### 6.3.3 Activity 3: Information retrieval

Participants were provided a set of activities and asked to find information on the university website. Table 19 provides participants' average time spent finding the information along with their success rate. The table indicates that even when information was placed deep in the hierarchy, participants' average time to find it did not increase much. Only three participants could not find the information that was placed deep in the hierarchy of website (*Goal D*).

Table 19: Goal achievement times and success rate

Goal	Optimal Path (clicks)	Successful participants' average goal completion time (seconds) ( $M \pm SD$ )	Success rate
Goal A	1	59.0 $\pm$ 44.4 (13 of 14)	92.7 %
Goal B	2	42.4 $\pm$ 29.5 (12 of 14)	85.7 %
Goal C	3	79.2 $\pm$ 40.7 (10 of 14)	71.4 %
Goal D	3	55.3 $\pm$ 36.4 (11 of 14)	78.4 %

### 6.3.4 Results from interviews in study 2

During the interviews with participants, a number of issues related to website UX were discussed, such as purposes for visiting the university website and their perception of the UX of the website. In participants' view, information was quite clear and understandable on the website and they were generally satisfied with its UX. Table 20 provides an overview of participants' UX assessment. From the table regarding the UX assessment of the website, it can be derived that the participants rated the usability of website as higher.

Table 20: Summary of participants feedback for university website

UX assessment	( $M \pm SD$ ) (1.Very poor ... 5.Very good)
Ease of use	3.2 $\pm$ 1.12
Attractiveness of design/appearance	3.4 $\pm$ 1.28
Ease of finding information services	2.7 $\pm$ 1.14
Information that was clear and easy to understand	3.7 $\pm$ 1.14
Accurate and up to date information	3.4 $\pm$ 1.16
Usefulness of site search	3.4 $\pm$ 1.01

In the interviews, participants stated that the university website was very structured.

*Before the university website was not that good but now it is very good. Now it is really structured and different levels and the categories are available at different level. I find the information quite easily.*

(Participant id-1)



The participants in study 2 rated the website UX as higher. Participants of the study were satisfied with the usability of the website.

## 6.4 Study 3: UX study of an e-commerce website in Pakistan

### 6.4.1 Description of participants

A total of 30 participants, 17 female and 13 male, from the Institute of Business and Management at the University of Engineering and Technology<sup>23</sup> in Lahore participated in the experiment, while the pilot study included 3 participants. Study 3 was conducted at a different university than study 1. The average age of participants was 20 years ( $SD \pm 1.65$ ). Most of the participants were in business studies (73.3%) and some were from science and education (26.7%). The participants in the study had studied for an average of 14 years ( $SD \pm 1.04$ ). All the participants ( $N=30$ ) had had a computer in their homes for an average of 6.5 years ( $SD \pm 3.01$ ). Most of the participants (83%) had had internet access in their homes for an average of 3.5 years ( $SD \pm 3.08$ ).

The participants were asked to rate their proficiency in English, Urdu, and one local or other language. English and Urdu were chosen because both are official languages of Pakistan, with Urdu also being the national language of the country. Participants were asked to rate their language proficiency in reading, writing, and speaking. Half the participants also filled in language proficiency for a local or other language (11 for Punjabi, 1 for Arabic, 1 for Sindhi, 1 for Saraiki, and 1 for German).

Table 21 shows the language fluency of the study participants for English and Urdu. The rating of the language fluency is from 1 (not at all fluent) to 5 (native). Participants fluency in Urdu speaking was significantly higher than English,  $t(58) = -7.08$ ,  $p < 0.001$ .

Table 21: Participants' language fluency

<i>N = 30</i>	<i>English</i>	<i>Urdu</i>
<i>Reading (M ± SD)</i>	3.07 ± 0.64	3.67 ± 0.99
<i>Writing (M ± SD)</i>	3.10 ± 0.61	3.30 ± 1.15
<i>Speaking (M ± SD)</i>	2.47 ± 0.73	3.93 ± 0.87

<sup>23</sup> <http://www.uet.edu.pk/>

The participants of the study considered their speaking proficiency in Urdu to be better than that in English. When asked about their use of language for writing reports and making presentations, all participants (100%) stated that they used English as their functional language for writing reports and making presentations, with only one participant also using Urdu in those situations.

#### **6.4.2 The website studied**

Symbios.pk is an online shopping site based in Pakistan that sells items such as laptops, PDAs, mobile phones, home appliances, and digital Qurans. An overview of the website was taken from Alexa,<sup>24</sup> yielding traffic data, global rankings, and other information. The average load time for the website was slow at 2.788 seconds, with 83% of sites in the world loading more quickly. The audience demographic of the website showed that 94% of its visitors were from Pakistan. Estimated daily unique page views per user for the website were 5.8 pages and visiting users spent 5 minutes and 37 seconds on average on the website. From the website, a set of 41 cards that represented its content were extracted, as described above, and used in the card sorting activity.

#### **6.4.3 Card sorting results**

During the open card sorting activity, participants made on average 6.31 first level categories ( $SD \pm 2.80$ ) and 1.59 ( $SD \pm 2.69$ ) second level categories. Less than half of the participants (43%) made second level categories. Participants who did make second level categories, made an average 3.54 ( $SD \pm 3.07$ ).

I used cluster analysis to analyze the open card sorting, using the website service Optimal Sort<sup>25</sup> as a tool. I decided on a threshold of 60% agreement of items between participants, in keeping with recommendations by Katsanos et al. (2008a, b) and Hudson (2012). The number of items decreases when participants' agreement increases. Katsanos et al. (2008a, b) used a similarity matrix correlation from two tools, Autocardsorter and Card sorting, and found a similarity of participants between 50% to 61% agreement. During the analysis, a single card was included in the group only if at least 60% of the participants had placed it in the same group in their individual sorts.

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<sup>24</sup> [www.alexa.com](http://www.alexa.com)

<sup>25</sup> <http://www.optimalworkshop.com/optimalsort.htm>

The dendrogram of participants' classifications (figure 19) shows that participants agreed 60% or more on card placement for most of the cards (35 of 41, or 85%). The participants clustered items in three major groups, with an average of 7 cards in each ( $7.67 \pm 4.7$ ), and additional groups with only a few cards. The largest cluster shows participants agreeing on placing one third (13 of 41 cards, or 31%) of the cards in a single category with a theme of 'kitchen'.

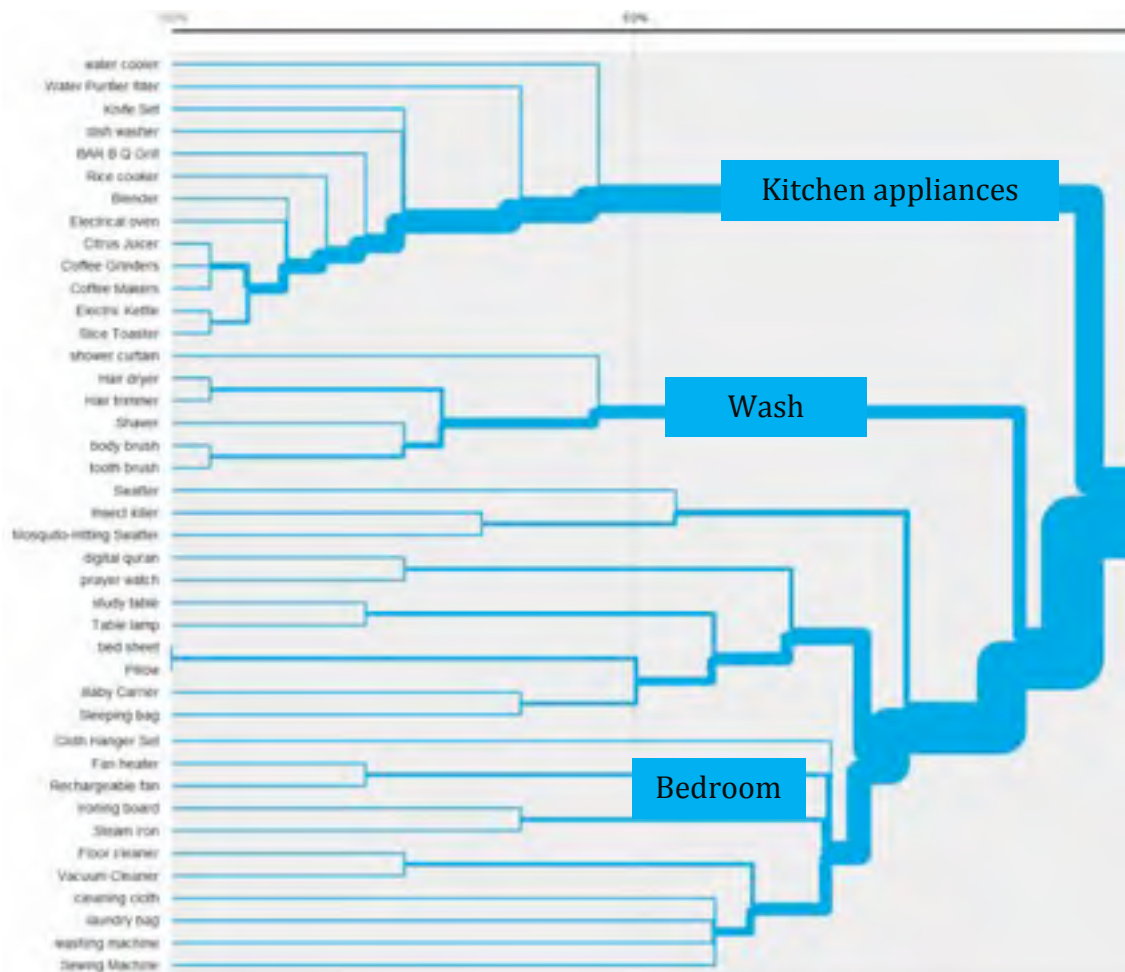


Figure 19: The dendrogram of information structuring by Pakistani participants

The participants provided different labels for this group, including "Kitchen Appliances" (participants 3, 4, 9, 10, 13, 14, 19, 22, 28, and 29), "Kitchen Electronic Appliances" (participants 1, and 27), "Kitchen equipment" (participants 8 and 23), "Kitchen products" (participants 16, 20, and 24), "Kitchen Accessories" (participants 17 and 30), "Kitchen" (participants 6, 7, 18, 21, and 25), and "Kitchen items" (participants 26, 29, and 30). The second largest category contained 6 items (13%) clustered together under the theme of

‘washroom’. The names used by participants such as “Wash Room” (participants 7, 12, 15, 18, and 22), “Wash Room Things” (participant 11), “Bath Room” (participant 25), “Washroom appliance” (participants 9, 14, 15, and 26), and “washroom accessories” (participants 16, 17, and 30). The third main theme contained 4 items (10%) clustered together in a theme of ‘bedroom’. The participants used alternative naming conventions such as “Bed Room” (participants 4, 6, 8, 11, and 19), and “Bedroom Appliances” (participants 4 and 5). The rest of the cards (approximately 44%, or 18 cards out of 41) were either in small clusters with only two cards in each or not clustered. For these cards, there was no agreement across participants as to clustering the cards into similar groups.

#### 6.4.4 Information retrieval results

I hypothesized that participants would take less time to find information located on the first level of the hierarchy of website, due to the smaller number of clicks required. Conversely, finding information would take more time if the information was on the second level of the hierarchy, as it would take more clicks to reach the information. Participants in the study were provided with four information retrieval activities and were given three minutes to find the information described in each goal.

Table 22: Information retrieval times and success rate

Goal	Optimal Path (clicks)	Successful participants' average goal completion time (seconds) ( <i>M ± SD</i> )	Success rate
Goal A	1	68.5 ± 49.9 (16 of 30)	53.3 %
Goal B	1	25.7 ± 36.4 (29 of 30)	96.7 %
Goal C	2	86.9 ± 49.7 (14 of 30)	53.3 %
Goal D	2	97.9 ± 43.0 (26 of 30)	86.7 %

Table 22 provides an overview of optimal path clicks to reach to the requested information. It also provides successful participants' goal completion times, success rates (the percentage of participants finding the goal with the given time), and the average goal completion times. For Goal A, even though only one optimal click was required to find the information, half of the participants could not find in the required time of three minutes. One of the reasons participants gave for not finding the information was general usability issues with the website, notably that the information was not placed in the right category.

Generally, participants took more time to find information that was placed deeper in the hierarchy.

#### **6.4.5 Website use in local and English language**

Participants in the study were asked about the accessibility and use of websites in their local or national language. Table 23 shows the amount of time participants spent on local language and English language websites.

Participants clearly spent more time on websites that provided information in English. When they were asked why they preferred to access websites in English, many of the participants stated that accessing information in English helped them to practice and train their English language proficiency (see section 6.4.1). In the interviews, participants also noted that they accessed more websites in English because there was simply more information available. Furthermore, the technical issues described below regarding information retrieval in local languages were another reason for participants using English websites for information.

*Table 23: Browsing webpages in Pakistan*

	<i>Local language websites</i>		<i>English language Websites</i>	
<i>Do not Open it</i>	(15)	50.0%	(1)	3.3%
<i>Less than 1 minute</i>	(8)	26.7%	(4)	13.3%
<i>1-10 minutes</i>	(7)	23.3%	(9)	30.0%
<i>10-30 minutes or more</i>	(0)	0%	(16)	53.3%

It was interesting to find that half of the participants (50%) never opened websites in a local language or in Urdu. A further quarter of the participants (26.7 %) only visited web pages in local or national languages such as Urdu for an average of less than one minute per visit. This is at least in part because local language websites had a number of problematic issues. When the participants were asked about the biggest general problem in their use of websites in their local language, most (53%) stated that they were unable to find information in the local language. Some of the participants (19%) stated that it took too long to view and download pages that are presented in local languages. One of the reasons they stated for this was that text on web pages in local languages (Urdu and Punjabi) was presented as image files, and hence was less readable.



Figure 20: An example of searchable text on the website (left) and text presented as image file (right)<sup>26</sup>

Figure 20 provides the searchable text (left) and text as image file (right) as an example of the display of text generally practiced on local websites in Pakistan. The participants expressed that although websites displays text as an image file, the font style of the searchable text (left) makes it difficult to read information. They further mentioned that the text in the image files could not be retrieved during their search queries, making it difficult to use the websites in the local language. Despite this, when participants were asked if an organization should ever present its website in local language, only 36% of the participants wanted to see this happen because of the respect it would show for their local culture. Some participants (30%) also wanted to see website contents in local languages because it would be useful for more people.

## 6.5 Study 4: UX study of an e-commerce website in Malaysia

### 6.5.1 Description of participants

A total of 38 participants (14 male and 24 female) from the University of Malaysia Sarawak participated in the experiment. The average age of participants was 24 years (SD  $\pm$  1.71). All of the participants were studying information technology at the bachelor or master's level and had studied for more than 15 years (SD  $\pm$  1.46). Most of the participants (94%, or 36 of 38) had had a computer in their homes for an average of 8.6 years (SD  $\pm$  3.99), although two of the participants did not have a computer in their home at the time of the study. Most participants (76%, or 29 of 38) with a computer had had access to the internet in their homes for an average of 7.31 years (SD  $\pm$  3.67).

<sup>26</sup> The text in both pictures is read from right to left.

To ascertain language proficiency in different languages, all the participants filled out a language fluency questionnaire for English and Malaysian in reading, writing, and speaking. A total of 17 participants filled in the questionnaire for Chinese language proficiency, 4 participants claimed Tamil language proficiency, and one participant claimed fluency in Bidayuh. The language fluency rating of the language was again measured on a scale from 1 (not at all fluent) to 5 (native). For language fluency in English and Malay, the results of the study showed that students considered their language fluency in Malay to be significantly better than English in their reading,  $t(37) = -4.01, p < 0.01$ , writing  $t(37) = -4.52, p < 0.01$ , and speaking  $t(37) = -5.12, p < 0.01$ .

Table 24: Malaysian participants' language fluency in English, Malay, Chinese, and Tamil

	<i>English Language</i>	<i>Malay Language</i>	<i>Malaysian participants' language fluency</i>		
			<i>Malay</i>	<i>Chinese</i>	<i>Tamil</i>
	<i>N=38</i>	<i>N=38</i>	<i>N=15</i>	<i>N= 17</i>	<i>N=4</i>
<i>Reading (M ± SD)</i>	3.39 ± 0.72	4.03 ± 0.85	4.40 ± 0.91	3.94 ± 1.06	4.0 ± 1.15
<i>Writing (M ± SD)</i>	3.08 ± 0.59	3.76 ± 0.88	4.27 ± 0.88	3.75 ± 1.12	3.75 ± 1.50
<i>Speaking (M ± SD)</i>	3.03 ± 0.59	3.84 ± 0.85	4.40 ± 0.91	4.06 ± 1.85	3.75 ± 1.50

I further compared the language fluency of Malaysians with Chinese ethnicity and Malaysians with Malay ethnicity, finding that Malaysian participants of Chinese ethnicity were better in reading,  $t(15) = 2.44, p < 0.05$ , in Chinese than Malaysian participants of Malay ethnicity were in the Malay language. However, there was not much difference in fluency of writing between the Chinese and Malay participants. This implies that despite living in the same geographical area, participants with Chinese ethnicity found it comfortable to access information in Chinese language.

### 6.5.2 The website in Malaysia

Lelong.com.my is a Malaysian e-commerce website started in 1998 and a pioneer of the e-auction sector in Malaysia. At the time of the writing of this article, approximately 75% of website's visitors were in Malaysia. The estimated percentage of global internet users who visited the website was 0.0262%. The average load time for the website was slow (1.834 Seconds), with 64% of websites were loading more quickly. An estimated daily unique page views per user was 9.9 pages and users spent an average of 8 minutes and 35

seconds per visit. A set of 38 cards representing the content of lelong.com.my were developed and used in card sorting.

### **6.5.3 Card sorting results**

The results of the card sorting activity showed that participants sorted the cards into an average of 6.03 ( $SD \pm 2.40$ ) first level categories and 4.76 second level categories. There was a great variance ( $SD \pm 5.24$ ) in making second level categories. More than half of the participants (55.26%, or 21 of 38) made second level categories. Among those who made subcategories, an average of 7.33 subcategories ( $SD \pm 5.05$ ) were produced.

As in study 3, I used a threshold of 60% agreement of items between participants. The analysis of cards using a dendrogram showed that participants agreed on card placement for most of the cards (89%, or 33 of 37). The level of agreement for grouping varied between the participants. For example, most of the participants (90%) agreed to place the two types of watches and clocks together, but the agreement to place all four items, *Metal alarm clock*, *White LED Clock*, *Golden Touchscreen watch*, and *Black Analog watch*, together was less than 60%. The participants clustered items into five main groups (accessories, stationary, entertainment, living room, and kitchen appliances), and two smaller groups (clocks and watches). Figure 21 shows how participants clustered the items into different groups. The main cluster shows that participants agreed to place one third of the total cards (32%, or 12 of 37) into a single category with sub-themes of communication, technology, and living room.

The participants clustered items into major groups with an average of 7 cards ( $6.0 \pm 3.0$ ). The biggest cluster shows that participants agree to place many cards (9 of 37 cards, or 24.32%) in a single theme. The participants provided different labels for this group, including “gadget”, “entertainment”, and “living room”. The same number of cards (9 of 37, or 24.32%) were placed in the theme of kitchen. The other theme of music and stationery had 3 cards (8%).



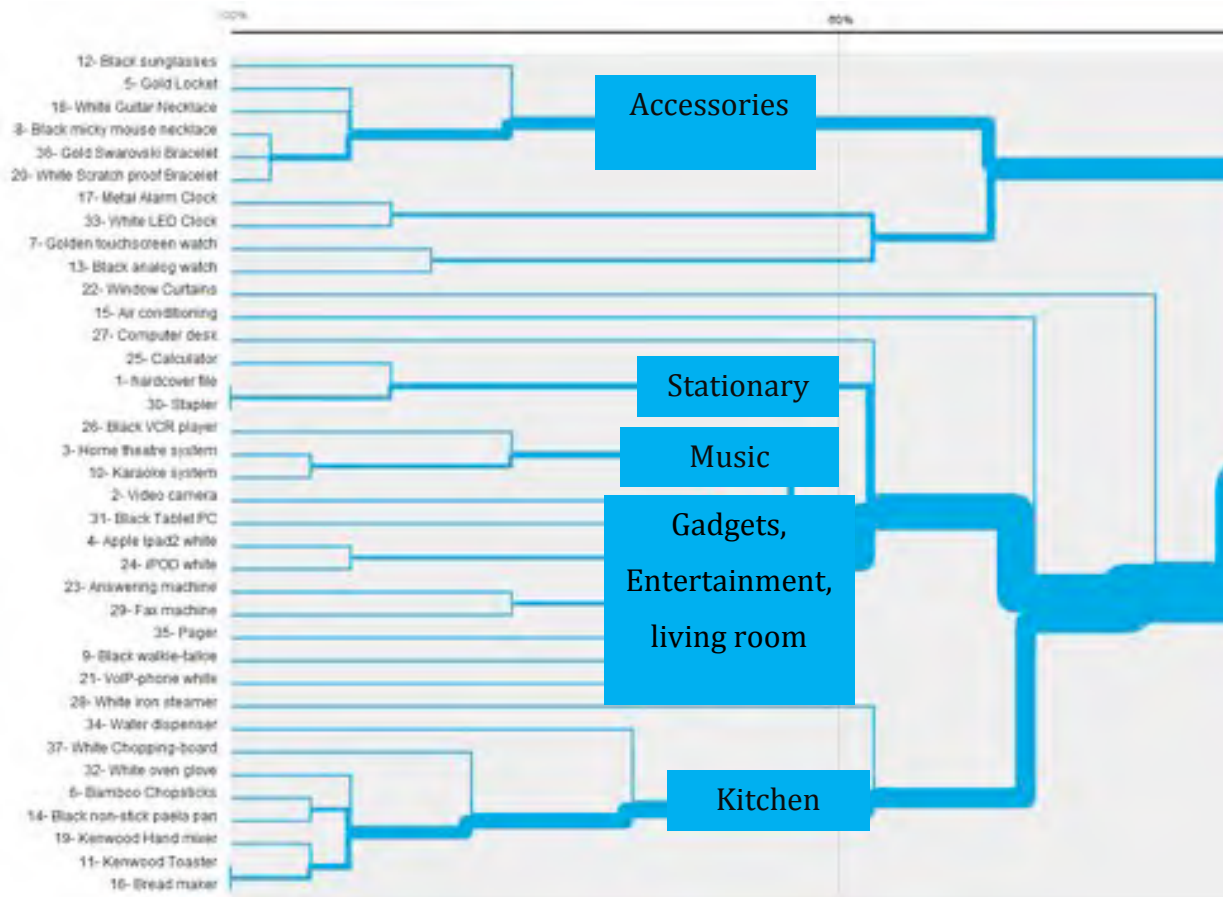


Figure 21: The dendrogram of Malaysian participants' website structures

#### 6.5.4 Information retrieval results

The participants' success rate in finding the required information was low and many of the participants were unable to find the information within the time limit of three minutes. The average success rate to find the information decreased when the information was placed deeper in the hierarchy. Table 25 shows the goal achievement time and the success rate of the participants of the study. It shows that in order to find information placed deep in the hierarchy, participants had to try more alternatives in the classification and thus spent more time on the task.

Table 25: Information retrieval times and success rate

<i>Goal</i>	<i>Optimal Path</i> <i>clicks</i>	<i>Successful participants goal</i> <i>completion time</i>	<i>Success rate</i>
<i>Goal A</i>	1	64.46 ± 46.04 (26 of 38)	68 %
<i>Goal B</i>	2	64.50 ± 47.49 (26 of 38)	68 %
<i>Goal C</i>	2	83.96 ± 41.99 (23 of 38)	61 %
<i>Goal D</i>	3	114.41 ± 53.68 (17 of 38)	45 %

### 6.5.5 Results of website use in local and English language

Malaysian participants were asked about the accessibility and use of websites in local languages as well as in English. Participants stated that they opened websites in both Malay and English. Participants stated they stayed on English language web pages for a longer period of time than on local language web pages. On local language websites, participants largely spent between 1 and 10 minutes whereas they would spend more than 10 minutes to browse for information on English language web pages.

Table 26: Browsing web pages in Malaysia

	<i>Local language websites</i>	<i>English language websites</i>
<i>Do not Open it</i>	2 (5%)	0 (0%)
<i>Less than 1 minute</i>	6 (15%)	3 (7.9%)
<i>1-10 minutes</i>	17 (44.8%)	7 (18.4%)
<i>10-30 minutes or more</i>	13 (34%)	28 (73%)

Table 26 provides an overview of participants' browsing of web pages in English versus in local languages. When the participants were asked about the biggest general problem in the use of websites in their local languages, most participants (55%) stated that they were unable to find information in their local language. Some of the participants further stated that it took too long (29%) and that links often did not work (29%).

### 6.6 Card sorting analysis

A critical reflection on the use of card sorting was conducted (Nawaz, 2012). During the investigation of issues in website UX, I used card sorting as a technique to investigate users' cognitive style, which is shown through their information structure. Card sorting is a commonly used method in many UX studies when looking for users' patterns of

information structure. In the fourth paper, I looked into methodological and analysis issues related to the card sorting activity. I tried to understand how card sorting revealed different aspects of information structure and agreement between participants. I looked into the analytical issues for card sorting that was used as one of the main methods in this research. I shed light on how the choice of card sorting analysis can affect the suggested information structure for websites. In the card sorting technique, a variety of analyses are used to interpret the resulting data, which can help the researcher and designers to understand users' patterns of information structuring. These patterns show how users make sorting activities which reflect on their cognitive style, and thus can help to develop a user-centered website design. During analysis, the recurrence of patterns of classification between users influences the resulting website structure. However, the algorithm used in the analysis also influences the recurrent patterns found and thus has consequences for the resulting website design. I draw attention to the choice of card sorting techniques to understanding users' cognitive style shown. The comparison of card sorting analysis shows how the choice of analysis can impact on the results of card sorting data. Based on the analysis, it appeared that there was more agreement between the users when analysis was conducted with the best merger method (BMM). However, for the same data, the actual merger method (AMM) showed less agreement between the participants (Nawaz, 2012). This research focuses on how one can begin with the same data from a card sorting activity, yet arrive at different website structures. It further explains how the indicated agreement level between users can change for similar data depending on the choice of analysis.



## **7 Discussion**

The following section discusses the findings of this dissertation. It relates the findings to existing theory and previously conducted studies in HCI. I would like to relate UX issues to cognitive style, context of use, and website information architecture.

The aim of this section is to put things into perspective. A number of issues have been studied and explored throughout this research. This section looks into different factors that have been studied and explored. The initial exploration and elevation of the topic brought us to the important issues I identified as being important to study. In the first phase of literature review, there appeared to be a need for cross-cultural research into websites and users. Most of the cross-cultural research focused on the surface levels of interfaces (Garrett, 2010; Juric et al., 2003; Sheppard & Scholtz, 1999; Sun, 2001). The initial literature was used to frame the problem at the outset of the research. Figure 1 outlined the important concepts and issues to be studied.

### **7.1 Exploring website UX in Asia**

In the continuum of the first phase, it appeared that there was a need to look into regional research on website UX, as no such review had been performed previously. As the historical focus of HCI and UX studies has been in Europe and the United States, there is not much known about the history of HCI research in Asia, making it an important area to investigate. When framing research and its boundaries, there are different ways to deal with such issues. This research used a 'from within' approach to looking into website UX in the HCI research of Asia.

I explored propositions based on the literature and theory related to culture, HCI, and website UX. This provided a deep insight into the nature of HCI research in Asia and helped us to understand the development of HCI research on a national level and its level of maturity (Clemmensen, 2010; Smith et al., 2007). This led to the assumption that the number of publications on website UX in Asia would have increased over time, which was indeed the case over the investigated period of time. The reason for this increase in publications is due to the growth of the internet in the region, along with researchers gaining insight into website UX in different domains. The SCImago Journal & Country

Rank<sup>27</sup> indicates that China, Japan, and India were the top research publishers in Asia between 1997-2006. The increase in website usability research in Asia can be related to the massive increase in number of websites in the late 1990s (Netcraft, 2012; Nielsen, 2006). The analysis of articles showed China and Japan dominating HCI research on website usability as expected, while India did not appear particularly high on the list of countries performing such research.

One aim of reviewing the literature is to determine which theories might be used to explore the research question (Creswell, 2009). I found the use of theory to be rather minimal in the articles surveyed. Theories of behavioral intention, learning, and mental workload were the most often used. Among theories of culture, Hofstede's theory of national culture was the most popular. One reason for this is likely that Hofstede's theory has clear handles that help researchers to clarify their research. IS researchers believe that global organizations need to understand cultural differences in the design of information technology. However the use of 'national culture' may be overly simplistic as it glosses over the fact that ethnic and cultural groups can exist across many nations, just as cultural and ethnic differences can exist within nations (Myers & Tan, 2003). Myers and Tan (2003) argued that the concept of national culture is theoretically weak and ignores some of the facts of history. Thus, research methodologies should be improved to study culture and information systems.

Quantitative analyses were the predominant form of analysis used in the studies of website usability in Asia, another reason that Hofstede's theory of culture was regarded as an appropriate model. An effective approach to website UX requires a mix of qualitative and quantitative methods. Quantitative website measures help to explain web analytics data and users' satisfaction, whereas qualitative focused on group themes and subjective interpretations of users' behaviors.

There were a number of studies (11%) that looked into the issue of cultural markers in different cultures. Some of the studies found significant differences in website UX when culturally appropriate markers were used, while other studies were less definite,

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<sup>27</sup> <http://www.scimagojr.com/index.php>. SCImago Journal & Country Rank is a portal that includes the journals and country scientific indicators developed from the information contained in the Scopus® database (Elsevier B.V.).

suggesting that cultural markers were “possibly preferred” in a particular culture. The studies of cultural markers emphasized language issues, perception and animation, fonts, icons and images, and information design. The studies of cultural markers emphasized that better cultural marker results increased the usability of web pages and reduced the complexity and mental load of users. Most of the studies did not emphasize the analysis of icon, images, fonts, etc., despite these features being considered major points of interest in cultural markers theory. The research into surface level components of websites such as icons, images, and fonts is important for website design, but more focus should be given to information design on the bases of users’ cognitive styles and contexts of use.

Exploring the website UX of human-computer interaction is a process that occurs in evolutionary stages as described by Smith et al. (2007). The assessment of website UX at country level showed that research in the Asian region as a whole is rapidly developing and becoming an important factor in the design and development of products.

## **7.2 Website UX assessment across studies**

I first compared website UX assessment scores provided by participants in all four studies. Participants were asked to assess the usability of websites on a scale from 1 to 5 (very bad to very good) in the first two studies. Six constructs were used to assess usability. These constructs were: ease of use, attractiveness of design, ease of finding information, clear and easy to understand information, accurate and up to date information, and usefulness of site search. The first four constructs were also used in studies 3 and 4. The data from the UX assessment of all four studies provided a global view of assessment of websites UX.

The collective average of UX rating of the university website in study 1 in Pakistan was 2.35 (SD± 0.58) and the collective average of UX rating of the university website in study 2 in Denmark was 3.31 (SD± 1.14). In studies 3 and 4, the collective average of UX rating for e-commerce websites was 2.83 (SD± 0.69) and 3.11 (SD± 0.86) consecutively. The users also provided further assessment of the websites in the interviews.

The general UX scores shows that evaluation score for academic website and e-commerce website in Pakistan are generally low. The quantitative measure for UX assessment depicted a general idea of website UX. For example, the collective average of for study 1 is 2.35 (SD± 0.58), users’ attitudes and expression in the qualitative interviews for the

website were also generally negative. On the other hand in study 2, the collective average score for study 2 was 3.31 (SD± 1.14), users' general opinion in the qualitative interviews for the website were also positive.

I usually find the Information that I need. The menu is very easy and there is quite few Information in start. I have seen some websites where there are lot of Information in one menu that makes it difficult to use: (Participant 2, Study 2)

In summary, there were some UX issues with the websites across studies. There were general UX differences among the users within a group as well as across groups. The quantitative assessment of UX problems of websites provided some indication and reasoning for the difference in UX. The users' feedback in the interviews provided a qualitative reasoning that website UX issues were dependent on the context of use.

### **7.3 Exploring users' models of IA**

All four empirical studies assessed users' models of information structure through different techniques such as card sorting, information retrieval, and interviews. In website UX, a lack of appropriate website design (i.e., wireframes) can cause critical UX problems and degrade the overall interaction experience (Katsanos et al., 2008a, b). When new information becomes available on a website, this information is fitted into pre-existing structures alongside other information, or a new design must be created.

While analyzing the card sorting data, study 1 of the academic website in Pakistan showed that users made 6.7 first level categories, and in study 2 of the academic website in Denmark, users made 7.1 first level categories. However the difference between the Pakistani participants and Danish participants for users' sorts in term of depth of information is not significant. The analyses of study 3 of e-commerce in Pakistan and study 4 of e-commerce in Malaysia showed that for information classification, participants in these two cases constructed the information in a similar way. Pakistani participants made 7.7 first level categories and Malaysia participants made 7.3 first level categories. Pakistani participants made more first level categories because participants did not go deep in the hierarchy and made 3.54 categories on second level hierarchy. On the other hand, Malaysian participants made fewer first level categories, but made 7.3 sub-categories at second level of hierarchy. Compared to studies 1 and 2, which had fewer



participants (14), the findings seem to indicate that Pakistani participants like to see information which are not provided deep in hierarchy in comparison do Danes and Malaysian participants. This difference could be aligned to Walton et al.'s (2002) view of the structure of pages. Walton et al. (2002) questioned whether the western hierarchical tree, as seen in traditional file structures, is suitable for South African users. The result indicates that there is more hierarchy of information classification in Demark and in Malaysia compared to Pakistan.

The analysis of studies 1 and 2 showed that a majority of the Danish users agreed on the placement of 76% of the cards containing website contents, but that the majority of Pakistani users agreed on the placement of only 38% of the cards. One of the reasons for this lack of agreement among the Pakistani participants could be that there are different backgrounds of participants in a similar culture. In the interviews it was indicated that the majority of the users came to study at the university from different villages and thus had a more varied cultural background than was expected. Users' cognitive style is shaped by shared knowledge, and influenced by the values, attitudes, and practices of the local ethnic groups they belong. This result is aligned with other researchers, who have argued such differences are present in the values, attitudes, communications, social practices, and cognitive styles of users (Nisbett, 2003; Plocher et al., 2012; Kayan et al., 2006). Although Nisbett (2003) divides our world into the East and the West, this study indicates that even within countries like Pakistan there is a great variance in the cognitive style of the users of websites.

#### **7.4 Measuring information retrieval**

Study 1 of a university website in Pakistan and study 2 of a university website in Denmark showed that the average time to successfully complete a task decreased with an increase in the depth of information (Nawaz & Clemmensen, 2011a, Nawaz & Clemmensen, 2011b). Overall, for all four studies, the studies partially confirmed the classic depth versus breadth trade-off (Norman, 1991; Yuviler-Gavish & Parush, 2008). For Pakistani users, the average time increased quickly when information depth increased and the success rate correspondingly decreased. Answer depth in this example, figure 22, is the minimum number of clicks required to find the information on the website. A low answer depth means the information is accessible by fewer clicks (e.g. 1 click). Conversely, a high answer

depth means that finding the information takes more clicks (e.g. 3 to 4 clicks). For Danish participants the average task completion time for tasks at low, medium, and high depth was 62 seconds (SD  $\pm$  56), 67 seconds (SD  $\pm$  53), and 82 seconds (SD  $\pm$  62). For Pakistani participants the average task completion time for tasks at low, medium, and high depth was 58 seconds (SD  $\pm$  39), 88 seconds (SD  $\pm$  59), and 134 seconds (SD  $\pm$  51), respectively.

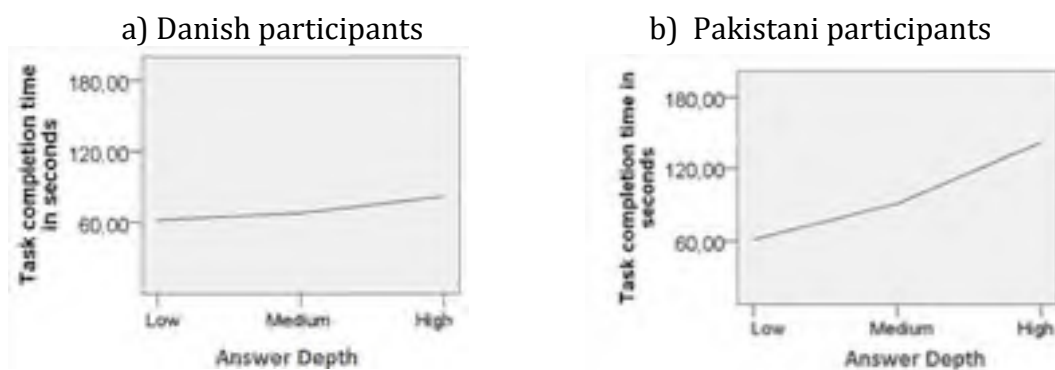


Figure 22: Relationship between task completion time and answer depth (studies 1 and 2).

In terms of task completion time, success rate, and information depth, there was some consistency. The context of use of the websites also had an impact on the results of the studies. Pakistani users in study 1 stated that they used the internet an average of once a day, whereas in Denmark participants were using internet several times a day. The university website use of the Pakistani users was also limited, with Pakistani users spending an average of 12 minutes on the website in a week. Whereas Danish users spent more than 100 minutes per week accessing university websites. Study 1 of a university website in Pakistan and study 2 of a university website in Denmark explained the relationship between task completion, answer depth, and success rate, providing an overview of Pakistani and Danish participants. It explained that response time and success rate are a function of information depth (Norman, 1991). For Danish participants of study 1, there was no relationship between increase in information depth and decrease in success.

For studies 3 and 4 of e-commerce websites in Pakistan and Malaysia, the time to find information increased with the increase of depth of information except in task A of study 4 in which half of the users were unable to find the information even though only one optimal click was required to find it. Malaysian users expressed that there were too many categories on the front page of the website and it was therefore not easy for users to find

the information. The analysis of the websites showed that on average Malaysian e-commerce website had more selectable categories in a single page than the e-commerce website used in Pakistan. Malaysian e-commerce website had more than 20 selectable categories ( $20.66 \pm 15.17$ ) on a single page.. The e-commerce website in Pakistan had more than 17 selectable categories on a single page ( $17.53 \pm 18.15$ ). In term of numbers of products, at the time of UX study the Malaysian website had approximately 378,718 products, while the Pakistani website had approximately 35,000 products. The selectable categories on the Malaysian or Pakistani websites, indicated in these two websites, may not be the general tendency for other websites in these countries

These four comparisons describe that the process of information retrieval contains a complex mechanism involving users' information retrieval activities. Partially, the process of information retrieval can be explained through general user interaction and UX rules such as response time and success rate being a function of information depth (Norman, 1991). In addition to the depth/breadth tradeoff, general UX issues with the website also added to the different success rates among the users of studies.

The studies in this dissertation have indicated that major issues regarding the UX can be addressed by assessing the general usability of the websites. Due to the user-centered nature of usability issues, cultural aspects of website usability can be treated as users' requirements for information display. These requirements are changed and can be addressed by understanding users' cognitive styles, which can be gathered through card sorting studies. The representation of user-centered information structures entails societal understanding of the information. These structures express the particular reflection of a society that is taken as the base of constructing information structure.

For websites' IA, the studies in this research further indicated that there are some contents of websites that are regarded as central, while others are not central. For the central contents of the websites, users tend to agree within the group about its place in the overall information structure, whereas for less central content users tend to disagree about their placement. Users' shared knowledge plays an important role in framing their views in these cases of disagreement. Further, non-central contents tend to increase users' navigational burden unless their placement is aligned with the users' view, in accordance

to the shared knowledge in their society. In term of users' information retrieval behavior, I saw that users tended to take different paths to reach target information.

Figure 23, inspired by Hudson (2012), shows commonly taken incorrect and ideal paths towards target information.



Figure 23: Overview of information retrieval

Users do not use one strategy to find information. Some users acquire information through serial inspection, whereas others acquire information through random inspection. Nevertheless, the choice of users' information retrieval approach takes input from their general understanding of the system and shared knowledge.

## 7.5 Context of use of websites

In this section, I address one of the many aspects of context of use, language.

Understanding context of use can help to better illustrate users' requirements and the impact of context on information. It helps to explain the UX of a system and to see if it fits well with users' mental models or not. Context of use requires much attention in UX research. Shackel (1991) explains the paradigm of usability as a combination of users, tasks, and tools in an environment. For example, in study 1 the interviews with participants revealed their context of use in local culture. Website context of use required websites to be built not only in English, but to have some sections in a local language so that parents of students could view fee payments schedules and exam results in their local language as they often have difficulty reading and understanding English. The participants easily related the context of use of websites in studies 1 and 2 with their personal experience because participants were using websites on a regular basis.

In study 3, the results showed that participants did not display any difference in their reading skills between English and Urdu. There was, however, a significant difference in

their ability to speak English fluently relative to Urdu. In terms of the use of the websites in local languages, in study 3 in Pakistan half of the participants did not use any websites in their local language. Even though their language fluency in Urdu was as good as in English, participants did not use local language websites. The participants expressed that they looked for information in English generally because they were students and most of their studies were conducted in English. When I asked the participants about their preference for English language websites, they stated that there was more information available in English, and that they did not have problems with searching for information in English language, whereas local language (Urdu) websites had inferior search algorithms and text was displayed in the form of an image (section 6.4.5, figure 20).

In study 4 in Malaysia, the results showed that participants considered their language fluency in Malay to be significantly better than English when both reading and speaking. Only two participants (5%) stated that they did not open local language websites. This is a clear indication that participants in case study 3 (Pakistan) were more prone to use websites in English due to the issue with website use in local language as well as use of English language websites as a tool to practice English language skills.

Language related information was not collected in studies 1 and 2. However, assuming that Danish users are fluent in English and Danish, and they prefer to use websites in Danish. The results indicate that Pakistani users' preference for using English language websites is different from Danish and Malay users for using local language. The choice of language preference is in line with users in Botswana who felt more comfortable speaking their own language in local situations, but when it came to computer use, preferred English (Sapienza, 2008).

Users' cognitive styles and thinking processes relative to website structure are associated with their local environment. For example, in the first study in Pakistan, some participants mentioned in the interview that they would like to see bi-lingual website structures in a single interface.

My parents are interested in knowing how I am doing in my studies... Both [of my parents] are literate but [they] cannot read English language. Currently website only provides my transcripts in English. They want access the section

of webpage which contains my profile and transcripts. It would be such a relief if that section is provided in local [Urdu] language as I do not have issue in any language. (Participant 13 - study 1)

The association of local environment is also there in users' choices of language for websites in Pakistan. The use of English is helpful in upward social mobility, leading users to argue that they use websites in English so that they can practice their language skills at the same time as finding information and browsing the internet.

[...] Perception of English and Urdu versions, we feel shy of our own language I also don't want to tell anyone that I am good at Punjabi. I also didn't write it in my resume this is because we want to speak English at organizational level and I need to practice that. (Participant 7 - study3)

Regarding information updates, one of the participants related it to the recent security threat and expressed that information was not updated.

It is quite confusing as you don't get to know about the latest information and news about the university schedule, holidays. Just a day ago when there was a security threat and university was closed, no information was displayed on the webpage as to when would the university will resume again, students ultimately have to consult university office and to check notice boards about the latest information. (Participant 13 - study3)

## **7.6 Critical reflection on HCI research design in cross-cultural studies**

There are a number of ways in which data can be collected in cross-cultural studies. A country-specific approach takes the country itself as a unit of analysis for data collection. Geert Hofstede's (1984) cross-cultural theory takes national culture as its unit of analysis. In Hofstede's views, taking a country specific approach often provides a common geographical proximity, shared language, related historical background, similar religious beliefs and practices, common philosophical influences, and identical political systems in a country. Some of these things are not true, however, as some countries are enormous. Many countries have multiple languages and cultural groups may not share interpretations or experiences of history or religious beliefs.

Based on the experience of current study, a number of approaches are suggested for cross-cultural studies in diverse geographical locations. Following each of the approaches has its own merits and critical issues for conducting research. There are two main aspects of research design: activities to collect data and content used by users in the study. Table 27 suggests approaches for experimental design in HCI in cross-cultural studies. The *contents* describe the material that can be used for conducting cross-cultural studies. The material (information) can be taken from a website which is mainly accessed within a cultural group, or from a website which is accessed in different regions. The *activities* refer to the tasks (such as card sorting, information retrieval etc.) that are performed in HCI study. These activities can be localized or used across different groups.

*Table 27: HCI Research design structure in diverse geographical locations*

<i>Approach</i>	<i>Contents</i>	<i>Activities</i>
<b>Local research design</b>	Local	Local
<b>Comparative research design</b>	Universal	Local
<b>Universal research design</b>	Universal	Universal
<b>Comparative research design</b>	Local	Universal

*Local research design* helps to understand the issues within each cultural or ethnic group. In this approach, local contents are used and local activities are designed for each group. For example, the content may not be usable by users in another group, as they may contain information that is only important and valuable to the users of one specific group, culture, or ethnicity. However, this may make it problematic to validate the study, and will lead to challenges in comparing the studied group with another group.

In *comparative research design I*, the contents of the study are same across different cultural groups. The activities in comparative research design I are locally designed. These activities are designed by keeping in mind the requirements of each cultural group. However, the same content is used across cultural groups in the experiments. For example, the content may be provided to one group in a metropolitan city who can understand them and can easily classify them into categories, while similar content is used in a rural area in which locals do not understand the descriptive language. The moderator then uses different ways (such as use of symbols) to make the content understandable for the local

population. The similarity of content helps to compare studies across groups. However, a moderator may use different activities, which make sense to the local group. The approach of *comparative research design I* was not appropriate for this study because it uses the same content across groups. Using same content across different groups might miss aspects that are more important and relevant to the users of studied groups when local contents are provided. For example, for an academic website, the local contents might give a better understanding to the local users for grouping things into categories. The *comparative research design I* approach might provide good information about the contents validation through different activities, but it might not provide an explanation of why these issues appeared in different groups.

Most researchers use a *universal research design* approach to conducting HCI studies for cross-cultural research. In this approach, both the content and activities are universal. Since similar, but not same, contents are used with same activities across different cultural groups, this approach provides an easy and understandable way to conduct cross-cultural research. This is the case, for example, when the contents are taken from a universal website such as popular e-commerce website (e.g. eBay, IKEA, Amazon) and same contents are used across different locations for data collection. The same tasks are also given in this approach across different groups. This approach was not feasible for this research, because I wanted to use local content that would make sense to the users of a specific group.

In *comparative research design II*, local content is used in the experimental study, but same activities are designed across studied groups. This approach helps to understanding local issues of users' groups. Local contents are used in this approach, however the contents of the study are comparable with other studies. Thus contents of study are taken from a general domain and genre that can be compared with the contents used with other studied groups. This research used the *comparative research design II* approach for two key reasons. First, it helped to explain local content and issues related to the content from the users' point of view. Second, it was comparable with other studies because same activities were followed across the different studied groups.



## **7.7 Limitations**

In this section, I present the limitations of all studies. I also discuss limitations that were faced during the process of data gathering, compiling, and analyzing.

### **7.7.1 Limitations of studies 1 and 2**

*Difficulty of in-group comparison:* The choice of having two groups of users with two websites, instead of two groups and a single website, in order to avoid bias for one of the two groups, did make it difficult to compare group results.

*Sample size trade-off:* The number of participants in study 1 were appropriate for card sorting to reach appropriation of 90% but not large enough for statistical analysis. On other hand, it is a trade-off because individual participants take up to 2 hours to go through the different phases. The study cannot only rely on survey questionnaire and needs the supporting material to combine with the survey.

*Literacy:* There is no clear measure of participants' computer and internet literacy that supports our argument that the group were homogenous.

*Genre of website:* Only one genre of website was researched in this study. In the exploratory stage, there was not a clear typology of website genres. The selection of university website genre, may be too similar across countries, compared to other kinds of websites.

*Quality measure of website:* There was no independent measure of the quality of the website.

*Data material and analysis:* study 1 analyzed brainstorming data, instead of actual website content. The analysis of the study hinted that coherence and chances of higher inter-rater reliability could be achieved by conducting the same analysis on the contents of the website instead of brainstorm data.

### **7.7.2 Limitations of studies 3 and 4**

*Limited usage of e-commerce website:* In studies 3 and 4, I choose e-commerce websites for data collection. Most of the participants in studies 3 and 4 revealed that they did not use e-commerce websites, however, as most require a credit card, which they did not have access to.

*Amount of products and information:* The percentage of local traffic was the general measure used to pick the local websites. However, there was substantially more information and products available on the e-commerce website of study 4 in comparison to the e-commerce website of study 3. A better measure is required for future studies that not only looks into the traffic on the website but also looks into the quantity of information on the website as well.

### **7.7.3 General limitations**

From an analysis perspective, it was rather challenging to analyze the data of the card based brainstorming because users' ways of thinking about information and representing it on cards were not very structured. The attributes of information structure were only revealed through the depth and relationship of grouped items.

During these activities, asking users to find information via menu-based structures without using the search function had some disadvantages. For information retrieval, some of the users found it challenging to navigate through menus and links.

The use of edit-distance has some limitations in the analysis. Although the value of distance ( $d$ ) is subjective to the researcher, the increase in number of categories results in more discrepancies between the groups. If users make many of categories (for example more than 10), it becomes difficult to interpret the results of card sorting, because there is a larger distance between the users

One of the limitations for the experiments was that participants might lack intrinsic motivation because their performance in the experiment had no real consequence for them. The usability study, as with other lab experiments, suffered from low validity because the experimental situations were artificial and participants might have behaved differently in the lab compared to how they would behave in everyday life. The number of participants in the experiments, for practical reasons, was low compared to the vast number of people in the groups of which the participants were hypothesized to be representative.

## **8 Conclusion**

When considering the UX of website structure, we must pay attention to users' cognitive styles and contexts of use. Understanding users' viewpoints, contexts of use, and cognitive styles is fundamental to user-centered design of local websites. This dissertation aimed to investigate users' cognitive styles and contexts of use to improve the design of the information structures of websites.

The information structure of local websites should be aligned with local users' cognitive styles for context of use of websites, and it should comply with local users' images of website usability to improve UX. The overall conclusion must be that through this study we have gained a better understanding of relation between users' cognitive styles and contexts of use, and the information structure of local websites, and how this can contribute to a better website structure, more aligned with users' cognitive models. Through this study we are able to understand the nature of regional research in website UX.

### **8.1 Answering the research question**

This research has answered the research questions in following ways.

RQ 1.1: Which issues related to websites and website domains are important in website UX research in Asia?

The first question was answered by exploring the issues related to website UX research in Asia. This revealed that website UX research in Asia is growing. I found that there are some genres and aspects of website UX which were studied frequently in Asia, but also that the use of cultural theories and frameworks for studying website UX was rather limited. The study revealed that not a single study used rural users as study participants, despite most of the population in Asian countries living in rural areas. Much of the research on website UX is conducted in the United States. While China and Japan are top research locations for website UX in Asia, they do not feature in the top five locations for website UX research globally. In contrast to the strong focus on only one kind of user, the finding of this study was that a broad variety of genres were studied, particularly academic websites, e-government websites, e-portfolios, library websites, and tourism websites.

The primary research question was thus answered on different levels. I emphasized the gap in the literature, explained how research into website UX is conducted in Asia, and pointed toward the proportion of website UX research according to country. UX research in Asia was compared with the general spread of research around the world and it has been argued that the focus of studies in Asia has been on different domains of interest, such as tourism websites UX, and different topics of study, such as the mental stress of users. In term of nature of research, the website UX research in Asia did not suffer from gaps, but instead emphasized different topics compared to website UX research in Europe.

RQ 1.2: How do local users' cognitive styles relate to their context of use when using local websites?

The second question was answered by exploring how users' cognitive style in terms of the classification of web content in Pakistan and Denmark related to context of use and information architecture. One part of this research looked into different classifications, such as thematic and taxonomic classification (Nawaz & Clemmensen, 2011a, Nawaz & Clemmensen, 2011b). There was an indication that the cognitive style of users in Pakistan is slightly different because, as their success rate decreased, their edit distance increased and there were lower numbers of second level categories. The analysis of taxonomic and thematic classification revealed that Pakistani users tended to use taxonomic classification more than the Danish users, classifying information into categories for which information items could mostly be related through higher levels of abstraction. In term of the resemblance of information structure of local websites with users' information models in the studied groups, the two websites matched their users' classifications to different extents. In the information retrieval tasks, the study found that Pakistan participants' success rates decreased as the answer depth increased. There was no such relationship between information depth and success for Danish users.

The research found both differences and similarities between the Danish and Pakistani participants. The analysis of taxonomic and thematic classification reveals that Pakistani users provide more taxonomical classification than Danish users, herby cognitive style of Pakistani users differs concerning the structure of web contents than those of the Danish users. The difference in the percentage of taxonomic classification could be interpreted as a cultural difference in cognitive sorting style. The Pakistani participants classified

information into categories, for which information items can mostly be related through higher levels of abstraction. The Pakistani participants' shallow classification might be explained by cultural background, literacy, and the website domain. The results also revealed that users in Pakistan were generally less satisfied with the usability of websites while Danish users were generally more satisfied with the usability of websites.

RQ 1.3: How do local users' cognitive styles and contexts of use relate to the information architecture of local websites?

The third question was answered by looking into users' cognitive styles through the activities of card sorting and information searching tasks. In the third question, I compared the case of Pakistan and Malaysia in terms of users' information retrieval and users' information structure within and across studies. While analyzing the study of Pakistan and Malaysia I found that the users had different approaches to acquiring information. Users tended to acquire information in a serial manner and to go into a website and look for information without skipping any part. The strategy of looking to acquire information through serial inspection brings the issue of serial or repeated failure, increasing users' navigational burden. On the other hand, random inspection information retrieval with replacement provides users with cues about the webpages they had already visited (article 3). It also revealed that although participants language skills in Pakistan were similar in English and Urdu, participants clearly spent more time on websites that provided information in English.

RQ 1.4: How could different card sorting analyses influence the design of the information architecture of a website?

The fourth question has been answered by explaining how analysis can help or hinder the results of cross-cultural studies of website UX. I have explained how the choice of analysis technique for card sorting studies can impact the resulting information structure for a website. The study indicated that the information structure of a website should not only come from an analysis of card sorting, but should also be evaluated by subsequent usability testing. This fourth question regarding the analysis of card sorting also helps to build better websites. The choice of analysis for card sorting studies affects the suggested information structure for websites. Therefore it is important to understand the analysis

and its impact on the resulting structure. It helps to understand the choice of an appropriate approach to the analysis of card sorting studies. In summary, all questions and aspects of this research assist in building better websites for users.

## **8.2 Theoretical contribution**

The main contribution of this dissertation is the argument that different website information structures, contexts of use, and cognitive styles matter. People's ability to navigate is context dependent, and thus the information in the structures of websites should adhere to local users' cognitive styles. In term of the localization of websites, different IAs matter because this research supports that idea that users of websites have a tendency to perceive websites in a context dependent way. A theoretical framework is suggested that can be used to study cross-cultural issues related to website UX.

Looking into users' cognitive styles for information retrieval is something that can be studied further in the future. There are more studies required to confirm the results concerning thematic and taxonomic classification. Measuring users' information retrieval through keeping different patterns in mind would be another way to move forward on the basis of this research.

In the comparison of card sorting analyses, much of the useful information regarding second level categorization of users was apprehended as part of first level categories in this research due to the limitations of tools that were used for data analysis. Finding a way to address this issue so that members of second and third level categories could also be incorporated into the analysis and assessed for recommendations would be valuable.

This research provided some ways to analyze studies that contain data of both qualitative and quantitative nature. For example, the study provided edit-distance as a method to evaluate if users cognitive style matches the content structure. Still more work is required to address the issue of data analysis for studies that include activities such as card sorting.

## **8.3 Practical Contribution**

This research has contributed empirically to HCI research. First, it has shown how the combining different activities in UX studies confirms the results from different activities. It also emphasizes the importance of understanding the methodological issues surrounding card sorting as a tool for analysis. Card sorting has great potential to help us understand

users' mental models. From a practical perspective, this dissertation has provided knowledge for UX practitioners who often use card sorting as one of their primary methods of collecting data. The study shows that users' language background might not be the only reason for users' choice of languages for website use. It has shown how the choice of the card sorting technique in UX studies has substantial implications for the results. It suggests that the choice of analysis for card sorting has consequences for website designs because the agreement level for different methods varies for the same data and different methods can thus suggest different structures of web content.

This research helps to understand website information from the user perspective. It addresses the issues of information structure regarding content centrality. It further addresses how some contents are central in websites while others goes into different categories on the basis of users' previous interactions with similar contents. The contents that are not central, these contexts are influenced through users' backgrounds, which shape their cognition to view these contents.

This research helps to build better websites through understanding a number of issues. In terms of the literature, it helps to understand how website UX is being researched in Asia and what kinds of domains are being studied. The literature survey helps to understand the focus of website UX on different domains of websites. Thus, this research helps to build better websites through understanding the issues surrounding information architecture and information retrieval through user goals.





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## Appendices



## 9 Appendix 1: Research articles selected for the dissertation

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## **Appendix 1a: Research Article 1**

### **Website Usability in Asia 'from Within': An Overview of a Decade of Literature.**

**Nawaz, A.,** Clemmensen, T. (2013). Website Usability in Asia 'from Within': An Overview of a Decade of Literature. *International Journal of Human-Computer Interaction (IJHCI)*, 29(4), 256-273.





# ***Website Usability in Asia ‘from Within’: An Overview of a Decade of Literature***

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**Abstract:** As the number of website users in Asia grows, there is an increasing need to gain an overview of HCI research about users and websites in that context. We present an overview of HCI research on website usability in Asia ‘from within’, which outlines the articles written by researchers with affiliations to universities in that part of the world. Based on a keyword approach to major HCI research outlets, we identified and analysed 60 articles from the period 2001 to 2011. Our results indicate that academic websites, e-commerce websites and tourism websites were the most studied web site domains in Asia. Typically, university graduates were used as participants in a laboratory setup and asked to navigate and find information on a website. No systematic use of cultural variables or theories to code, analyse and interpret data and findings was found. We discuss our results and the need for a greater sensitivity to what is ‘local’ and ‘from within’ in HCI research and what this can add to the existing literature on website usability.

## **Keywords**

Website, Usability, User Experience, HCI, Asia, UX, Local, Literature, review.

## **1 INTRODUCTION**

The number of users of websites in Asian countries<sup>1</sup> is growing at faster rate than the rate of growth in Europe in the recent years. Asia has had 210.8 million new internet users since 2000 (Pingdom, 2010). This article provides an overview of human-computer interaction (HCI) research on website usability in Asia that has been performed by researchers affiliated with institutions in Asia from 2001-2011. Due to strong economic growth and the pattern of internet development in Asia, the use of websites has become a standard means of searching for information and buying commodities and products in the region. However, the majority of research studies in HCI focus on users in the USA, Canada and European countries, or at best compare one of those countries with countries in Asia (Clemmensen & Roese, 2010). Few studies have focused on HCI and website usability in Asia

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<sup>1</sup> Asian countries were chosen on the basis of United Nations Geoscheme. The macro-geographical regions are arranged to the extent possible according to continents. <http://unstats.un.org/unsd/methods/m49/m49regin.htm>

specifically, despite HCI being of key importance to the ICT industry in that part of the world (Smith et al., 2007; Yeo et al., 2011).

Academic HCI research has advocated the importance of website usability for decades. Website usability issues include overwhelming amounts of information, complexity, lack of structure, insufficiency of search mechanisms, lack of fit with users' preferences for colors, inappropriate metaphors, and difficulty of navigation (Nielsen, 1994). Existing theories of usability are likely to be applicable in Asia, but website usability may not be universal and culture might influence the perception of usability (Frandsen-Thorlacius et al., 2009, Yeo, 1998). More generally, topics chosen for HCI research, data collection, analysis and discussion may all to some degree be 'local' or 'indigenous' to different regions of the world (Clemmensen, 2012). For example, the theory and method of so-called 'cultural markers' might be of special importance to research on Asian websites (Sun, 2001). Similarly, Hofstede's (1980) national cultural dimensions have turned out to be relevant theory for HCI research on Asian websites, see for example (Smith et al., 2004), while rarely being used to examine US websites.

There are Asia-specific controversies for website usability related to preference for website language, content and visual design (Choong & Salvendy, 1997; Marcus & Hamoodi, 2009). Further, there are several issues and gaps that will need to be filled out through existing or new theory. Such theories must address issues such as the variation of website structure within the Asian region, the relation between usability and user experience in Asian websites and the design of bilingual websites with two or more languages presented concurrently on a single webpage. There may also be a need to look into Asia-specific HCI methods, if any, to study website usability in that region. Finally, being aware and sensitive to the numerous variables relevant to understanding website usability in Asia may in fact be most possible for HCI researchers who live in the region (Clemmensen, 2012). In sum, we decided to focus on usability research performed by HCI researchers affiliated to Asian institutions. This paper aims at answer the question: *What local HCI research has investigated website usability in Asia?*

This article shows how the research in HCI and website usability in Asia has evolved over a period of 10 years from 2001-2011. It examines the distribution of website usability research across countries, use of theories, study topics and what genres of websites that have been researched during this period. The article provides a summary of research with different methodological approaches, such as theoretical analyses, field studies, experiments, ethnographies, interviews and surveys. The article also looks into the kinds of participants in the studies and how many participants were used in each. Finally, the article discusses several gaps in the literature and identifies key areas of future research for website usability in Asia and in general.

## 2 BACKGROUND

The number of website users in Asian countries increased drastically in the decade 2001-2011. According to the US Census Bureau, in 2011 44% of the world's internet users lived in Asia<sup>2</sup>. Due to strong economic growth in internet development in Asia in the preceding years, website use became a normal part of daily life. During the period, the software and hardware industries and web-based services such as e-commerce developed even further in large Asian countries like Japan, India and China (Smith et al., 2007). People started to use the web to search for information and to buy commodities and products. Social media, e-commerce and web applications, many of which were unfamiliar to USA and European users and HCI researchers. For example, Sina Weibo, a site similar to Facebook with over 100 million users (Joinson, 2008) were used by hundreds of millions of people in Asia.

Historically, HCI and usability studies originated mainly in Europe and the United States while not much is known about the history of HCI research in Asia. Anecdotal evidence suggests a rapid development of research took place in the period 2001-2011, and that HCI research that focuses on the region, or is hosted in Asia, has been published in a variety of HCI journals (Chui Yin Wong, personal communication, 24 November, 2011). Development of HCI research on a national level has been described as 'institutionalizing HCI research' and conceptualized as a process that occurs in evolutionary stages (see table 1). Applying these stages on a country level showed that HCI research in the Asian region as a whole rapidly developed to be an important factor in the design and development of products (Smith et al., 2007). However, the evolutionary approach to the development of HCI is limited in different aspects, one obvious one being that technology developed in one country often spreads rather swiftly around the world and does not occur in stages in each country (Clemmensen, 2010).

**Table 1:** Stages of usability maturity and their indicators (Smith et al., 2007)

<i>Level</i>	<i>Indicators</i>
Recognised	Problem recognition, performed processes
Considered	Quality in use awareness, user focus
Implemented	User involvement, human factors technology, human factors skills
Integrated	Integration, improvement, iteration
Institutionalized	Human-centred leadership, organizational human-centeredness

A number of research studies show that users differ importantly according to culture (Day & Evers, 2001; Callahan, 2005; Marcus & Hamoodi, 2009). Studies of user performance indicate that a cultural fit between technology and target user group may be important. Wan Rahim et al. (2009) conducted a survey of local Islamic websites and suggested that Middle East and Malaysian users performed faster when they used websites that were targeted towards their cultural groups. Studies of user preferences indicate that people from different countries may exhibit specific preferences for

<sup>2</sup> <http://www.census.gov/>

layout of the websites. For example, Callahan (2004) suggested that users in Japan and Malaysia may have a preference for a vertical layout, whereas users in Austria and Denmark may have a preference for horizontal page design. The study used Hofstede's dimensions of national culture as the main framework to examine cultural differences between different countries. One possible shortcoming of this approach, and of many other studies that use national culture as a variable, is that it did not discuss within country differences between user groups. For example, Callahan (2004) used 20 webpages from Malaysia, which were presented to participants in Malay, or in Malay plus an English version of the homepage, but did not discuss which particular language, ethnic and cultural groups, among the many different languages within Malaysia, that the study concerned.

Every group or category of people, it has been argued, carries a set of common mental programs that constitute its culture (Hofstede, 1980). There may, therefore, be systematic difference in the cognitive styles of Asians and Westerns, for instance; Asians tend to apply a holistic view of the world, as ancient Chinese thinkers promoted this way of thinking, whereas Western people tend to apply an analytical view of the world following the traditions of ancient Greek thought (Nisbett, 2003). Likewise, most 'high context' cultures, such as Asia and Latin America, rely heavily on contextual clues, whereas low context cultures (for example the United States, Germany and Scandinavia) rely on more definite cues, such as the written word (Nantel & Glaser, 2008). For example, members of individualist cultures such as Germany tend to perceive objects in context independently, while members of collectivist cultures such as Malaysia focus on the relation between objects and the entire field (Kühnen et al., 2001). The difference between cultural groups with a focus on individual objects versus objects-in-context has also been explained by reference to the different perceptual environments of each cultural group (Miyamoto et al., 2006). For example, people living in densely populated megacities might experience a different and more contextual physical environment, compared those living in sparsely populated areas. People in Denmark will tend to see a fish when presented with fish in an aquarium, while people in China will see an aquarium, because aquariums are common in city life in China and rare in city life in Denmark. Similarly, talking to someone on a mobile phone when you are more or less alone in the street is a different user experience from talking to someone on the mobile phone when surrounded by other people also using their mobile devices. In summary, the country or regional culture of users and designers affect individual experiences on a basic cognitive and perceptual level, and it is highly relevant to HCI in many ways.

Cultural differences influence HCI in more ways than just directly through users' perception and cognition. The mental program of designers and developers of websites may be more or less embedded in and anchored to the local culture, resulting in variations in their understanding of local users' needs. Faiola and Mateio (2005) compared the online performance of 27 Chinese students and 26 American students who completed online tasks. The results indicated that online task time performance of participants was faster when participants used web sites created by designers from their own national culture. Finally, differences in language usage between different cultures may have complex and not yet understood implications for the usability and user experience of websites.

Differences in language and culture are of key importance in the usability of websites and should be considered when dealing with different cultures.

## **2.1 Website usability and user experience**

Website usability and user experience may not be universal across different countries. Successful usability evaluation depends on culturally-embedded meaning of objects which is not explained appropriately by a universal understanding of usability (Smith & Yetim, 2004).

The concept of ‘cultural markers’ had been of particular importance to understanding website usability. The idea is that when users browse web pages, they subconsciously apply cultural preferences to evaluate the design (Sheppard & Scholtz, 1999; Juric et al., 2003). Cultural markers are interface design elements and features that are prevalent, and possibly preferred, within a particular cultural group. In other words, cultural markers in web design are the cues of picture, icon, shape, colour, texts and tone frequently used in a particular culture to interpret meaning. Users are receptive and possibly prefer websites that display cultural markers of the local culture. Targeting a user group with cultural markers could thus potentially increase the usability of websites. It had been shown that users from different cultures preferred different modes of cultural markers (Sun, 2001). Sun (2001) investigated strategies for the development of representative interfaces in a multicultural context. Her study used Hofstede’s (1980) power distance and Marcus’s (2000) approach for multi-dimensional web-interfaces to identify cultural representations of multicultural Malaysia. Marcus (2000) used cultural markers to explore three characteristics of web sites: Language, colour, and pattern/image. The result of the study pointed out that those websites that use cultural markers in their design are accepted by their target audience. However, it is difficult to generalise cultural markers for users in the frequently multi-ethnic and multicultural societies of Asia. For example, users in Malaysia may well have different cultural backgrounds, such as Chinese, Malay, and Indian. Each of these cultural groups may have different ways of relating to cultural markers embedded in websites. While looking into a country such as Pakistan, there are different cultural characteristics that need to be taken in consideration in website usability. For example, while looking on a university website users there consider their association with their family of importance for how they manage information (Nawaz et al., 2011; Nawaz & Clemmensen, 2010).

In summary, research on website usability in Asian countries has been emerging rapidly in the period from 2001-2011. Studies of HCI and usability started to get a focus in countries like China and India in late 1990s (Smith et al., 2007). This research was practiced in the traditional way with university students as participants, a focus on academic websites and government websites, and on quantitative research. Furthermore, the countries studied, especially Western Asia<sup>3</sup>, were strong on Muslim majority values at that time, and websites in these countries became a medium through which Muslims and Islamic scholars accomplished many of their religious obligations (Murni & Abu Osman, 2011). Thus, we expected our review of research on HCI in Asia research to show

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<sup>3</sup> The macro-geographical regions of western Asia <http://unstats.un.org/unsd/methods/m49/m49regin.htm>

interest in religious identity and evaluation of religious websites, a topic that so far has been little studied (Al-shamaileh et al., 2011). More generally, from the literature on cognition and culture reviewed here, we expected many studies of website usability in Asia to focus on the religious, social, organizational, or cultural context of websites.

### **3 METHOD**

A keyword approach was applied to search in scientific repositories that covered all major outlets for HCI research. Initially, a search of website usability in Asia was conducted on Google scholar. It showed a distribution of publications across multiple journals and conferences. The initial overview of the search results showed that a search was needed for “website usability in Asia” across multiple disciplines, journals and conferences. We chose to approach the search for relevant "website usability in Asia" articles by searching major academic databases which are widely used to retrieve HCI research.

#### **3.1 About the analysts**

The analysis was primarily conducted by the first author, who has the competences and background required for analysing the literature on website usability in Asia with an internal lens. The first author is a Pakistani national who grew up in Lahore and he has an undergraduate degree in computer science from Lahore University and postgraduate degrees from Sweden and Denmark. The first author speaks Urdu, English, Punjabi and some Danish. One of the observations which initiated our analysis was the observation during the literature search and data collection that despite the fact that 29 million people have internet access in Pakistan, there was no evidence of HCI and usability research. The second author is Danish with no formal affiliation to Asian Universities and HCI in Asia. His main qualification for participating in this paper was his experience and knowledge gained from coordinating a research project on cultural usability with researchers in India and China.

#### **3.2 Choice of Academic Databases**

The articles related to website usability in Asia were being found in multiple academic databases, because there was no single repository for HCI research or website usability in Asia. Focusing on top HCI journals and conferences would not provide optimal results, because emerging HCI research, as we estimated was the case in Asia, often straddles multiple disciplines (e.g. engineering, IS, information science, psychology, and human factors). When searching for relevant literature, it was therefore necessary to look not only within the HCI literature as determined by its standard journals and conferences, but also outside the field (Webster & Watson, 2002). Hence we decided to search in largest, most famous, and most comprehensive scientific repositories. The obvious risk of searching in these repositories rather than focusing on a narrow set of conferences or journals was that we could be overwhelmed by the potential large number of HCI research articles on the topic studying question, and that we might find articles that were not appropriate to the topic.

However, in our judgement, this risk was worthwhile in order to catch the potentially interesting and possibly widely scattered articles on website usability in Asia.

We chose four academic search engines, “ACM”, “Web of science”, “Scopus” and “Science Direct”, to search for relevant articles for the study. We selected these four databases because they covered all major HCI journals and conferences. We also looked other HCI researchers’ literature review papers and their choice of HCI databases (Clemmensen, 2010; Bargas & Hornbaek, 2011). The four repositories cover 20,200 publication venues. We searched for the articles between 2001 and 2011. This period of time was selected because there was an incredible growth in the internet and its users in Asia between 2001 and 2011 (Pingdom, 2010). The penetration of the internet in Asian population was 20.1% in 2011 and Asia represented 43.4 % of the world internet users at that time, the most in the world. In all, Asia showed a growth of 568.8 % in internet use over the period<sup>4</sup>.

### **3.3 Keyword and screening criteria for relevant articles**

To identify articles within the set of chosen outlets, we used the two keywords: *website* AND *usability* to search in the titles, abstracts and keywords of the articles. This procedure had implications: we found only those articles which focused on website and usability in the abstracts of the articles.

After using the keywords to identify a list of articles, we wanted to include only those articles that focused on website usability in Asia. Therefore we defined the additional screening criteria of country of authors/publication and general topic:

- Country of authors’ university: We used the first author’s university affiliation as an indicator of the geographical region of the research article. The country of the first author’s university was deemed suitable for refining the list of articles to those relevant to HCI in Asia because there was no other reliable common factor that could be tracked. The aim was to include only those articles that addressed website usability in an Asian country.
- General topic of the articles: The articles were screened to see if they had sufficient focus on website usability topics by reading all abstracts, skimming the articles and deciding whether to include them or not.

The search results from repositories were imported and duplicates (identical publications, but from different databases) were removed. Only articles written in English were included because it was difficult to interpret focuses of articles from the summary of articles which were not written in English. In the later stage, we included seven papers (see appendix A) which were identified by a research assistant from Chinese academy of Science as good examples of Chinese- language research in on website usability.

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<sup>4</sup> An overview of internet usage, data and statistics worldwide: <http://suite101.com/article/internet-usage-data-and-statistics-worldwide-a235149>



### **3.4 Propositions**

A number of propositions about HCI research on website usability in Asia were formed before the analysis of articles. These propositions were based on the literature discussed above and more. We also formulated additional propositions about the use of research methods and types of theory used in the articles. This resulted in the following propositions about HCI research papers on website usability research in Asia prior to analysis:

1. The number of publications on website usability in Asia would have increased over the period 2001-2011 due to increased interest in the topic linked to a rapid increase in website users in Asia at that time.
2. A majority of the articles would have been written by authors with affiliations to universities in China and India, due to the large size of these countries and their corresponding populations of academic researchers.
3. For the use of theories, cultural theories would be used as major frameworks for studies of websites and usability in Asia, because Asian users feel a strong association with their local culture. Such theories would be used to explain whether websites are culturally contextualized according to users' local culture, and whether symbols and national colours are appropriated.
4. The topics studied in HCI research on website usability in Asia would mainly be usability evaluation methods and website design methods in general, and the findings would involve analysis in terms of cultural theory. The reason for this proposition was that existing usability theory should remain relevant in Asia, though perhaps with additional cultural aspects.
5. The particular genres of websites that would have been studied would be university websites, religious websites and government websites in addition to other website domains. University websites would be studied because much of HCI research has traditionally been conducted in universities and has tended to use students as participants. Religious websites would be studied because religion has been a central feature of a number of Asian countries over the period covered. Government websites would be studied because governments have recently begun providing many online services to potentially a large user groups, making testing the accessibility and usability of these services for their citizens a critical area of study.
6. A large proportion of the articles would focus on cultural markers and usability, as it had been shown that users from different cultures tend to prefer different modes of cultural markers and that there are interface design elements and features that are prevalent, and possibly preferred, within particular cultural groups (Sun, 2001).
7. There would be more quantitative studies (for example questionnaires) than qualitative studies (for example open interviews), because quantitative science has dominated HCI research in general (Cairns, 2007). In many Asian countries, HCI research was an emerging discipline during the period, and emerging disciplines often starts out using conventional research methods in the discipline, suggesting a likelihood of quantitative methods.

8. The participants in the studies would have been the representative of the studied domains. We would expect a reasonably large body of articles with rural users as study participants. We expect this because governments and organizations are not only providing online services through websites to users living in urban areas but they are also trying to provide these information and services to users who live in rural areas.

## 4 ANALYSIS AND RESULT

We searched for relevant articles sequentially in each of the selected four academic databases.

- *ACM Digital Library*. We searched for *website* AND *usability* in the abstracts of the articles between 2001 and 2011 and found 231 in ACM database and affiliated Organizations of ACM database. Since ACM did not provide refinement though locations, we screened the 231 articles for the locations of the institutes and first author's location. The 231 articles were retrieved from 100 different institutions. In this list of articles, four articles were not presented by any institute but rather by a company or individual person (IBM, Oracle, Sun Microsystems and Aaron Markus). We selected one article from these four articles because this discussed culture and choice of users' interfaces and placed it in 'China'. Ultimately, we were left with 17 articles from the ACM database. One of the articles was not available for downloading. We downloaded the remaining 16 articles in the final ACM list.
- *Scopus*. The search for *website* AND *usability* was conducted in the abstracts of articles between 2001 and 2011 and resulted in 289 articles. A total of 44 articles from the 289 articles were from the Asian region. Of the 44 articles, 13 articles were not available online, which left us with 31 articles downloaded.
- *Web of Science (SSCI)*. The search for *website* AND *usability* in the abstracts of the articles between 2001 and 2011 resulted in 265 articles. The search was applied to the database fields of article title, abstract and keywords. After screening the articles according to the geographical locations, we were left with 31 articles. Five articles could not be downloaded due to unavailability of articles in digital form, resulting in 26 articles from web of science.
- *Science Direct*. We searched for *website* AND *usability* in the abstracts of the journal articles and found 57 articles. Of these, after screening of abstracts for location and topic, we were left with 13 articles.

Table 2 provides an overview of the found articles. The Scopus database appears to be the most comprehensive with 31 articles on website usability in Asia.

We combined all the articles from the four databases and found 26 (29%) articles replicated in one or more databases. After removing the duplicate publications, we were left with a final list of 60 articles for analysis. The articles were analysed further according to the propositions derived from other studies. In order to search for relevant information in articles, the abstracts of the articles were read thoroughly. The introduction and conclusions were read to search for relevant information if it was not available in the abstract of the article. The body of the article was studied to search for

information if necessary. We coded the articles for categories of interest. The choice of categories was informed by the propositions presented in section 3.3. The coding was done by going through all the 60 articles to look for information that were relevant to each proposition. The first author coded for all propositions and all the articles. The abstract of all articles were read thoroughly and body of the article was skimmed to search for relevant information. During this process, codes were generated to find the theories, methods, studied topics and type of users been used. As a control of the coding quality, the coding done by the first author was compared with a coding done by the second author for the “theory” used in the 60 articles, using the set of “theory” codes developed by the first author. The comparison of the two coding was performed qualitatively with both authors discussing disagreements and reaching a consensus.

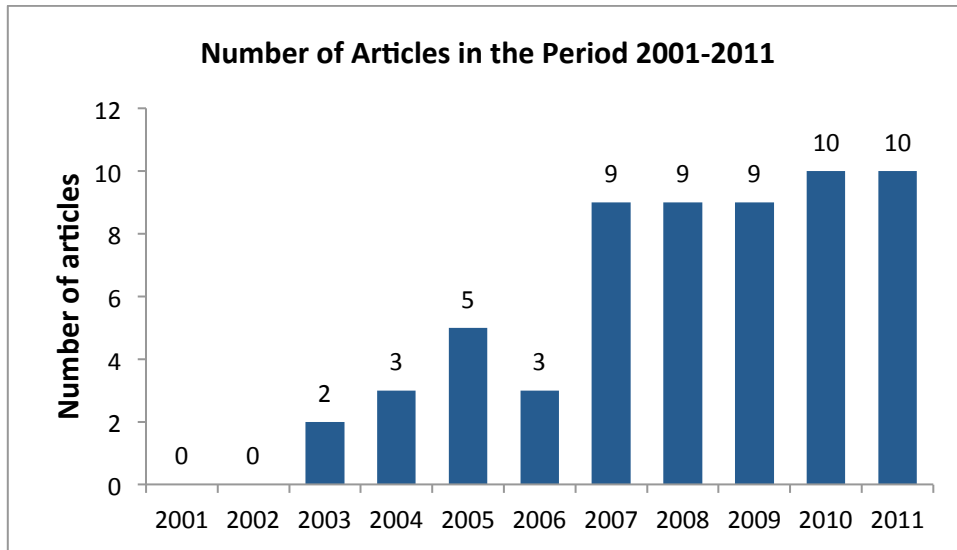
**Table 2:** Distribution of articles across different regions of Asia

<i>Database</i>	<i>ACM</i>	<i>Science Direct</i>	<i>Scopus</i>	<i>Web of Science</i>
Country	China ( 7 ) Japan ( 5 ) Taiwan ( 1 ) Korea ( 1 ) Malaysia ( 1 ) Turkey ( 1 )	Taiwan ( 4 ) China ( 3 ) Turkey ( 2 ) Oman ( 1 ) South Korea ( 1 ) Iran ( 1 ) Japan ( 1 )	Japan ( 7 ) China ( 7 ) South Korea ( 2 ) Taiwan ( 4 ) Malaysia ( 5 ) Jordan ( 2 ) Iran ( 2 ) Singapore ( 1 ) Turkey ( 1 ) Oman ( 1 )	Taiwan ( 9 ) South Korea ( 6 ) China ( 3 ) Malaysia ( 2 ) Turkey ( 2 ) Iran ( 2 ) Japan ( 1 ) Singapore ( 1 )
<b>Total = 86</b>	<b>16</b>	<b>13</b>	<b>31</b>	<b>26</b>

#### **4.1 The number of publications on website usability in Asia**

We wanted to look into the articles’ distribution in different repositories during the period 2001-2011. With an increase in internet users in Asia, we expected that the research in website usability would have grown every year during the period of interest. Figure 1 shows the trend in publication of the articles of interest in the decade investigated.

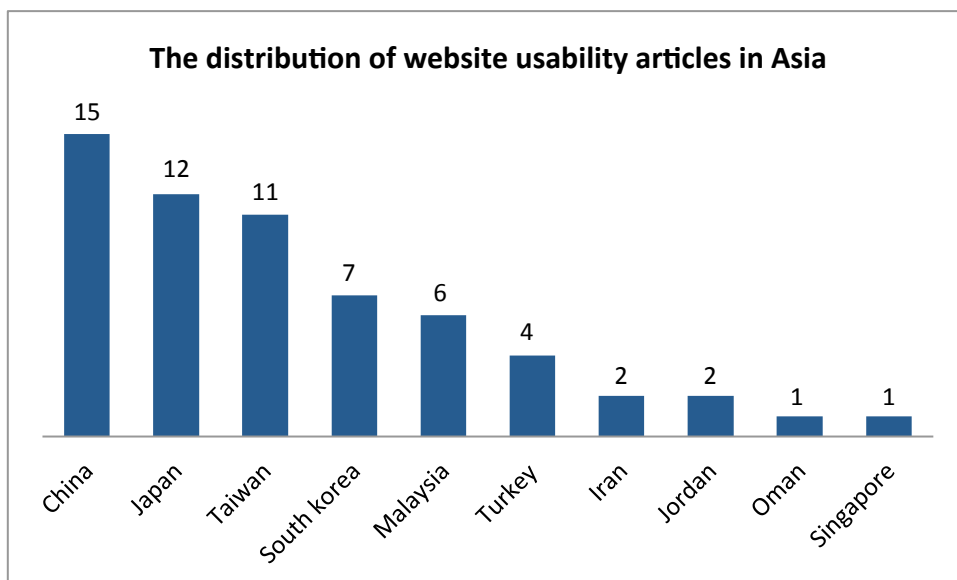
Figure 1 illustrates that, as expected, there was indeed a trend, with publications on “website usability in Asia” increasing during the investigated period of time. From the beginning of the period with 0-3 articles published per year, to 10 articles published per year at the end of the period. Figure 1 also shows that publications on “website usability in Asia” only began to appear from 2003.



**Figure 1.** The distribution of 60 “website usability in Asia” research articles in the period 2001-2011.

#### **4.2 The distribution of articles on Website Usability in Asia**

A majority of the research articles could be expected to come from China, Japan and India, due to the population size of those countries and their correspondingly greater number of academic researchers. Figure 2 shows the distribution of articles on website usability in Asia across different Asian countries. Figure 2 illustrates that a majority (25%, 15 of 60) of the “website usability in Asia” articles were from China (and Hong Kong), and nearly as many website usability articles were retrieved from Japan (20%, 12 of 60) and Taiwan (18%, 11 of 60). In contrast, little research on “website usability in Asia” has been conducted in Western Asia.



**Figure 2.** The distribution of the 60 articles on Website Usability in Asia across countries

### 4.3 The use of theories

From previous research it could be expected that the use of theories would be limited, and that cultural theories would be the most frequently used frameworks for studies of websites and usability in Asia. The first of these propositions turned out to be true - the use of theory was scarce in many of the investigated articles. A little more than half of the articles (61%, 37 of 60) mentioned any identifiable theory. In those cases, we read the paper to determine whether it could be characterized as a use of a particular theory or not. Table 3 shows the theories used in the articles. In this table and in the following, the letter *P* with a number refers to an article in the list of the 60 investigated articles in Appendix A.

The second proposition - that cultural theories would be the most frequently used frameworks for studies of websites and usability in Asia - was not true. Table 3 illustrates that despite the fact that the investigated articles were carefully selected to be about “website usability in Asia”, even among the articles that did mention theory, cultural theory was rarely used. The most frequently used theories were those related to behavioural intention (P7, P19, P37, P44, P48), learning (P6, P20, P23, P55, P4) and a number of different cognitively oriented theories such as mental workload, cognitive theories and cognitive aging theory (P13, P16, P22, P27, P47). Only a few articles (8%, 5 of 60) used cultural theories or globalization theories to conceptualise what was specific about “Asia”. Of the five cultural theory articles, four articles used Hofstede’s cultural dimensions.

**Table 3:** Theories used in articles on “website usability in Asia”

<i>Theories</i>			
Aesthetic	P34	Information Desire	P17
Ant colony optimization	P60	Information Foraging Theory	P11
Behavioural Intention	P7, P19, P37, P44, P48	Information Learning	P6, P20, P23, P55, P4
Cognitive Aging Theory	P13	Information Management	P5, P21
Cognitive Theory	P22, P27, P47	Mental workload	P16
Cultural Dimensions	P2, P8, P36, P56	Theory of Gestalt psychology	P3
Disconfirmation Theory	P22, P52	Theory of Globalisation	P10
Empirical law	P35	Trust	P39
Graph Theory	P31, P32	Visual	P15, P30, P33, P58

Another subset of the articles used website usability as the general framework of the study, without mentioning any specific theory. The use of website usability as a framework raises the issue of whether such papers should be classified as concerning theory, frameworks or a method of study. Table 4 shows the articles that used website usability as a framework, and also the different focuses within website usability (i.e., information navigation), if any.

Table 4 illustrates that the articles used website usability as a general theory/framework of study and did not emphasize any particular characteristic of website usability. For a few articles, the website usability framework appeared to have a focus on a particular issue. For example,

information navigation studies focused on navigation burden (P40), information retrieval and mining web structure (P41), evaluation of website metrics for navigation (P50) and general user interface navigation (P51).

**Table 4:** Articles using website usability as a framework theory

<i>Website usability as a framework theory</i>	
Active control	P24
Information Navigation	P40, P41, P42, P50, P51
Others	P12, P46, P49
Quality	P38
Website usability	P1, P9, P14, P18, P25, P26, P28, P29, P43, P45, P53 P54, P57, P59

Some articles were studies of usability evaluation methods (P27, P38, P41, P43, P59 and P60), rather than studies that used such usability methods to evaluate the websites or do other kinds of research. Thus, these articles did not clearly discuss any theory, but focused on methods and method development. The methods were rationalized, customized and presented as new methods, for example using new expression for the previous methods with addition of a step (i.e., Scenario based walkthrough: Colony meta-heuristic technique modified heuristic usability evaluation).

#### 4.4 The studied topics

We wanted to look into the topics that were studied most in the selected articles. We expected the studied topics to be usability evaluation methods and website design methods, and expected the findings to be analysed in terms of cultural theory. Table 6 shows the distribution of the studied topics across the 60 articles. It is clear from Table 6 that a usability analysis of a website was a common (43%, 26 of 60 articles) and accepted form of research into website usability in Asia.

**Table 6:** Studied Topics of the articles

<i>Studied Topics</i>	
Usability analysis of a website domain	P1, P2, P4, P6, P9, P10, P11, P12, P14, P14, P21, P22, P23, P25, P26, P28, P29, P31, P35, P44, P45, P46, P47, P52, P53, P55
Analysis and methods	P27, P38, P41, P43, P49, P50, P54, P59, P60
Asian users website evaluation	P36
Blind users experience	P32
Design solution for older adults	P13
Factors affects usability	P8, P18, P56
Interactive learning	P20
Information desire	P17
Mental stress	P16, P40, P51
Mobile networking	P19
Portal Information Management	P5
Trust	P34, P39, P48
Visual interfaces	P3, P30, P33, P58
Web mining	P7, P42, P57

The analysis and methods for website usability, second row in table 6, involved evaluation of websites through Latent Semantic Analysis (P27), ranking website pages (P31, P38), Markov Model based website measures (P41), scenario based walkthrough (P43), automatic evaluation metrics (P50), automatic data collection system for website usability (P59) and the Colony meta-

heuristic evaluation technique (P60). These studies represented a type of research that focussed on methods and techniques for evaluating websites, rather than the usability of the website itself. Visual interfaces were the single most studied explicit topic of website usability in Asia research. The visual interface research emphasized Gestalt-like perception measures (P3), factors affecting webpage perception (P30), iconic hyperlinks (P33) and gazing point of information (P58).

The articles that studied topics related to trust (P34, P39 and P48) emphasized trust development with the users of a website and how digital aesthetics plays a role in the process. The articles on trust further analysed users' intentions and shopping experiences and how they could be converted into purchasing intentions.

Moving on towards the studied topics of stress and its relationship with websites, three articles (P16, P40 and P51) emphasized the mental stress and navigational burdens of users when searching for information. Navigational burden and stress were analysed via metrics such as number of clicks, task efficiency and number of errors. All the studied topics that related to the mental stress of the users discussed the mental stress of search tasks and navigation and its relevance to the website usability. While the other topic of study focused on information purchase intention (P24, P37) and website usability. Web mining articles (P7, P42 and P57) focused on the efficiency and reliability of data for users.

#### 4.5 The website domains

We expected that the major genres of websites researched in the literature would be university websites, religious websites and government websites. This proposition turned out to be partly true, as there was a great variety in the studied website domains. Table 7 provides a list of domains that have been studied and gives examples of the focus of the articles in each particular domain of websites.

**Table 7:** Domains of websites in Articles

<i>Domain</i>		<i>Focus</i>
Academic websites	P3, P4, P6, P9, P14, P20, P28, P42, P50, P55, P59	Children service, usability evaluation, students learning
Databases	P12, P46	Information retrieval
E-commerce	P11, P17, P24, P33, P39, P48, P53, P56	Evaluation, trust, intention
E-government websites	P23, P25, P26, P45	Learning, e-services accessibility evaluation, performance
Industry websites	P8, P18	Perceived usability
Mobile websites	P19, P34	Mobile social networking, mobile commerce
Product and Services	P31, P36, P38, P43	E-services, company services, case study
Public Services	P5, P16, P47, P60	Community websites, public libraries
Tourism Websites	P10, P22, P29, P44, P52,	Navigation and evaluation, performance

	P54	and perception
Websites/systems	P30, P40, P41, P49, P51 P57, P58	Web applications, web systems, web base systems
Other domains	P1, P2, P7, P13, P15, P27, P32, P35, P37	Blogs, community based websites, adaptive websites, web systems, English learning websites, local websites, web based systems

From Table 7 we can see that the website domains studied included a broad variety of domains such as academic websites, e-government websites, e-portfolios, library websites and tourism websites. In terms of the number of studies, the academic domain and the tourism and e-commerce domains were the most studied.

Studies on academic website usability emphasized the enhancement of students' learning and of user experience for academic library websites. There was not much emphasis on healthcare and only two articles talked about healthcare websites and services. The e-commerce websites clearly focused more on trust, user purchase intention and the evaluation of e-commerce websites for end user satisfaction. For tourism and hotel research, studies from Hong Kong focused on tourism and hotel websites' usability. Within this, emphasis was placed on travellers' perceptions of the functionality of hotel websites as well as general usability. The e-portfolio and e-services studies stressed databases and information retrieval. E-government website studies emphasized evaluation of the quality of government websites their accessibility. The studies also discussed the enhancement of learning opportunities though e-government websites. E-commerce (19%, 5 of 27) and academic websites (19%, 4 of 27) was the second and third most studied domains. The other studies focused on usability of websites for the elderly and customer loyalty.

From previous research it was expected that a significant number of articles would focus on the usability of religious websites, particularly in articles from Muslim majority countries (that is, Pakistan, Indonesia, Oman, and Saudi Arabia) and with large Muslim populations (India). We expected this because religion is an important part of the social system and structure in these countries. However, of the 60 articles investigated here only one study (P2) analyzed religion as a variable in any depth. Thus there was not a significant body of articles related to religious identity and evaluation of religious websites. For studies of the topic that are located outside the articles discussed here, see (Al-shamaileh et al., 2011; Murni & Abu Osman, 2011).

#### **4.6 The focus on cultural markers**

We expected that a large proportion of the articles would focus on cultural markers, as it had been shown that users from different cultures preferred different modes of cultural markers (Sun, 2001). There were a number of studies that looked into the issue of cultural markers (11%, 7 of 60) in different cultures. Some of the studies found significant differences in website usability when culturally appropriate markers were used, while other studies were less definite, suggesting that cultural markers were "possibly preferred" in a particular culture. The studies of cultural markers emphasized language issues (P2), perception and animation (P3, P22), fonts (P15), icons and



images (P33, P56) and information design (P36). The studies of cultural markers emphasized that better cultural marker results increased the usability of web pages and reduced the complexity and mental load of users. However most of the studies did not emphasize the analysis of icon, images, fonts, etc., despite these feature being considered major points of interest in cultural markers theory. The research methods used in the articles

It could be expected that the investigated studies would tend toward more conventional quantitative methods (for example questionnaires), rather than qualitative methods (for example open interviews). This proposition was true, as the analysis of the 60 articles showed that a large proportion of the articles (65%, 39 of 60) applied quantitative methods when conducting their studies of website usability. Few studies (12%, 7 of 60) leveraged qualitative methods. A further few articles (16%, 10 of 60) used a mixed methods approach (Creswell, 2009). While other articles emphasized methods and theory, some articles (8%, 5 of 60) directly expounded a model and framework for website usability.

Besides looking at the quantitative/qualitative distinction, one way to characterise a body of research is to divide articles according to whether they are mainly theoretical research, field studies, experiments, ethnographical observations, interviews, surveys or other types. For the set of articles about studied here, it turned out that a large proportion (46%, 28 of 60) concerned experimental research. The activities in the experiments with website usability involved measuring task performance, assessing web pages according to Likert scales after task, testing iconic identifiability (P33), information seeking tasks (P9, P11, P24, P37, P47), and time and click counts for tasks (P27, P47, P51, P58).

Another section of the studies used surveys (20%, 12 of 60) to understand Asian users' perceptions of website usability. Questionnaires were posted on the websites or collected individually from users of the websites. The survey articles also included those articles that examined a list of websites and selected a sample of websites for usability evaluation in a particular domain. Ethnographic studies and interviews were least used, with only three articles using interviews for website evaluation (P19, P29, and P30).

#### **4.7 The user representation**

In any usability study, it is important to recruit users who are representative of the population and area of study. It could thus be expected that study participants in the investigated articles would represent the domains for which the usability studies were conducted. We expected that a reasonable number of studies would have rural users as study participants. The reason for this was because governments and organizations in many Asian countries are trying to provide services not only to urban communities but also to the substantial population that lives in rural areas. However, in the investigated articles, there were no studies with rural users as the participants, and there were no studies of websites in rural settings. A majority of the studies (62%, 18 of 29) used college and university students and lecturers for data collection. The students' type and characteristics varied in some studies. Two of the studies used blind students (P16, P32), one study used 5<sup>th</sup> grade students (P47) and two studies used college students (P20, P24). Some studies (14%, 4 of 29) did not

provide sufficient details to determine the nature of the subjects of the study. The remaining articles (24%, 7 of 29), which did not use students, used participants that were appropriate to their case studies: hotel guests and travel industry professionals (P29), IT/IS professionals (P35, P56), mobile users (P19, P34), senior citizens (P13), and usability professionals (P36).

In the investigated articles, the variation depended on the domain of research and experimental design and activities. The results showed that academic websites were studied many times in the usability studies of a single domain of website, but the ratio of university students was higher than the ratio of academic websites as domain. The use of representative user groups was lower in other domains of websites.

The number of participants for experiments varied from 3 to 54 participants (P13, P16, P19, P21, P22, P24, P30, P32, P33, P36, P47 P56, P58, and P59). Articles using survey data recruited between 77 and 250 participants (P20, P23, P29, P34, P37, P39, P44, P48). Two of the studies (P16, P32) used blind users (3 and 6 users) in their experiments. Three users were used to test a navigational tool by asking them to find information on the company website (P58).

## **5 Discussion**

The analysis of the selected 60 articles on website usability in Asia published between 2001 and 2011 showed an increase in publishing on website usability topics. While it is not possible to conclude on the weak tendency, increasing research on HCI in Asia published by researchers within the region, may help to assess if in fact usability is not universal (Frandsen-Thorlacius et al., 2009) and whether the culturally-embedded meaning of objects has been insufficiently explained by current theories of website usability (Smith & Yetim, 2004). In the following we discuss the key findings from our analysis.

### ***5.1 Which countries produced HCI research on website usability in Asia?***

A large part of the articles on website usability in Asia originated in China, Japan, Malaysia and Taiwan, while a fewer articles retrieved from South Korea, and Malaysia. Somewhat surprisingly, despite a significant and promising ICT industry in India (Smith, Joshi et al. 2007), there were not many articles identified from that country. When research on website usability is compared to website usability research in general another picture emerges. Table 8 shows the top five countries producing website usability articles in Asia relative to website usability papers in general. Clearly, much research on website usability is conducted in the United States. Whereas China and Japan are top research locations for website usability in Asia, they do not feature in the top five locations for website usability research in general.

**Table 8:** A comparison of articles on *website usability* in Asia with the general spread of articles in Scopus 2001-2011

<i>Asia</i>	<i>Proportion</i>	<i>In General</i>	<i>Proportion</i>
China	7 of 31 or 22%	United States	86 of 289 or 30%
Japan	7 of 31 or 22%	United Kingdom	23 of 289 or 8%
Malaysia	5 of 31 or 16%	Spain	19 of 289 or 7%
Taiwan	4 of 31 or 12%	Canada	17 of 289 or 6%
Malaysia, South Korea, Jordan, Iran	2 of 31 or 6%	Australia	13 of 289 or 5%

## 5.2 Religious websites as a research topic

While we were excited about the possibility of identify a body of research on religion and websites in Asia, the analysis in this article revealed only one study analyzing religion in any depth. The propositions relied on recent research on the use of websites for religious purposes in particular in Muslim majority countries (Murni & Abu Osman, 2011). However, it has also been suggested that people that belong to other religious groups, for example Christians, with strong religious feelings may have needs that require new definitions and extensions of existing website usability concepts (Al-shamaileh et al., 2011). For example, their concept of usability may focus more on content and authenticity. We would therefore still expect to see future studies with focus on religious websites and religious domain, both within and outside Asia.

## 5.3 Who and Where

The findings in this paper show that undergraduate and graduate students are commonly recruited for studies of website usability in Asia. While using Hofstede's and similar cultural theories as a frame of reference which outlines that culture is carried around by the individuals' minds, rather than emerging from practice in context. In this sense, it can be argued that it is acceptable to recruit university students as representative of their larger national culture as research shows that users are different in different cultures (Day & Evers, 2001; Callahan, 2005; Marcus & Hamoodi, 2009). In some cultures users prefer the reading which has a fundamental of reading from right to left while others always read which has fundamental of reading from left to right. Thus it can be argued if a design fits with a local group of students, it will also fit with other people from same society, ethnic group and country (Isa et al., 2009), that is, that there can be a 'cultural fit' (Clemmensen, 2011). However, in the investigated articles, there were no studies with rural users as the participants, and there were no studies of websites in rural settings. Thus only one category of users was considered across Asian countries.

In contrast to the strong focus on only one kind of user, the finding of this study was that a broad variety of domains were studied, particularly academic websites, e-government websites, e-portfolios, library websites and tourism websites (with academic websites being the most frequent). Due to the focus of the study on website usability, half of the articles consisted of usability analyses

of websites. Thus it appears that it may be sufficient as a start to use students for study, given the substantial differences in language usage between different cultures and their implications for the understanding of usability of websites.

Participants clearly play a critical role in the results of any study. However, the issue of researcher perspective, background and potential bias should not be ignored. Relative to culture, this contextual influence of the researchers and usability evaluators on the results of studies has been shown to be even greater in context-dependent China, compared to context-independent Denmark (Shi, 2010).

#### **5.4 Coding, analysis and interpretation of data**

Studies of cultural markers provided an impression that understanding cultural markers in a culture can help in implementing it for a similar audience. However, implementing cultural markers for similar user groups in another culture may not be a very good way to approach the issue. Instead, the representations associated with a culture such as the use of a certain set of colours, fonts, and information design should be identified, applied and tested with a representative audience before any generalisations are made.

Authors mention cultural markers as being of key interest to website usability studies in Asia. The further discovery in the results above shows that typographical attributes of cultural markers are considered central to this. In cultural markers studies, typographical guidelines used for presenting the English alphabet cannot be applied directly to Asian languages such as Korean characters (Hangul), for instance.

On the other hand, studies of cultural markers focused on users' preferences of pictures, icons, shapes, colours, texts and tones to judge whether the site targets users or not. This is critical for designers to consider when looking for standardized icons that convey a similar meaning across locations and cultures. Crucially, they should also consider meanings that the icons may convey to user groups others than the target audience.

In this study we did not find, contrary to our propositions, that most studies used Hofstede's cultural dimensions to conceptualize what is "Asia-specific" for website usability. This may be because Hofstede's model of national culture – which assumes that cultural differences are in some way aligned with the territorial boundaries of the nation state – is problematic in various aspects (Myers & Tan, 2003). Other approaches have been proposed that focus more on empirical data collection in order to define a concept of cultural usability (Clemmensen, 2011) or that focus on cultural value criteria (Kurosu, 2008). This study found that many cognitive and psychological theories were used to study website usability in Asia, though these theories hardly could be categorized as cultural theories.

#### **5.5 Are there topical gaps in website usability research in Asia?**

In order to identify gaps in the literature, our findings on website usability in Asia can be compared to similar findings from Europe. We conducted an additional review of the studied domains in

European countries. This overview helped us to understand the studied domains in developed countries and to compare it with studied domains in Asian countries. The keyword ‘website usability’ was used in the ‘Scopus’ database. We used ‘Scopus’ for an overview because ‘Scopus’ returned a maximal number of articles. A total of 27 articles were published between 2001 and 2011 in European countries such as Switzerland, US, Germany, Austria. Some of the studied articles (26%, 7 of 27) in developed countries focused on the healthcare domain. Topics of articles in this domain focused on the usability of medicine websites, brain injury rehabilitation service websites, health promotion websites, surgery program websites and nutrition websites. In contrast, in Asia the studies concerned different domains of interest, such as tourism, and different topics of study, such as mental stress. In summary, the website usability research in Asia does not suffer from gaps, but rather emphasizes different topics compared to website usability research in Europe.

## **5.6 Overview of articles with English Summary**

The articles analyzed in this paper were only selected if they were written and published in English. However, due to the nature of diverse culture and multi-lingual society in the context of Asia, some relevant and related website usability studies may well have been published in local Asian language publications (e.g. Chinese, Japanese, Korean). It is thus a limitation of this study that we only examined English-language articles. To test this, we performed a search on website usability in Chinese-language journals and looked for articles with an English summary. The articles were mainly written in Chinese. Seven papers (see appendix A) were identified by a research assistant from the Chinese academy of Science as good examples of Chinese-language research on website usability and several of the papers were indeed about Asia-specific topics. One paper was about social network groups from an ‘Otaku’ (excessive fan behaviour) perspective (Li & Yin, 2011). Another compared the search effectiveness of Google and Baidu which is Chinese search engine, and found that Google was better in content accuracy while worse in contents accessibility and overall less effective for searches. There were also significant differences between the two search engines in user experience patterns. Users’ perception of the effectiveness of Google was mainly derived from content accuracy; while their effectiveness perception of Baidu was derived from both accuracy and accessibility (Liuzi et al., 2010). A third paper was a design method paper that proposed “the clicking read with mouse” as a new website user experience evaluation method combining “thinking aloud” with “point reading” (Zhang, 2011). The other four papers were about general user experience: digital network designers’ duty to think beyond the design of the interface itself and to rethink the meaning of design when doing website design (Ni, 2008), user experience design with web design as an example (He & Liu, 2010), applying Maslow's hierarchy of needs to HCI to argue that web design may satisfy users' experience requirement at a higher level (Wei & Gong, 2011), and arguing that user experience design should focus on users' cognition using Donald Norman’s model (Li, 2010). It remains difficult, however, to select many articles from other languages with an English summary, because in order to perform a decent review, we would have to be able to read not only the abstract, but also the entire contents of the article.

## **5.7 Limitations**

In this work, we used the two key words ‘website’ and ‘usability’ to search in academic databases of literature. We did not consider those articles that used different key words to address website usability (including typographical differences such as ‘web site’ and ‘web-site’). We also did not consider using broader terms that imply the use of the web, such as e-commerce, or e-government. Another approach we could have used was to also use the names of specific countries. A script could have been written to search for appropriate papers, which contained the names of the country and also the word “usability” and “web” or “website”. However, using more than one keyword would return many articles which were not directly relevant to the study

Finally, a possible contributing factor to the lack of articles dealing with religious aspects of website usability in Asia could be that the keywords used when searching the academic databases did not directly focus on religious websites or religious users.

## **6 CONCLUSION**

The study presented here indicates that the number of publications on website usability in Asia has increased in the studied period of 2001 to 2011. This suggests an increasing interest among researchers in website usability in Asia. There were several gaps in the literature. Website usability research in domain of healthcare was limited, for instance, and few studies employed qualitative measures in their evaluations. The propositions that China would be a major source of research held true. The result of the review showed that much of the research work on website usability in Asia was conducted in Japan, Taiwan and China. In contrast, little work had been conducted in Western Asia. Quantitative methods were preferred to examine website usability, although some studies used both qualitative and quantitative approaches to measuring website usability and focused on user involvement. The focus of website usability for tourism websites was one surprising finding in this literature review. Many of the articles focused on website usability of a single domain of websites. The articles did not use Hofstede too frequently. On the contrary, there were more cognitive and psychological theories used to study website usability in Asia, rather than cultural theories. In general, the use of theory was limited in the articles. Although there is an increasing focus across the globe on the creation of indigenous and local language content, there is not much indication towards localisation of contents.

### **6.1 Implications**

This research adds to the small but important research literature in HCI on website usability in Asia by providing an overview of the current state of the literature in Asia. The implication for a theory of “website usability in Asia” is that the existing theories for website usability should be augmented and re-interpreted in the Asian context. As a first step, we recommend that authors of research papers explicitly state which theories they use to study their topic, as this information was frequently missing. Furthermore, the study of website usability in Asia should take into account

which website domains have been examined, and perhaps expand this to include not only government and academic websites as there are certainly under-explored areas.

Future literature reviews of this subject may include conference papers in all databases to better understand the diverse nature of research on website usability research in Asia. Practitioners may learn from this study that there is in fact an emerging and growing literature on website usability in Asia, and that at least some of this literature deals with Asia-specific issues of website usability.

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## APPENDIX A

**Table A1:** List of articles used for analysis

<i>Code</i>	<i>Article</i>
P1	Morita, T., Narimatsu, H., Matsumura, T., Kodama, Y., Hori, A., Kishi, Y., Kami, M. (2007). A study of cancer information for cancer patients on the internet. <i>International Journal of Clinical Oncology</i> , 12(6), 440-447.
P2	Talukder, M., & Yeow, P. H. P. (2007). A comparative study of virtual communities in Bangladesh and the USA. <i>Journal of Computer Information Systems</i> , 47(4), 82-90.
P3	Hsiao, S. W., & Chou, J. R. (2006). A Gestalt-like perceptual measure for home page design using a fuzzy entropy approach. <i>International Journal of Human-Computer Studies</i> , 64(2), 137-156.
P4	Genc, Z., & Tinmaz, H. (2010). A reflection of preservice teachers on e-portfolio assessment. <i>Procedia - Social and Behavioral Sciences</i> , 9(0), 1504-1508.
P5	Noh, Y. (2011). A study on metadata elements for web-based reference resources system developed through usability testing. <i>Library Hi Tech</i> , 29(2), 242-265.
P6	Kanazawa, M., & Maruyama, Y. (2008). An evaluation of public library websites: Describing children's services in Japan. <i>Public Library Quarterly</i> , 27(4), 291-310.
P7	Lee, J.-H., & Shiu, W.K. (2004). An adaptive website system to improve efficiency with web mining techniques. <i>Advanced Engineering Informatics</i> , 18(3), 129-142.
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## APPENDIX B

**Table B1:** List of Chinese articles used for analysis

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<i>Code</i>	<i>Article</i>
C1	He, J. and G. Liu (2010). "The Importance and Basic Method of User Experience: On the Usage Case of Web Design." <i>Art and Design</i> 3: 176-178.
C2	Li, H.-f. and J. Yin (2011). "Social Network User Experience from the Otaku Culture Perspective." <i>Packaging Engineering</i> 32(24): 113-116.
C3	Li, X.-q. (2010). "User Experience Design Based on User Mental Research." <i>Information Technology</i> 28(5): 763-767.
C4	Liuzi, H., F. Zhang, et al. (2010). "Comparative study on search effectiveness of Google and Baidu based on user experience. ." <i>Journal of Zhejiang University(Science Edition)</i> 37(5): 605-610.
C5	Ni, L. (2008). "The Duties of Web UI Design." <i>Art and Design</i> 5: 24-25.
C6	Wei, W. and X. Gong (2011). "HCI develop trend based on user-experience. ." <i>Journal of Beijing University of Aeronautics and Astronautics</i> 37(7): 868-871.
C7	Zhang, Q. (2011). "The Clicking Read with Mouse, A New Method of Web-site User Experience Evaluation." <i>Art and Design</i> 86: 72-74.

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### Author Biographies.

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Ather Nawaz is a user experience (UX) researcher and usability expert with an interest to look into users side of information systems. He is currently a Ph.D. student in the Department of IT Management, Copenhagen Business School, Denmark. His research interests include websites information structure, Usability and User experience (UX) reserach, Informaiton classification and methods for evaluation of web information structures.

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Torkil Clemmensen is a Professor in the Department of IT Management, Copenhagen Business School, Denmark. He has more than 20 years of academic and industrial experience with human-centered methods and techniques for analysis, design, and evaluation of information and communication technology and digital media and how these are designed and used in organizational, human, social and cultural context.

## **Appendix 1b: Research Article 2**

### **Information Classification on University Websites: A Two-Country Card Sort Study.**

**Nawaz, A.,** Clemmensen, T., and Hertzum, M. (2011). Information Classification on University Websites: A Two-Country Card Sort Study. In J. Molka-Danielsen and K. K. Kimppa (eds.), Selected Papers of the Information Systems Research Seminar in Scandinavia 2011, pp. 109-122. Tapir Academic Press, Trondheim, NO.

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# Information Classification on University Websites: A Two-Country Card Sort Study

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**Abstract.** Websites are increasingly used as a medium for providing information to university students. The quality of a university website depends on how well the students' information classification fits with the structure of the information on the website. This paper investigates the information classification of 14 Danish and 14 Pakistani students and compares it with the information classification of their university website. Brainstorming, card sorting, and task exploration activities were used to discover similarities and differences in the participating students' classification of website information and their ability to navigate the websites. The results of the study indicate group differences in user classification and related task-performance differences. The main implications of the study are that (a) the edit distance appears a useful measure in cross-country HCI research and practice and (b) the comparative approach of thematic and taxonomic analysis can be used to understand classification and website structure.

**Keywords:** website structure, information architecture, classification, categorization, card sorting

## 1 Introduction

It is often a challenge to retrieve information from large complex websites such as university websites. The challenge may, however, not be the same in different countries. A central issue in good website design is the classification of the information on the website (Dumais & Chen, 2000; Lakoff, 1990; Parsons & Wand, 2008). If the website information is classified in a manner that fits well with the user's perception of the topics, then information retrieval on the website is efficient, and may even be experienced as satisfying (Bernard, 2000; Cole et al., 2007). Most of the cross-cultural studies of websites have focused on the usability, language biases, and structure of Asian and Western websites. Little work appears to have been done investigating the structure of the websites in communities that have recently joined the global

Internet community (ElSaid & Hone, 2004). In this study we compare two websites – a Danish university website and a Pakistani university website – to investigate differences in their structure, and whether these differences match the way in which the local users of the websites classify information.

In existing website studies, the content holders are usually seen as the ones who determine how the information is structured (Bachiochi et al., 1997). It is, however, well-known that designers' decisions about the structure of a system may not match how users think about the system (Norman, 1986). This problem intensifies in cross-cultural settings where designers with one cultural background make websites for users with another cultural background. Two ways of improving our understanding of the interrelation between cultural background and website structure are to (a) compare across countries the structure of websites developed and used locally and (b) study how well the structure of such websites matches the way in which the target users classify the information that is accessible on the website. In this study we do both, by having Danish and Pakistani university students make card sorts of the information on their respective university websites and find information on the websites. We chose university websites as our object of study because university websites in different countries must provide support for a similar set of activities (e.g., information about available study programmes, about class schedules for current courses, and about access to resources such as libraries). We chose Danish and Pakistani university websites for this study because there are sizeable cultural differences between these two countries and because website structure and use in Pakistan has not received much research attention.

In the next section we describe literature relevant to the classification of information, particularly website information. Then, we explain the method of our empirical work, which comprises brainstorming, card sorting, and information-retrieval tasks, and we present our results. Finally, we discuss implications of the results and possible extensions of this study.

## **2 Relevant Literature**

### **2.1 Information Classification**

In website design, the classification determines how information is distributed across different hierarchical levels of website pages and what labelling is used to group information on a webpage. Websites use different classification and navigation structures such as linear, tree, network, and global structures (Broughton, 2001; Morville & Rosenfeld, 2006). Barber and Badre (1998) identified the localized elements of an interface (i.e., the elements specific to a given culture) and termed them cultural markers. But cultural markers emphasize only the interface elements that are preferred within a particular cultural group and do not talk about the classification of the website information. Different countries may display profound differences in the structure of website information. The research of Isa et al. (2008) explored the relationship between culture and website structure. The study found that users have their own understanding of the structure of the information on a website, and that this understanding differs across groups of users.

The placement of information at different levels of a website affects its findability. Allen (1983) investigated the effect of information depth on the response time and error rate at each hierarchical level of a website. Response times became longer for searches deeper into the

website, and the study participants made more errors when the information to be retrieved were at deeper levels (Allen, 1983). Researchers have compared the knowledge representation of students in US, mainland China, and Taiwan on four websites (Rau et al., 2004). For participants from Taiwan and mainland China, the study showed advantages of a thematic structure with respect to error rate on information-retrieval tasks. The research of Kralisch et al. (2006) investigated the impact of culture, language, and medical knowledge on users' information categorization. The study found that culture influences the users' preferences in information categorization, their attitudes, and their behaviour, whereas language predominantly affects the users' beliefs about ease of use and usefulness. On the basis of a large data set about national cultural differences, Hofstede (1980) has developed the concept of cultural dimensions.

## 2.2 Mental Models and Website Structure

A mental model is a cognitive structure of concepts and procedures that users apply when selecting the relevant goals, choosing and executing appropriate actions, and understanding what happens when they interact with a computer system (Carroll, 2003). The concepts of classification and categorization are used interchangeably in the literature on human-computer interaction (HCI), information management, and information systems. A classification is a clustering of information that shares a common property (Bowker & Star, 2000; Lakoff, 1990). It is a set of metaphorical boxes that contain information with common themes (Lakoff, 1990). In addition to information classification and navigation on websites, culture is an important aspect of website structure. In this study we explain culture as information-classification tendencies shared by a particular group of people with the same nationality, and we describe their mental model using card sorting.

Figure 1 presents a more complex example that is closer to a website structure. Figure 1(a) is a thematic classification of items into three groups. The items in each group of the thematic classification are related to each other and can be explained without the group names '*football*', '*cricket*', and '*swimming*'. The classified items in the thematic classification have a coherent story of the situation for each group. Figure 1(b) is a taxonomic classification with seven groups. The items in each group of the taxonomic classification are related to each other through higher levels of abstraction. It also explains that classified items in a group inherit properties from the group name.

## 2.3 Thematic and Taxonomic Classification

Different users may prefer different classifications of the information on a website. Specifically, a user may classify the information items in a thematic or taxonomic way. A thematic structure classifies items into groups according to themes, each of which includes all the elements that relate to the name of the group. The items in a thematic classification are related to each other through a coherent story or situation. In a thematic classification of banana, monkey and panda, the two items banana and monkey go together. Banana and monkey provide a thematic classification based on eating habits and a coherent story of the situation that monkey eats banana.

A taxonomic structure classifies items into groups according to the function or inferences drawn from the items in the group. The study of Rau et al. (2004) used the notion of 'functional' to explain taxonomic classification. The items are related to each other through

higher level abstraction, the names of the groups. In a taxonomic classification of panda monkey and bannana, panda and monkey are grouped together because they are similar at a higher level of abstraction, whereas banana belongs in another group. The higher level of abstraction common to panda and monkey is that they are both mammals.

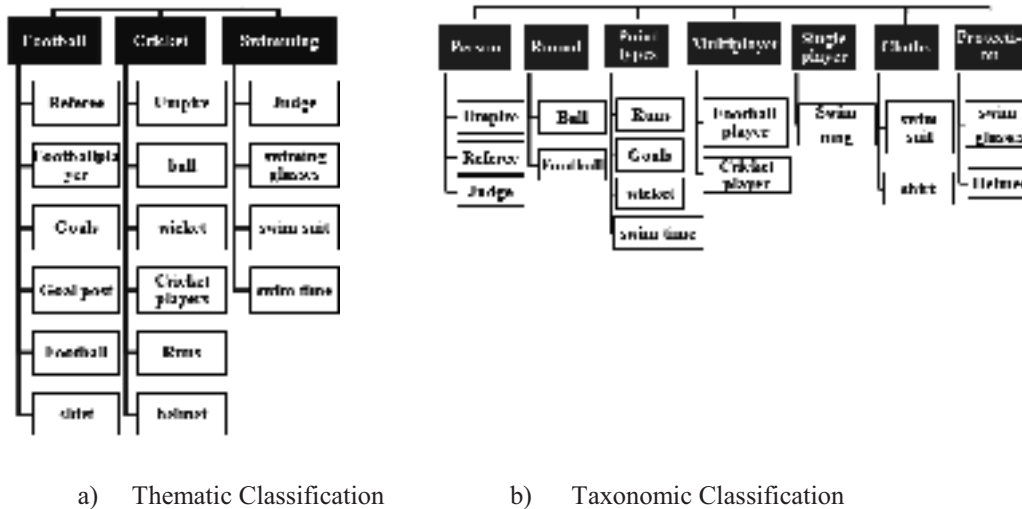


Figure 1: Classification structure of Thematic and Taxonomic Classification

Smiley and Brown (1979) examined people’s conceptual preference and found that young and old individuals preferred thematic classification while school age and college adults preferred taxonomic classification (Smiley & Brown, 1979). Rau et al. (2004) explained classification from the example that cleaning liquids such as dishwash liquid, bathtub cleaner, toilet bowl cleaner and detergent are usually grouped together as cleaning products in supermarkets, because of their cleaning function – a taxonomic classification. These cleaning liquids are not grouped together according to a thematic relation. In a thematic classification, dishwash liquid would be grouped with other kitchen items according to their use-situation relations.

### 3 Method

In order to investigate the match between the structure of university websites and their users’ classification of the information accessible on the websites, we performed a card-sorting study with students from two universities. A cross-case analysis (Yin, 2003) was performed of the two university websites. The study was conducted in the usability laboratory at the University of Management and Technology (UMT) in Lahore, Pakistan, and the usability laboratory at Copenhagen Business School (CBS) in Copenhagen, Denmark.

#### 3.1 Card sorting

Card sorting is a technique aligned with Kelly’s personal construct theory (Kelly, 1991). It assumes that people make sense of the world through classification and that people can describe their own classification of the world with reasonable validity and reliability (Kelly, 1991; Rugg & McGeorge, 1997). Card sorting provides an insight into how users classify

information and, thereby, how they construe their world, illuminating the otherwise often tacit ways in which they group, sort, and label information and objects (Deibel & Anderson, 2005; Donna Spencer, 2009; Rugg & McGeorge, 1997). The general idea of card sorting is to ask participants in interviews or workshops to sort labelled paper cards into piles. The analyst then compares the different participants' sorting of the cards. Card sorting has been used in multiple studies of knowledge organization and information classification. For example, Chen and Occenã (1999) used card sorting to investigate domain experts' ways of organizing their knowledge. Martine and Rugg (2005) measured the perceived similarity of webpages using card sorting, and McLaughlin and Mandin (2002) used card sorting to assess the clinical curriculum and medical students' knowledge organization.

### 3.2 Participants

A total of 14 Danish university students at CBS and 14 Pakistani university students at UMT participated in the study. Nielsen (2004) reports that for practical purposes approximately 15 users are enough to reach a correlation of 0.90 in a card sort but recommends twice as many for a big project.

To recruit participants, a message was posted on a Facebook page of the university. The message contained a link to a document that explained the purpose of the study, the criteria for participation, and the activities and duration of the experiment. The message and document were posted in English and in the local language (Danish in Denmark and Urdu in Pakistan). In Denmark, we also applied snowball sampling by asking each recruited participant to point out a possible future participant among their acquaintances. We required that all participants should be 20-35 years of age, hold citizenship in the country, be residents of the country, have been born and raised in their country, have attended primary school in the country, and have lived in their country for most of their lives but they may have been abroad for part of their later education. We aimed for an equal number of male and female participants. All participants should have at least 5 years of experience using computers and the Internet. We excluded participants with experience as software or hardware developers – including analysts, designers, programmers, and testers.

<i>N</i> = 28	<i>Danish</i>	<i>Pakistani</i>
Years of age ( <i>M</i> ± <i>SD</i> )	22.6 ± 1.3	21.3 ± 3.3
Number of study years ( <i>M</i> ± <i>SD</i> )	16.1 ± 0.9	15.0 ± 1.7
University-website use in minutes/week ( <i>M</i> + <i>SD</i> )	108.2 + 131.6	12.2 + 11.1
Male (%)	50	50
Female (%)	50	50

Table 1: Participants' demographics

Table 1 shows demographic information about the participants. There was no age difference between Danish and Pakistani participants,  $t(26) = 1.34$ ,  $p = 0.2$ , but a significant difference in number of years of study,  $t(26) = 2.07$ ,  $p < 0.05$ . There was also a significant difference in weekly use of the university website,  $t(26) = 2.7$ ,  $p < 0.05$ . The Pakistani participants explained in interviews that they mainly used other sources for information about their university. We attained a balanced gender distribution in both groups.

### 3.3 Procedure

All the sessions were conducted individually. The participants were welcomed in the usability lab and signed an informed consent form. Then, the test leader introduced the participants to card sorting, and asked them to fill in a questionnaire with questions about their age, study years, internet use, and time spent on the university website during the last week. The experimental part of the sessions comprised three activities, to be described below: brainstorming, card sorting, and information retrieval. Each participant received a gift voucher of DKK 200.

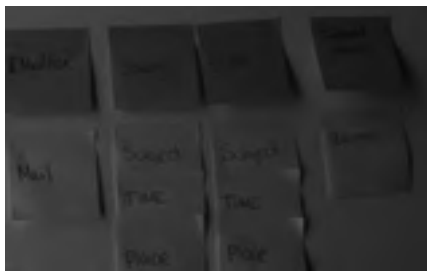
#### 3.3.1 Brainstorming

Once the participants had filled in the questionnaire, they were provided with a set of 5×5 cm blank index cards in two colours. Participants were asked to indicate elements of website content on cards of one colour and names of groups of website content on cards of the other colour. And, participants were asked to sort their element cards into the groups defined by their group cards in such a way as to create a site map for a university website. The participants were told that they did not necessarily have to make a grouping similar to that of their own university website. As recommended in previous studies, participants were requested to justify the created website structure orally (Medin, et al., 1997; Ross, 2004). The intension of this brainstorming activity was to elicit the participants' understanding of what information to include on a university website and how to structure it. Participants were provided 15 minutes for this brainstorming activity.

#### 3.3.2 Card sorting

For the card sort, the participants were provided with 50 index cards. They were also provided with six category names, each representing a page on their local university website ( <http://uk.cbs.dk/>, <https://e-campus.dk/> for Copenhagen Business School, and <http://www.umt.edu.pk/> for University of Management and Technology). The Danish and Pakistani participants received separate sets of cards.

a) Brainstorming



b) Card sorting

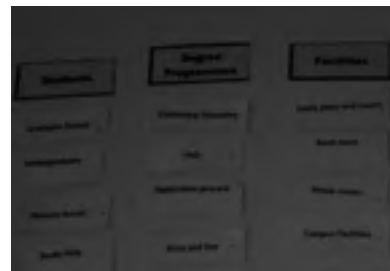


Figure2: Part of the brainstorming and card-sorting data

The selection of web pages for the cards was made by two researchers. Both sets of 50 cards were in English because both university websites were in English. We used a semi-closed card sort, in which participants begin with predefined cards and groups but are allowed to rename groups, add new groups, and remove groups (Geven et al., 2008; Lewis & Hepburn, 2010). The participants were asked to sort the cards into groups that constituted what they

would consider a natural classification of the website content. Participants were provided 15 minutes for this activity. Figure 2 shows data from the brainstorming and card sorting.

### 3.3.3 Information-retrieval tasks

The participants were asked to solve five information-retrieval tasks on the website of their local university. The tasks concerned information the participants might need to retrieve from the website. As an example, one of the tasks was: *Please find the contact information of the person/secretary who can provide you further information about Hostels. Please notify the instructor when you finish.* Due to the differences between the Danish and Pakistani websites, Danish and Pakistani participants received tasks that were pair-wise similar, but not identical. Participants were provided three minutes for each task. The university websites of CBS and UMT (Figure 3) were selected for use in this study because we had full access to these sites and because they were considered representative for the class of university websites in the respective regions.

## 3.4 Data Analysis

The *brainstorming* data were analyzed by characterizing the type of classification that was present in the categories and subcategories created by the participants. Three independent coders (i.e., the authors) analyzed the brainstorming data by coding each group as *thematic* categorization, *taxonomic* categorization, or *other*. The coders first coded about one fifth of the data as an individual training exercise and then collectively discussed their codings. As a result of the training it was decided that when participants made multi-level groups that involved *taxonomic* classification at one level and *thematic* classification at another then that group was coded as *other*. Then the coders individually coded the remaining brainstorming data. Table 2 shows the pair-wise agreement between the coders and the kappa values (a statistical measure of the interrater agreement of categorical items). The kappa values are fairly moderate, according to the interpretation given by Landis and Koch (1977). The agreement varies between 59 and 68 percent with the kappa value varying between 0.39 and 0.52.

To analyze the *card sort* data we calculated, for each participant, the distance between the structure of the information on the website and the participant's classification of the information as represented in the participant's card sort. The distance between two classifications is the number of disagreements between them. That is, a distance of one means that a single card is placed differently by a participant compared to how the information is structured on the university website (Deibel & Anderson, 2005; Nawaz & Clemmensen, 2007). This resulted in an average distance between the Danish university website and the Danish participants' card sorts and an average distance between the Pakistani university website and the Pakistani participants' card sorts. We also calculated the average distance between all pairs of Danish participants' card sorts and the average distance between all pairs of Pakistani participants' card sorts. To calculate the distances, we used the UW Card Sort Analyzer (<http://www.cs.washington.edu/research/edtech/CardSorts/>).

The data from the *information-retrieval tasks* were analyzed by determining how long participants took to answer the tasks and how many tasks participants answered correctly. Tasks not solved within the allocated three minutes were treated as incorrect.

a) University website in Denmark



b) University website in Pakistan



Figure 3: Screenshots of the two university websites

The answers to the information-retrieval tasks were at different depths in the website structure. That is, the answers were a different number of mouse clicks away from the position at which participants started solving each task. The depth was determined for each task and labelled low, medium, or high. We contend that higher depth corresponds to higher task complexity.

<i>Coder</i>	<i>1 vs. 2</i>	<i>1 vs. 3</i>	<i>2 vs. 3</i>
Number of agreements	115	132	127
Proportion of agreement	59%	68%	65%
Agreement ( Kappa)	0.391	0.524	0.472

Table 2: Interrater reliability of coders

## 4 Results

Below we first analyze the brainstorming data, then the card-sort data, and finally the information-retrieval tasks.

### 4.1 Brainstorming

Table 3 shows that the Danish participants made an average of 7.1 first-level categories during the brainstorming session, whereas the Pakistani participants made an average of 6.7 first-level categories. There was no effect of participant group on the number of first-level categories,  $t(26) = 0.58, p = 0.6$ . Seven (50%) of the Danish participants made second-level categories during their brainstorming session, whereas only three (21%) of the Pakistani participants made second-level categories. There was no effect of participant group on the number of second-level categories,  $t(26) = 1.59, p = 0.1$ .



<i>N</i> = 28	<i>Danish</i>	<i>Pakistani</i>
Number of first-level categories (M ± SD)	7.1 ± 2.0	6.7 ± 1.0
Number of participants who made sub-categories	7	3
Percentage of Taxonomic categories (M ± SD)	32.1 ± 9.9	51.2 ± 15.0
Percentage of Thematic categories (M ± SD)	34.2 ± 12.7	33.2 ± 15.5
Percentage of Other categories (M ± SD)	33.7 ± 16.1	15.7 ± 13.6

Table 3: Brainstorming

There were significant differences between the two groups in the percentage of *taxonomic* categories,  $t(26) = -4.26$ ,  $p < 0.001$ , and *other* categories,  $t(26) = 3.42$ ,  $p < 0.01$ . There was no significant difference between the two groups in the percentage of *thematic* categories,  $t(26) = 0.36$ ,  $p = 0.7$ . Danish participants used a mixture of taxonomic and thematic categories and therefore many of the Danish participants' categories ended up being coded as *other*, whereas Pakistani participants made more use of taxonomic classification and not many participant made sub-categories. The brainstorming data showed some differences between the participants in their classification of university-website information. This suggests that the information on such websites should be structured differently to match how Danish and Pakistani students classify information.

## 4.2 Card sorting

To investigate the quality of the structure of the information on the two university websites, we analyzed how well this structure matched the way participants classified the same information. Table 4 shows the average distance between the structure of the website content and the participants' card sorts of the website information. The Danish participants had an average distance of 22.4 from the website, the Pakistani participants had an average distance of 26.1. There was a significant difference in distance between Danish and Pakistani participants,  $t(26) = -4.7$ ,  $p < 0.01$ , indicating that the two websites match their users' classification of the website content to different extents.

<i>N</i> = 28	<i>Danish</i>	<i>Pakistani</i>
Distance from website to card sort of all cards (M ± SD)	22.4 ± 2.1	26.1 ± 2.6
Number of cards on which a majority of participants agree	34	19

Table 4: Distance between website structure and participants' card sorts

For each card we determined the number of participants who classified the card in the same way - that is, placed it in the same group. We then selected the subset of cards classified in the same way by a majority (50% or more) of the participants. This was done separately for Danish and Pakistani participants. A majority of the Danish and Pakistani participants agreed about the classification of subsets of 34 and 19 cards, respectively.

### 4.3 Information-retrieval tasks

Finally, we analyzed whether the task completion times and success rates of the information-retrieval tasks were affected by the depth at which answers to the tasks were located. For Danish participants the average task completion time for tasks at low, medium, and high depth was 62 seconds ( $SD = 56$ ), 67 seconds ( $SD = 53$ ), and 82 seconds ( $SD = 62$ ).

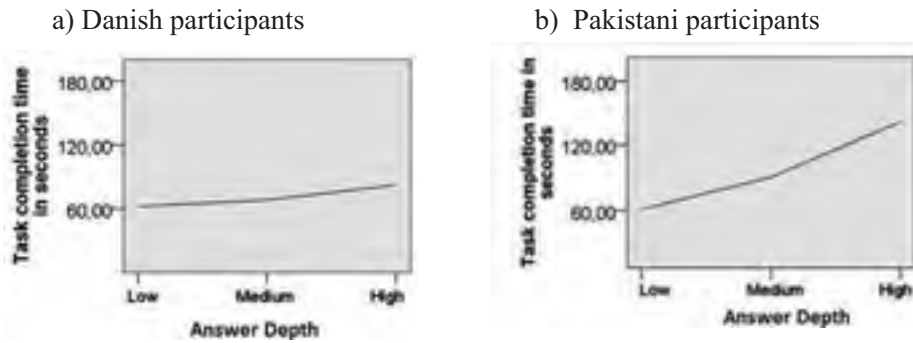


Figure 4: Relationship between task completion time and answer depth

The Danish participants' average success rate for tasks at low, medium, and high depth was 85% ( $SD = 36$ ), 92% ( $SD = 27$ ), and 82% ( $SD = 62$ ), respectively.

For Pakistani participants the average task completion time for tasks at low, medium, and high depth was 58 seconds ( $SD = 39$ ), 88 seconds ( $SD = 59$ ), and 134 seconds ( $SD = 51$ ), respectively. The Pakistani participants' average success rate for tasks at low, medium, and high depth was 92% ( $SD = 26$ ), 86% ( $SD = 36$ ), and 50% ( $SD = 38$ ), respectively.

Figure 4 shows the relationship between task completion time and the depth at which the answers to the tasks were located. Compared to the Pakistani participants, the task completion time for the Danish participants did not increase across depths. The Pakistani and Danish participants spent about the same time on low-depth tasks but the time for Pakistani participants increased as depth increased.

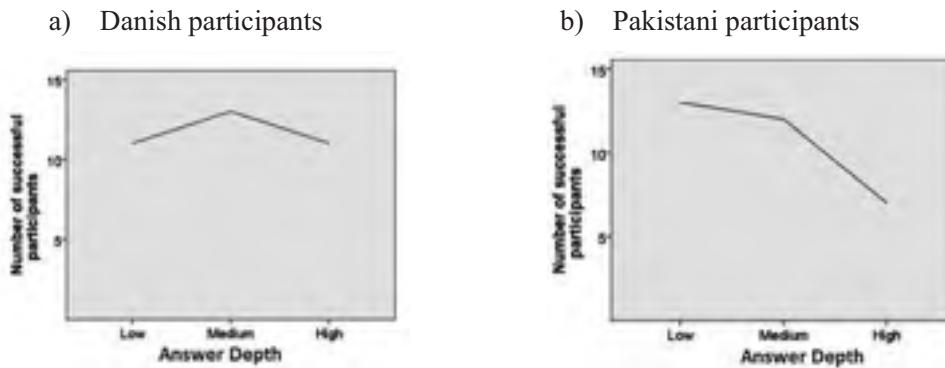


Figure 5: Relationship between success rate and answer depth

Figure 5 shows the relationship between the success rate and the depth at which the answers to the tasks were located. For Pakistani participants the success rate decreases as answer depth increased. For Danish participants we found no relationship between success rate and answer

depth. Both of these analyses suggest that the website structure affected participants' information retrieval.

## 5 Discussion

This cross-case study of university websites uses card-based brainstorming, card sorting, and information-retrieval tasks to investigate the participants' ways of organizing website information. There was a logic in the relationship between the three activities of the study: The brainstorming provided insight into the participants' classification of information items they considered it relevant to include on a university website, and revealed the number of participants who made sub-categories. The card sorting gave insights into the participants' classification of information items appearing on their university website, and how far the participants were from the actual university websites and from each other, in terms of the edit-distance measure. The information-retrieval tasks explored how the answer depth impacted the participants' success rate and task completion time. We find both differences and similarities between the Danish and Pakistani participants. The higher edit distance and lower success rate for Pakistani participants suggest that their mental models differ more from the structure of their university website than for the Danish participants. The difference in the percentage of taxonomic classification can be interpreted as a cultural difference in cognitive sorting style.

For the brainstorming, the analysis of taxonomic and thematic categorization shows that the Pakistani participants tend to use taxonomic classification more than the Danish participants. The Pakistani participants classify information into categories for which information items can mostly be related through higher levels of abstraction. The Pakistani participants' shallow classification may be explained by a South African study about culture, literacy, and web dimensions (Walton & Vukovic, 2003). In their study, Walton and Vukovic (2003) state that more communication practice on the web enhances users' tendency to categorize information in a way they have experienced before. Half of the Danish participants made a multilevel classification during brainstorming. These Danish participants used a mixture of taxonomic and thematic categorisation at different levels. The material and procedure of the brainstorming were the same for the Danish and Pakistani participants, and the brainstorming data can therefore be compared across the two groups of participants.

The difference in Danish and Pakistani participants' card sorts was measured using the edit distance. Previous work suggests that for websites an edit distance of 4 to 5 for comparisons of 20 website elements indicates closely related contents (Deibel & Anderson, 2005). On this basis the participants in our study were far from each other in their categorization of the 50 cards with website content. The web content may be categorized differently for numerous reasons. The information may, for example, fit in multiple categories. Content such as 'Contact us' can be placed in most of the main categories including 'Facilities', 'Library', and 'Admission'. Another reason for the high edit distances may be that the content on some cards, e.g., 'alumni', was not understood by all participants and their different interpretations of these cards would then result in placing the cards in different categories.

In the card sort, the majority of the Danish participants agreed about the placement of 76% of the cards containing website content. Conversely, the majority of the Pakistani participants agreed about the placement of only 38% of the cards with website content. Regarding the

relationship between task completion time and answer depth, Pakistani participants took more time to locate high-depth answers. Also, Pakistani participants' success rate decreases with increasing answer depth. A possible reason for this decrease may be that Pakistani participants spent less time on their university website compared to Danish participants. Methodologically, this study provides an initial investigation of an approach that can be used in cross-country comparisons of website structure. We used taxonomic and thematic categorisation to compare and contrast the participants across countries. This method can provide insight into users' classification criteria. To minimise the impact of having two different websites in the experiment, we chose the same genre for both websites.

## 6 Conclusion

This card-sort study offers an approach to the study of cross-country differences in the structure of university websites and user classification of website content. Pakistani students tend to use more taxonomic classification, but fewer levels of categories, as compared to Danish students. The study also finds similarities between Pakistani and Danish users, for example in the retrieval of website content that is not located deep in the website hierarchy. The edit distance appears to be a useful measure in cross-country analyses of website structure. Furthermore, comparing websites developed and used locally can be a valuable comparative approach in cross-country HCI research and practice. The current study is limited by its focus on two websites and by the moderate number of participants from each of the two countries. Another limitation of the study is that only one genre of website was researched. In this study we conducted the analysis of thematic and taxonomic classification on the basis of the card-based brainstorming data. In a forthcoming study we will apply the analysis of taxonomic and thematic classification to card sorts of actual website content.

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**Appendix 1c: Research Article 3**

**Information Classification and Acquisition on Websites: Users Interaction on E-commerce Websites in two Asian Countries.**

**Nawaz, A** and Clemmensen, T (submitted). Information Classification and Acquisition on Websites: Users Interaction on E-commerce Websites in two Asian Countries.

# **Information Classification and Acquisition on Websites: User Interaction on E-commerce Websites in two Asian Countries**

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## **Abstract:**

Pervasive access to e-commerce through the internet has changed the world into an international marketplace. At the same time, people in different countries and cultures look for information on websites in their own ways and are influenced by their local contextual and social understanding. This article contributes to classification and information acquisition theory within HCI by applying it the theory to data from usability test sessions in Pakistan and Malaysia, relating the findings to previous comparative studies of website information classification in Europe and Asia. Classification principles and information acquisition models were used to identify the users' views of website structures and information classification in the two countries. A total of 66 students in the two countries participated in card sorting activities, interviews and usability tests on local e-commerce websites. We point towards contextual issues related to information classification. The findings suggest that users in these two cases construct information in a similar way, and that this appears to be different from how website users behave in previous studies of the same activity in western countries. In brief, users chose different strategies to look for information on websites. The study confirms that the classic depth versus breadth trade-off is important, but emphasizes that there are other factors, including digital fluency and cultural markers, that should be taken into consideration. The study concludes that taking users' views of information classification into account can be seen as a simple and practical way to improve usability for culturally diverse users, particularly in Malaysia and Pakistan.

## **Keywords:**

Intercultural usability, information structure, classification, culture, cross-cultural HCI, acquisition



## 1. Introduction

With the rapid development of technology, users across the globe can now access e-commerce websites at any time. Users can acquire information about products and services as well as order them online. Pervasive access to e-commerce through the internet has changed the world into an international marketplace.

Understanding users' cultural characteristics and language preferences has increasingly become an important aspect of HCI research on websites. People from different cultures perceive information differently (Alostath et al., 2011; Plocher et al., 2012). People look for information on these websites in their own ways, influenced by their local contextual and social understanding. These differences go beyond language and extend to values, attitudes, communications and social practices and cognitive styles (Plocher et al., 2012).

One of the basic mental activities people engage in is the organization of information. Information is organized into categories in a number of different ways (Rosch, 1978). Some information is truly universal and all the groups of people in their different settings perceive it in a similar way. For example, the recognition and perception of facial expressions and colors is considered somewhat similar in most settings (Matsumoto & Assar, 1992). Other information is not universal and is perceived differently in different geographical locations. Users of web sites perceive information in categories based on its function or properties ( ). If an item has a single function or property it goes into one category, but if the item has multiple functions or properties, it may potentially be a member of a number of groups under which it can be placed depending on various factors, including the current cultural context.

A web site user's sense of the information structure of a website may be based on their cognitive styles (Faiola & Matei, 2005). Cognitive style is an individual's typical way of thinking, processing and organizing information, solving problems and learning (Riding & Rayner, 1998). One way to understand users' cognitive styles is to study how they group things into categories (Riding & Rayner, 1998). The cognitive styles of web site users concerning information organization can thus be explained in different ways. It can be explained through the groupings of different forms of information and their relationships considered relevant by the user group. Cultural cognitive styles consist of those patterns of categories and relationships that are generally practiced in the local cultural setting. The process of understanding user's cognitive styles and identifying users'

categorization structures can thus be approached by studying users' activities of organizing and searching information.

Web site users tend to have a particular way of thinking about information classification that is contextualized according to their background (Yeo & Loo, 2004). User's view of the world is influenced by childhood learning which results in a preoccupied thinking about different concepts of the world (Nisbett, 2003). These factors also influence users' thinking about, for example, different web site domains. In a multicultural country or society, information might be presented mostly in a language and taxonomy directed towards a specific cultural group and this might make it difficult for other cultural groups to understand.

There are regional differences in the website information structure in different countries (Isa, Noor, & Aidid, 2008; Marcus & Hamoodi, 2009; Mushtaha & De Troyer, 2009; Sheppard & Scholtz, 1999). These differences are in the design of different language websites, use of colors, symbols, and information structure (Mushtaha & De Troyer, 2009; Sun, 2001). There could also be regional differences in information classification and acquisition on websites when looking into the user's information acquisition pattern in diverse countries like Denmark, Pakistan and Malaysia. In this study, we discuss the structuring of websites in terms of whether it fits well with the user's view of the world. We specifically address users' information acquisition on local e-commerce websites.

In this article, we discuss the design and use of a website structure as an information classification problem. First, we look into users' views on information structures and explore them through theories of classification. Second, we study the information acquisition behaviour of web site users, explaining the process through distinguishing factors such as navigational burden and information abundance. Third, we look for similarities and differences between web site users from two different countries in the same region of the world. Our research question in this article is thus: How can we explain users' information classification and acquisition behaviour in Pakistan and Malaysia through the theories of information classification and a model of information acquisition?

The remainder of this article is organized as follows. Section 2 discusses concepts of classification and information acquisition and addresses the role of cultural similarities and differences in these processes. Section 3 presents the method used to study information classification and acquisition, explaining the study design and describing cases to be compared. It further discusses the recruited participants, the material and websites used for the study, and the activities used in the usability

studies. It also briefly explains the analysis to be conducted for study. Section 4 gives a detailed account of the results of each case study in turn. Finally, section 5 presents the discussion of the study and section 6 presents the conclusions and a brief summary.

## 2. Background

### 2.1. Classification

The concept of classification has been used in many areas of studies, such as information management, medical studies, anthropology, psychology and mathematics. It exists at the crossroads of the sociology of knowledge and technology, history, and information science (Bowker & Star, 2000). To classify is human and classifications are ordinarily invisible and imbricated in our lives. We spend large amounts of our days performing classifications often tacitly and using a range of ad hoc classifications. In our lives, classification includes even prosaic activities such as sorting clean dishes, clothes, laundry and important e-mails.

Different definitions have been used to define classification. Bowker and Star (2000) define classification as a “*spatial, temporal, or spatio-temporal segmentation of the world*” (pp.10). A classification is a set of boxes (metaphorical or literal) in which things can be grouped together. Classification is fundamentally a way of organizing information into clusters and groups in such a way that it becomes meaningful.

Web designers are faced with choices regarding classification principles, agendas for classification, consistency in classification of targeted user groups, and the order of classification. Classification and categorization principles have often been researched in different fields of study, but the major focus on information classification has been in the field of cognitive psychology (Rosch, 1978). According to cognitive psychology, two basic approaches are used to classify information. The first approach categorizes items on the basis of their prototype. For example, a *robin* comes under the prototype of birds whereas an *ostrich* is not a bird and may not come under the prototype bird. The second approach to classifying information is on the basis on defining attributes. For example an animal might be classified as bird if it has wings, lays eggs, and is warm-blooded. The use of these approaches has an effect on the resulting classification, but they are not the only factors that influence people’s classification behaviour. In addition, in a field such as website design, the principles involved are not as strict as they are in other fields such as medicine and biology. The presentation of information on websites is a continuous process. When new information or items

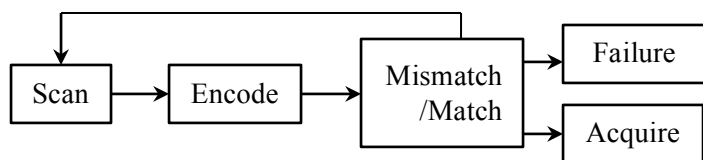
come into the structure of websites, they either go into pre-defined categories, or they necessitate new categories.

In the context of websites, information classification has been framed as a problem of how to persuade people to do certain things on a website. The persuasive classification of items in a website is intended to encourage users to look for certain items on a websites. For example, in e-commerce, the classification of items on websites is usually framed to encourage customers to look for alternative and additional products to purchase. Such persuasive information classification and presentation is derived from the concept of persuasive technologies, which persuade through the help of physical, psychological, language and social cues (Fogg, 2002). In persuasive information classification, items can be displayed according to an agenda. This agenda might be to commit users to look into information that they have not thought about initially while looking for items on the website, for example. Information classification has also been seen as related to consistency in interaction with the websites (Nielsen, 1999), decreasing the navigation burden in complex systems (Ahmad, Li, & Azam, 2006). Navigation burden is composed of time consumed, number of errors made, and number of clicks required while completing a task. Some information systems and websites use a 'natural order' of classification (Norman, 1991). For example, the online information system for an insurance website might classify information in the chronology and one set of information is displayed after other. When using the online system, the system may first ask the user to classify the location, direction and speed of a moving vehicle; secondly the system might ask the user to classify information about the point of impact; and thirdly it could ask the user to classify the amount of damage done (Norman, 1991). This natural order of information can only be used in certain genres of websites, however, as is not universally applicable.

## **2.2. Information acquisition**

Information acquisition describes the ways in which users inspect and acquire information from a website or information system. Users' inspection of information may be (a) a serial inspection of items, (b) a random inspection without repetition, (c) a random inspection with replacement (Norman, 1991). A serial inspection requires users to look for items one by one without skipping. In random inspection on the other hand, the user inspects items and skips between them out of order, but keeps the track of items that they have already visited. In a random inspection with replacement, the users may skip some items because an item might have been inspected over again. For example,

the color of link becomes different that user has clicked previously. The user's information acquisition depends upon the kind of task he/she is conducting.



a) Process model for targeted information acquisition

	Correct	Incorrect
Match	Found	Wrong position
Mismatch	Miss	Correct Rejection

b) Information acquisition matrix

**Fig.1.** Process model for a) targeted information acquisition and b) information acquisition matrix; adopted from Norman (1991)

Users can also be thought of as searching for information on a system or a website with or without targeted information. When users have a target, for example a watch with a particular brand, they tend to scan information and encode it with their own understanding of what users have in mind. The scanned information on the website matches or mismatches with the target watch which users have in their head. In the information acquisition, if a user is currently on a correct location on a webpage and the information matches their concept, watch of a brand, then the information is found. If the user checks the information but it does not match their understanding of watch, they are on a wrong position. If the user is on the right position, but cannot find the information, the information is simply missed. Finally, if the user attempting to find information at an incorrect location and does not find it, it is correctly rejected. In the process of information acquisition users find themselves in one of these four conditions described earlier. Pirolli and Card (2001) proposed Information Foraging Theory (IFT) as an explanation of the users' models of information acquisition. It is an approach to understanding how strategies for information seeking, gathering and consumption are adapted to the flux of information in the environment (Pirolli & Card, 1999).

The time users take to find information depends on the number of items or information being displayed on a single webpage or screen (Lee & MacGregor, 1985). It further depends how deep the information is placed in the hierarchy of the website. The optimal path to get to the destination information thus becomes an important factor to determining an efficient time for information acquisition.

Lee and MacGregor (1985) presented a model that explained that search time is a linear function of the number of alternatives that a user can choose between when searching for information. The more alternatives in a classification, the longer users will take to find required information. In any

information search, there are a number of alternatives that the users can inspect,  $E(A)$ . For any information search,  $E(A) = a$  is the total number of items in the frame. If the correct alternative is at a random position, then  $E(A) = (a+1)/2$ . Lee and Macgregor (1985) assumed that the total time for each choice is  $S = E(A)t + k + c$ , where  $t$  is the time required to read one alternative,  $k$  is the key-press time, and  $c$  is the computer response time.

In recent studies, the focus has been on the navigation burden and navigation structure (Ahmad et al., 2006; Chui & Li, 2005). Researchers suggest ideally users should be able to reach desired information on three clicks (Ahmad et al., 2006). These three measures, time, clicks and errors, aggravate the navigational burden of users. Table 1 shows the example criteria to setup navigation burden.

**Table 1.** Criteria to setup navigation burden (Ahmad et al., 2006)

<i>Burden</i>	<i>Unacceptable</i>	<i>Acceptable</i>	<i>Ideal</i>
<i>Navigation Burden Optimization</i>	0%	50%	100%
<i>Time (in seconds)</i>	266	130	6
<i>Number of clicks</i>	7	5	3
<i>Number of errors</i>	1	No middle value	0

Menu processing time as a function of the number of items has become an important issue in understanding how users access information efficiently. It can provide an understanding of whether the number of items should be limited on a webpage, and if so, how the hierarchy of items should be handled, when the items in a category become large. On the other hand, an increase in the depth also increases the time to access information. There is therefore a fine balance between the number of items and the depth of information on a web system or a website.

### **2.3. Cultural fit of information classification and acquisition on websites:**

#### **Pakistan/Malaysia vs. Denmark**

Many information systems (IS) researchers believe that global organizations need to understand cultural differences in the design of information technology, and hence use Hofstede's national culture dimensions – power distance, individualism–collectivism, masculinity–feminism and uncertainty avoidance (Hofstede, 1980; Vatrapu, 2007) – to study culture. It is important to focus on the culture in information systems, but the notion of 'national cultures' may be too simplistic since it glosses over the fact that ethnic and cultural groups can exist across many nations, just as it

glosses over the existence of cultural and ethnic differences within nations (Myers & Tan, 2003). Myers & Tan (2003) argue that concept of national culture is theoretically weak and ignores some of the facts of history.

Recently researchers have focused on cultural-fit and representation of information in a situation or context. Initially Leidner and Kayworth (2006) noticed the popularity of notion of cultural-fit in their review of 82 IS articles. Cultural-fit is idea that the level of congruence between a group's values and values embedded in a system determines the group's perception and use of that system. A mismatch in cultural-fit leads to a negative perception and use of the system, while a high degree of fit leads to positive perceptions and use of the system. Hong and Mallorie (2004) associated meaning creation in a situation or context with the knowledge that is available in that situation. A recent study by Clemmensen (2012) identified usability problems in culturally diverse settings as a cultural-fit issue. The study looked for practical ways to evaluate design from a cross-cultural perspective. These three examples position cultural issues as 'cultural-fit' issues.

A cultural-fit is required in information classification on websites. Regional similarities and differences in information classification and acquisition on websites have been studied in terms of users' cognitive styles (Faiola & Matei, 2005) and language (Sapienza et al., 2008), and relative to differences in web site structure (Smith et al., 2004). In a study of Danish and Pakistani web site users ( ); the results indicated several group differences. The users in Pakistan did not group information into deep hierarchies. There were related task-performance differences in Pakistani users. Pakistan users spent more time to find information which was placed deep. The Pakistani and Danish participants spent approximately the same amount of time on low-depth tasks. Finally, participants

Mentioned in the interviews they would like to see bi-lingual contents on a single university website webpage and its association with other family members for access of information ( ). Hence we would expect important regional differences in the fit between the structure of websites and users' classification and information acquisition behaviour.

Issues related to website localization are not limited to the localization of the information structure. They can be separated into three categories: input, encoding and display issues. An important aspect of regional differences in information classification and acquisition is the pattern of website use in local versus international (usually English) language (Sapienza et al., 2008). Language proficiency

related information can help to understand the relationship between the choice, availability and use of language for information on a website, particularly for online retailers and e-commerce websites who are eager to enhance their sales by attracting national and international users. Thus, understanding the importance of language in destined locations can enhance the usability and accessibility of websites (Clemmensen, 2011). Studies suggest that perceived usability and user satisfaction increase when a website is originally conceived in the native language of the users (Kralisch & Koeppen, 2005; Kralisch et al., 2006; Nantel & Glaser, 2008). Users' language fluency and literacy may thus affect their involvement in websites.

### **3. Method**

We wanted to study information classification and acquisition in Pakistan and Malaysia. The intention of the study is demonstrate how users' information classification and acquisition behaviour are influenced by the cultural understanding of information classification and aspects of language in their classification.

#### **3.1. Case Study design**

##### **3.1.1 Number of cases**

We used a focused case comparison study design, which emphasizes matching a small number of holistic cases (Druckman, 2005). We thus compared only a small number of cases, two from Asia in this study, and one from Europe from an earlier study. We wanted to probe deeply into cultural-fit in relation to users' website practices, and this would not be possible with a large number of cases. Another reason for the small number of cases was that we sought causal explanations of country-level variation between the information and classification behaviour of users of e-commerce and university websites, that is, between closely matched units of analysis.

##### **3.1.2 Matching of cases**

Focused case comparisons emphasize the matching of cases. In this study the participants used local e-commerce websites in Pakistan (case study 1) and Malaysia (case study 2). In both countries, the participants were provided with similar and comparable web site content. We used Alexa<sup>1</sup> to identify the local website for home appliances in each country. We choose e-commerce and home appliances websites, as e-commerce and home appliances websites contains lots of items which go

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<sup>1</sup> <http://www.alexa.com/>



into different categories. The top local e-commerce website of each country was then used when conducting the study in that country. The participants were also involved in similar activities in both cases. For data collection we performed triangulation by collecting data through open card sorting, tests of information-finding performance, and semi-structured interviews. Thus, the cases did match as both cases used the material from local e-commerce websites and in both cases participants were required to perform similar activities.

Furthermore, we aimed to select cases of website use that were similar in most aspects, adopting a most similar case approach (Skocpol & Somers, 1980), with the key difference being in geographical and cultural aspects. Critically, we wanted to investigate whether users from somewhat culturally similar countries would differ in their website use. This made our study different from other studies that would seek to select only those cases that as a whole were completely different. However, the distinction between a most similar case approach and other approaches is not necessarily so sharp, as the comparative approach is a broad one, rather than a specific technique with a step-by-step procedure.

### **3.1.3 *The analytical focus of the case study***

The aim of this study is to contribute to theory and to support cumulative research on information classification and acquisition behaviour in HCI. We therefore placed our analytical focus on these kinds of behaviours in our choice of cases. These behaviours include website use, and specifically language and other priorities in website use. This was intended to allow us to inform theory about information classification and information acquisition behaviour.

### **3.1.4 *The investigator's fit with the case study design***

The primary investigator on the study was familiar with website use in all the countries involved, understood the local languages, and was culturally acclimatized. Further, the primary investigator was trained in the data collection techniques used in this study and was aware of how to localize these techniques to the cultural contexts of the different countries. Another important aspect of data analysis taken in consideration was that investigator should thoroughly understand the theory of information classification and acquisition. Finally, an emphasis was placed on remaining flexible and adapting the study to local conditions. In the present study, the first author was the primary case investigator.

### **3.1.5 Countries and participants**

We focused on two Asian countries, Pakistan and Malaysia, because these were similar in the sense that both were countries with a majority Muslim culture. However, while Pakistan has a somewhat homogenous population, Malaysia has many different ethnic groups. Hence we expected both similarities and differences in website use between these two countries.

We chose to use students for this study, since students are a fairly comparable group across countries, helping to eliminate differences in their website use behaviour due to differences in, for example, age and vocational background. Furthermore we required that the participants should have studied and lived mostly in the country studied. This helped us to understand local users' understanding of information classification in a single location. The participants of study were not required to have experience in interface design and programming, but should be experienced in interacting with websites.

### **3.2. Data collection**

To study information classification and information acquisition we used a triangulation approach and collected data through open card sorting, tests of information-finding performance, and semi-structured interviews. In the open card sorting participants are provided with an initial stack of cards, and asked to sort them into meaningful groups. We used the open card sorting to assess the users' own classification of the website items. Participants' information acquisition activities were used to look into the navigation design of the website and the navigation burden which users face while seeking information. Participants were given goals such as "find the electrical mug" or "find Brand A's electric shaver". The depth of a given goal was measured as the number of clicks required to reach it.

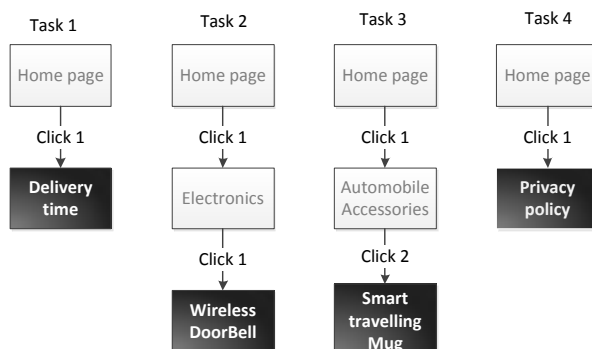
In each country, a local home and e-commerce websites were chosen as our material for the study, as described above. In both countries, participants' classification through open card sorting was measured based on contents taken from the local e-commerce website. Users' information-finding performance was tested using local websites. Users were asked to think aloud while looking for information. The users were interviewed after the card sorting experiment about their views on website usability as well about their classification of information. The data collection from a single participant took between 110-130 minutes.

### 3.2.1 Activity 1: Classification through card sorting

In this activity participants were provided with a stack of cards. The cards represented contents taken from a website<sup>2</sup> that sold home appliances. Each card represented an item which was shown in one section of the website. The participants were asked to place the cards into any category that made sense to them and were asked to write a category name for each group of cards. A single card could only be placed in one category, but participants were told that they could also make second level categories within the first level category. In this way, the card sorting produced a hierarchical structure with two or more levels (see figure 2a). The participants were asked to complete this task in no more than 15 minutes.

### 3.2.2 Activity 2: Information acquisition through user goal activity

In this activity the participants were provided with four goals. They were asked to find information on the home appliances website. Participants were told that the purpose of the activity was not test of their skills but was related to the usability of the website. They were instructed that they should take as much time as they normally would during a normal website visit and were provided 3 minutes for each task. The time of 3 minutes and 15 minutes for information acquisition activity was estimated after testing the goals with 3 test users.



a.) Optimal navigation path of 4 goals

b.) Screenshot of the website

**Fig.2.** User goal Activities on the website in a navigational structure of Case study 1

Failure to reach the goal was defined as occurring when a participant was unable to find information on the website within 3 minutes. None of the participants (except participant 23) had prior experience with the specific site used in the experiment.

<sup>2</sup> <http://symbios.pk>

### **3.2.3 Questionnaire about website use in local and English language**

The participants were provided with a questionnaire about their use of websites in local and English language. They were asked to provide information about accessibility and use of websites in their local or national language. The participants were interviewed at the end of the activities about their use experience in different languages. The interviews were used to compare the participants' website use in local and English language and also to identify any other contextual issues such as their preferences for websites language to support analysis of users' information finding performance.

### **3.3. Analysis**

For our analysis, we used both cross-case and within-case comparison, and also literature review of information classification and acquisition theory in an attempt to ensure external validity. We repeatedly examined our raw data to interpret cultural-fit and contextual use of websites, while staying open to new insights and opportunities. In particular, we triangulated the data, using the interviews, think-aloud sessions, and card sorting techniques to test and strengthen our findings. We used cluster analysis and dendrograms, made in the card sort analysis tool Optimal Sort. Furthermore, we performed a statistical analysis of optimal click paths and time on task data, and a qualitative analysis of interviews. We tried to sort and explore the relations between the variables within each case as much as possible.

Between the cases, we searched for patterns in web use behaviour, looking at the data by type across both cases investigated. The first author examined the data of each type and when he found patterns within one data type that was supported by patterns within another data type, we argued that the finding was stronger. In contrast, when the patterns conflicted, he would probe more deeply to find the source of the difference.

## **4. Results**

### **4.1. Case study 1: Pakistan**

#### **4.1.1 Description of participants**

Pakistan is an ethnically and linguistically diverse country. However, the population is overwhelmingly Muslim (97%) and the participants in our study in Pakistan were members of this majority culture. A total of 30 participants (17 female and 13 male) from the Institute of Business

and Management at the University of Engineering and Technology<sup>3</sup> in Lahore participated in the experiment. The average age of participants was 20 years ( $SD \pm 1.65$ ). Most of the participants were in business studies (73.3%) and some were from science and education (26.7%). The participants of the study had on average studied for 14 years ( $SD \pm 1.04$ ). All the participants (N=30) have had a computer in their homes for an average of 6.5 years ( $SD \pm 3.01$ ). Most of the participants (83%) have had internet access in their homes for an average of 3.5 years ( $SD \pm 3.08$ ).

The participants were asked to rate their proficiency in English, Urdu and one local or other language. English and Urdu were chosen because both are official languages of Pakistan, with Urdu also being the national language of the country. They were asked to rate the language proficiency in reading, writing and speaking. Half the participants also filled in language proficiency for a local or other language (11 for Punjabi, 1 for Arabic, 1 for Sindhi, 1 for Saraiki and 1 for German).

Table 2 shows the language proficiency of the study participants for English and Urdu. The rating of the language fluency is from 1 (not at all fluent) to 5 (native). For language fluency in English and Urdu, the result of the study showed that the students did not show any difference in their reading skills,  $t(58) = -2.78, p > 0.05$  and writing skills,  $t(58) = -0.84, p > 0.05$ . There was a significant difference in their ability to speak English fluently relative to Urdu,  $t(58) = -7.08, p < 0.001$ .

**Table 2:** Participants' Language fluency

<i>N = 30</i>	<i>English</i>	<i>Urdu</i>
<i>Reading (M ± SD)</i>	3.07 ± 0.64	3.67 ± 0.99
<i>Writing (M ± SD)</i>	3.10 ± 0.61	3.30 ± 1.15
<i>Speaking (M ± SD)</i>	2.47 ± 0.73	3.93 ± 0.87

The participants of the study considered their speaking proficiency in Urdu to be better than that in English. When asked about the use of language for writing reports and making presentations, all participants (100%) mentioned that they used English as their functional language for writing reports and making presentations, with only one participant also using Urdu in those situations.

<sup>3</sup> <http://www.uet.edu.pk/>

#### **4.1.2 The website in Pakistan**

Symbios.pk is an online shopping site based in Pakistan that sells items such as laptops, PDAs, mobile phones, home appliances and digital Qurans. The website was at the time of this study ranked the 218th most popular in the country<sup>3</sup>. The overview of the website was taken from Alexa<sup>4</sup>, yielding traffic data, global rankings and other information. The rank by country was calculated through a combination of the number of average daily visitors to the website and the number of page views on the website from users from that country over the past month. The site with the highest combination of visitors and page views was then ranked number one in that country. The estimated percentage of global internet users who visited this website was at the time 0.0043%. The average load time for the website was slow at 2.788 seconds, with 83% of sites in the world loading more quickly. The audience demographic of the website showed that 94% of its visitors were from Pakistan. Estimated daily unique page views per user for the website were 5.8 pages and visiting users spent 5 minutes and 37 seconds on average on the website. From the website, a set of 41 cards that represented its content were extracted, as described above, and used in the card sorting activity.

#### **4.1.3 Card sorting results**

During the open card sorting activity, participants made on average 6.31 first level categories ( $SD \pm 2.80$ ) and 1.59 ( $SD \pm 2.69$ ) second level categories. Less than half of the participants (43%) made second level categories at all. Participants who did make second level categories, made an average 3.54 ( $SD \pm 3.07$ ).

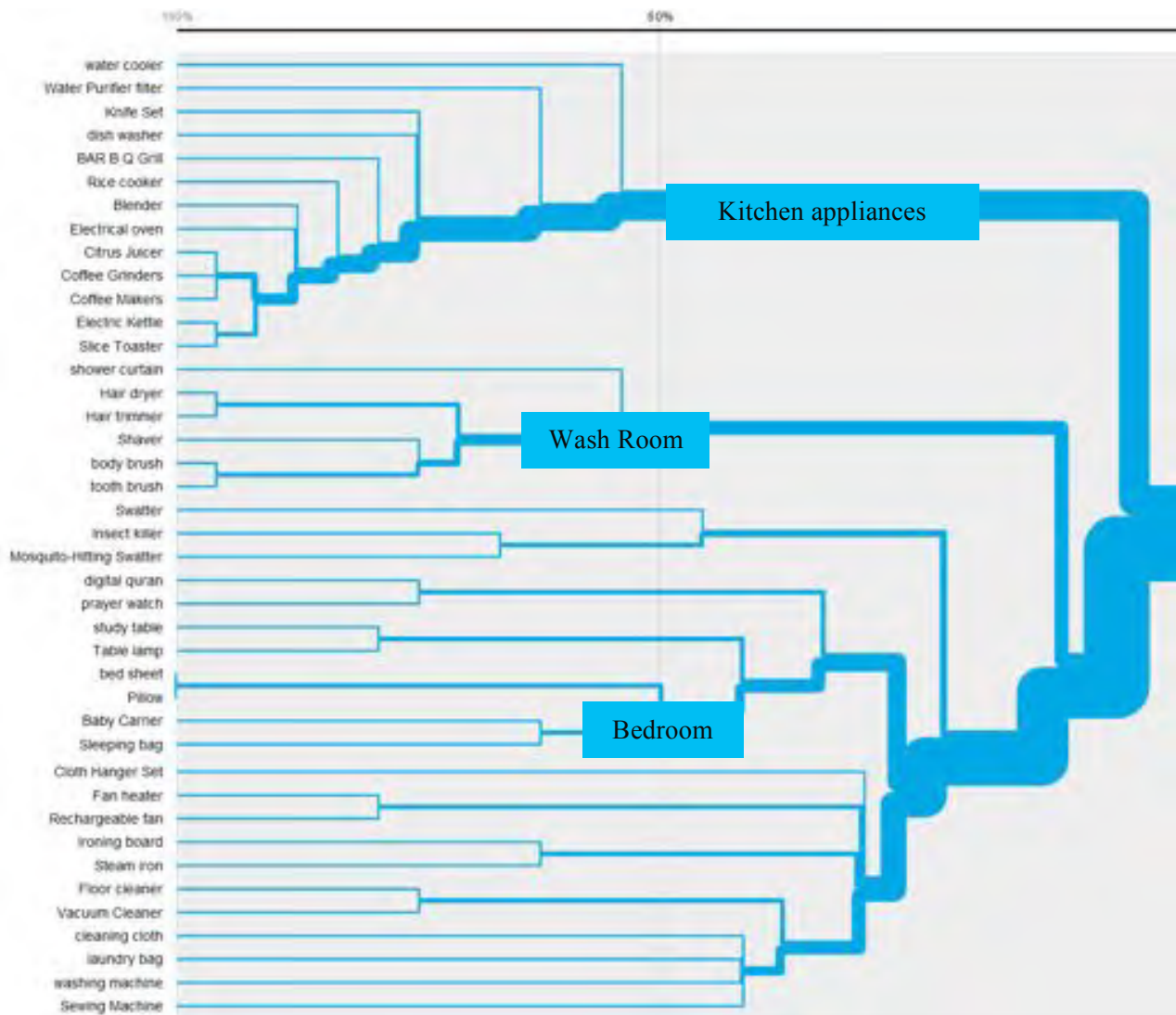
We used cluster analysis to analyze from the open card sorting, using Optimal Sort (2012) as a tool. We decided on a threshold of 60% agreement of items between participants, in keeping with recommendations by Katsanos et al. (2008) and William Hudson (2012). The number of items decreases when users' agreement increases between each other. Katsanos et al. (2008) used a similarity matrix correlation from two tools, Autocardsorter and Cardsorting, and found a similarity of users between 50% to 61% agreement. During the analysis, a single card was included in the group only if at least 60% of the participants had placed it in the same group in their individual sorts.

The dendrogram of participants' classifications (figure 3) shows that participants agreed 60% or more on card placement for most of the cards (35 of 41, or 85%). The participants clustered items in

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<sup>4</sup> www.alexa.com

three major groups, with an average of 7 cards in each ( $7.67 \pm 4.7$ ), in a single group and additional groups with only few cards. The largest cluster shows participants agreeing to place one third (13 of 41 cards, or 31%) of total cards in a single category with a theme of 'kitchen'.



**Fig.3.** The dendrogram of information structuring by Pakistani participants

The participants provided different labels for this group, including “Kitchen Appliances” (participants 3, 4, 9, 10, 13, 14, 19, 22, 28, and 29), “Kitchen Electronic Appliances” (participants 1, and 27), “Kitchen equipment” (participants 8 and 23), “Kitchen products” (participants 16, 20, and 24), “Kitchen Accessories” (participants 17 and 30), “Kitchen” (participants 6, 7, 18, 21, and 25), “Kitchen items” (participants 26, 29, and 30). The second largest category contained 6 items (13%) clustered together under the theme of ‘washroom’. The names used by participants such as “Wash Room” (participants 7, 12, 15, 18, and 22) “Wash Room Things” (participant 11), “Bath

Room” (participant 25), “Washroom appliance” (participants 9, 14, 15, and 26), “washroom accessories” (participant 16, 17, and 30). The third main theme contained 4 items (10%) clustered together in a theme of ‘bedroom’. The participants used alternative naming conventions such as “Bed Room” (participants 4, 6, 8, 11, and 19), and “Bedroom Appliances” (participants 4 and 5). The rest of the cards (approximately 44%, or 18 cards out of 41) were either in small clusters with only two cards in not clustered. For these cards, there was no agreement across participants as to clustering the cards in a similar group.

#### 4.1.4 Information acquisition results

We hypothesized that participants would take less time to find information located on the first level of the hierarchy of website, due to the smaller number of clicks required. Conversely, finding information would take more time if the information was on the second level in the hierarchy of the website structure, as it would take more clicks to reach the information. Participants in study were provided with four information-seeking goals and were given three minutes to find the information described in each goal.

Table 3 provides an overview of optimal path clicks that can be taken to reach to the destined information. It also provides successful participants’ goal completion times, success rates (the percentage of participants finding the goal with the given time), as well as the average goal completion times. There was a positive correlation (Pearson  $r = 0.82$ ) between the number of optimal path clicks required to reach to the goal information, and the average time it took for the successful participants to find the information.

**Table 3:** Goal achievement times and success rate

Goal	Optimal Path (clicks)	Successful participants’ average goal completion time (seconds) ( $M \pm SD$ )	Success rate
<i>Goal A</i>	1	68.5 ± 49.9 (16 of 30)	53.3 %
<i>Goal B</i>	1	25.7 ± 36.4 (29 of 30)	96.7 %
<i>Goal C</i>	2	86.9 ± 49.7 (14 of 30)	53.3 %
<i>Goal D</i>	2	97.9 ± 43.0 (26 of 30)	86.7 %



#### 4.1.5 Results on website use in local and English language

Participants in the study were asked about the accessibility and use of websites in their local or national language. Table 4 shows the amount of time participants spent on local language and English language websites.

Participants clearly spent more time on websites that provided information in English. When they were asked why they preferred to access websites in English, many of the participants stated that accessing information in English helped them to practice and train their English language proficiency (see section 5.2). In the interviews, participants also noted that they accessed more websites in English because there was simply more information available (see section 5.2). Furthermore, the technical issues described below regarding information searching in local languages were another reason for participants using English websites for information.

**Table 4:** Browsing web pages in a session in Pakistan

	<i>Local language websites</i>	<i>English language Websites</i>
<i>Do not Open it</i>	(15) 50.0%	(1) 3.3%
<i>Less than 1 minute</i>	(8) 26.7%	(4) 13.3%
<i>1-10 minutes</i>	(7) 23.3%	(9) 30.0%
<i>10-30 minutes or more</i>	(0) 0%	(16) 53.3%

It was interesting to find that half of the participants (50%) never opened websites in a local language or in Urdu. A further quarter of participants (26.7 %) only visited web pages in local or national languages such as Urdu for an average of less than one minute per visit. This is at least in part because local language websites had number of problematic issues. When the participants were asked about the biggest general problem in their use of websites in their local language, most (53%) stated that they were unable to find information in the local language. Some of the participants (19%) stated that it took too long to view and download pages presented in local languages. One of the reasons they stated for this was that text on web pages in local languages (Urdu and Punjabi) was presented as image files, and hence less readable. They further mentioned that the text in the image files could be retrieved during their search queries, making it difficult to use the websites in the local language. Despite this, when participants were asked if an organization should ever present its website in local language, a reasonable percentage of the participants (36%) did want to see this happen because of the respect they felt it would show for their local culture. Some participants

(30%) also wanted to see website contents in local languages because it would be useful for more people.

## **4.2. Case Study 2: Malaysia**

### **4.2.1 Description of participants**

Malaysia is a multicultural country made up of different ethnicities and ethnic groups. A slim majority of the population belongs to the Malay ethnicity (50.4%), whereas the Chinese ethnic group is the second largest (23.7%) in the population, followed by 11.0% comprised of diverse indigenous groups, 7.1% belonging to Indian ethnicity, and 7.8% of the population consisting of other ethnical groups. The majority of the participants were of Chinese ethnicity (44.7%, or 17 of 38) and of the Bumiputra ethnic group<sup>5</sup> (39.5%, or 15 of 38). Finally, some of the participants were of Indian ethnicity (10.5%, or 4 of 38), and two participants did not wish to disclose their ethnicity.

A total of 37 participants (14 males and 24 females) from the University of Malaysia Sarawak participated in the experiment. The average age of participants was 24 years ( $SD \pm 1.71$ ). All of the participants were studying information technology at the bachelor's or master's level and had studied for more than 15 years ( $SD \pm 1.46$ ). Most of the participants (94%, or 36 of 38) had had a computer in their homes for on average 8.6 years ( $SD \pm 3.99$ ), although two of the participants did not have computer in their home at the time of the study. Participants (76%, or 29 of 38) with computer had access to internet in their homes for an average of 7.31 years ( $SD \pm 3.67$ ).

To ascertain language proficiency in different languages, all the participants filled out the language fluency questionnaire for English and Malaysian in reading, writing and speaking. As regards fluency in languages other than English and Malay, 17 participants filled in the questionnaire for Chinese language proficiency, 4 participants claimed Tamil language proficiency and one participant claimed fluency in Bidayuh. The language fluency rating of the language was again measured on a scale from 1 (not at all fluent) to 5 (native). For language fluency in English and Malay, the results of the study showed that students considered their language fluency in Malay to be significantly better than English in their reading,  $t(37) = -4.01$ ,  $p < 0.01$ , writing  $t(37) = -4.52$ ,  $p < 0.01$  and speaking  $t(37) = -5.12$ ,  $p < 0.01$ .

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<sup>5</sup> There is some controversy concerning the criteria of the Bumiputra ethnical group. However, this article will not discuss this.

**Table 5:** Malaysian participants' language fluency in English, Malay, Chinese and Tamil

	<i>English Language</i>	<i>Malay Language</i>	<i>Malaysian participants' language fluency</i>		
			<i>Malay</i>	<i>Chinese</i>	<i>Tamil</i>
	<i>N=38</i>	<i>N=38</i>	<i>N=15</i>	<i>N= 17</i>	<i>N=4</i>
<i>Reading (M ± SD)</i>	3.39 ± 0.72	4.03 ± 0.85	4.40 ± 0.91	3.94 ± 1.06	4.0 ± 1.15
<i>Writing (M ± SD)</i>	3.08 ± 0.59	3.76 ± 0.88	4.27 ± 0.88	3.75 ± 1.12	3.75 ± 1.50
<i>Speaking (M ± SD)</i>	3.03 ± 0.59	3.84 ± 0.85	4.40 ± 0.91	4.06 ± 1.85	3.75 ± 1.50

We further compared the language fluency of Malaysians with Chinese ethnicity and Malaysians with Malay ethnicity, finding that Malaysian participants of Chinese ethnicity were better in reading,  $t(15) = 2.44$ ,  $p < 0.05$ , and writing  $t(15) = 1.699$ ,  $p > 0.05$  in Chinese than Malaysian participants of Malay ethnicity were in the Malay language. However, there was not much difference in fluency of writing,  $t(15) = -1.69$ ,  $p > 0.05$ , between the Chinese and Malay participants. This implies that despite living in the same geographical area, participants with Chinese ethnicity found it comfortable to access information in Chinese language.

#### 4.2.2 The website in Malaysia

Lelong.com.my was, at the time of the writing of this article, a popular Malaysian auction website started in 1998 and a pioneer of the e-auction sector in Malaysia<sup>6</sup>. It sold products and accessories such as books, comics, watches, pens, clocks and electronic appliances. At the time of the writing of this article, approximately 75% of website's visitors were in Malaysia and the website had attained a traffic rank of 21st in the country. The estimated percentage of global internet users who visited the website was 0.0262%. The average load time for the website was slow (1.834 Seconds), with 64% of websites were loading more quickly. An estimated daily unique page view per user was 9.9 pages and users spent an average of 8 minutes and 35 seconds per visit. A set of 38 cards representing the content of lelong.com.my were developed and used in card sorting.

#### 4.2.3 Card sorting results

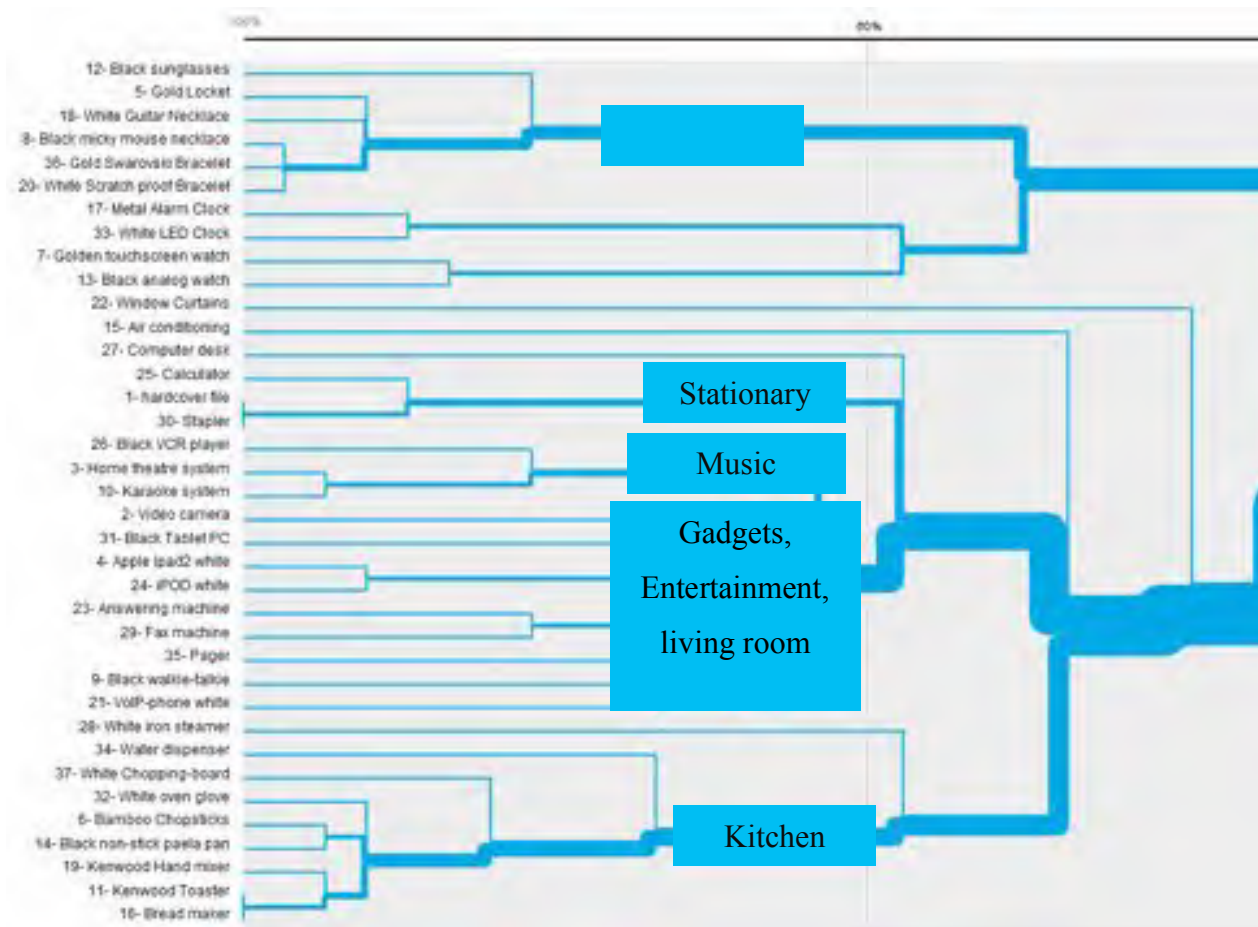
The results of the card sorting activity showed that participants sorted the cards into an average of 6.03 ( $SD \pm 2.40$ ) first level categories and 4.76 second level categories. There was a great variance ( $SD \pm 5.24$ ) in making second level categories. More than half of the participants (55.26%, or 21 of

<sup>6</sup> <http://ecommerce2009-311f.blogspot.com/2009/02/review-local-e-commerce-site.html>

38) also made second level categories. Among those who made subcategories, averages of 7.33 subcategories ( $SD \pm 5.05$ ) were produced.

As in case study 1, we used a threshold of 60% agreement of items between participants. The analysis of cards using dendrogram showed that participants agreed on card placement for most of the cards (89%, or 33 of 37). The level of agreement for grouping varied between the participants. For example, most of the participants agreed 90% to place the two types of watches and clocks together, but the agreement to place all four items, *Metal alarm clock*, *White LED Clock*, *Golden Touchscreen watch*, *Black Analog watch*, together was less than 60%. The participants clustered items into five main groups (accessories, stationary, entertainment, living room and kitchen appliances), and two smaller groups (clocks and watches). Figure 4 shows how participants clustered the items into different groups. The main cluster shows that participants agree to place one third of the total cards (32%, or 12 of 37) into a single category with sub-themes of communication, technology and living room.

The participants clustered items into major groups with an average of 7 cards, ( $M \pm SD$ ) ( $6.0 \pm 3.0$ ). The biggest cluster shows that participants agree to place many cards (9 of 37 cards, or 24.32%) in a single theme. The participants provided different labels for this group including “gadget”, “entertainment” or “living room”. The same number of cards (9 of 37, or 24.32%) was placed in the theme of kitchen. The other theme of music and stationery had 3 cards (8%) each were mainly used by participants of the study.



**Fig.4.** The dendrogram of participants' website structure for the Malaysian ecommerce website

#### **4.2.4 Information acquisition results**

The participants' success rate in finding the required information was low. Many of the participants were unable to find information within the time limit. A time of three minutes was again provided to the participants to find the target information. The average success rate to find information decreased when the information was placed deeper in the hierarchy. Table 6 shows the goal achievement time and the success rate of the participants of the study. There was a positive correlation between the optimal path clicks required to reach to the destined information, and the average time it took for all participants (Pearson  $r = 0.87$ ) and for successful participants (Pearson  $r=0.86$ ) to find the information. Table 6 shows that in order to find information placed deep in the hierarchy, participants had to try more alternatives in the classification and thus spent time more time on the task.

**Table 6:** Goal achievement times and success rate

<i>Goal</i>	<i>Optimal Path clicks</i>	<i>Goal completion Time</i>	<i>Successful participants goal completion time</i>	<i>Success rate</i>
<i>Goal A</i>	1	101	64.46 ± 46.04 (26 of 38)	68 %
<i>Goal B</i>	2	101	64.50 ± 47.49 (26 of 38)	68 %
<i>Goal C</i>	2	119	83.96 ± 41.99 (23 of 38)	61 %
<i>Goal D</i>	3	151	114.41 ± 53.68 (17 of 38)	45 %

#### 4.2.5 Results of website use in local and English language

Malaysian participants were asked about the accessibility and use of websites in local languages as well as in English language. Participants stated that they opened websites mainly in both languages. Participants stated they stayed on English language web pages for a longer period of time than on local language web pages. On local language websites, participants largely spent between 1 and 10 minutes whereas they would spend more than 10 minutes to browse for information on English language web pages. Table 7 provides an overview of participants' browsing of web pages in English versus in local languages. When the participants were asked about the biggest general problem in the use of websites in their local languages, most participants (55%) stated that they were unable to find information in their local language. Some of the participants further stated that it took too long (29%) and that links often did not work (29%).

**Table 7:** Browsing web pages in a session in Malaysia

	<i>Local language websites</i>	<i>English websites</i>
<i>Do not Open it</i>	2 (5%)	0 (0%)
<i>Less than 1 minute</i>	6 (15%)	3 (7.9%)
<i>1-10 minutes</i>	17 (44.8%)	7 (18.4%)
<i>10-30 minutes or more</i>	13 (34%)	28 (73%)

### 4.3 Focused case comparison

We now compare the case study 1 and case study 2. We focus on participants' classification, information acquisition, language fluency and their language preferences for website use.

#### 4.3.1 A comparison of case study 1 and case study 2 participants

A comparison of the participants' demographics, language fluency and internet fluency in case study 1 and case study 2 is given in table 8.

**Table 8:** Demographics, language and internet fluency

Country	Age ( $M \pm SD$ )	Education ( $M \pm SD$ )	Computers at home ( $M \pm SD$ )	Internet at home ( $M \pm SD$ )	English Fluency		
					Reading ( $M \pm SD$ )	Writing ( $M \pm SD$ )	Speaking ( $M \pm SD$ )
Pakistan	20 ± 1.6	14 ± 1.0	6.5 ± 3.0	3.5 ± 3.1	3.07 ± 0.6	3.1 ± 0.6	2.5 ± 0.7
Malaysi a	24 ± 1.7	15 ± 1.5	8.6 ± 4.0	7.31 ± 3.7	3.39 ± 0.7	3.0 ± 0.6	3.0 ± 0.6

Malaysian participants were slightly older than Pakistani participants therefore Malaysian participants had spent slightly more years in university than Pakistani participants,  $t(66) = -1.95, p < 0.05$ . In term of number of years of home computer use, there was no significant difference between Malaysian and Pakistani participants,  $t(66) = -1.77, p > 0.05$ . There was, however, difference in internet access at home between participants in Malaysia and Pakistan,  $t(66) = -2.96, p < 0.05$ , and for computer access at home,  $t(66) = 3.87, p < 0.05$ . Malaysian participants had computer and internet access in their homes for longer period of time than Pakistani participants.

For language fluency, English language fluency was compared between Malaysian and Pakistani participants because it was commonly used and spoken as a second language by both countries' participants. The language fluency result shows that there was no difference in fluency of reading,  $t(66) = -1.96, p > 0.05$ , and fluency in writing,  $t(66) = 0.145, p > 0.005$ , of English language between the Pakistani and Malaysian participants. In contrast, Malaysian participants' English language speaking fluency was better than that of the Pakistani participants,  $t(66) = -3.40, p < 0.001$ .

#### 4.3.2 Comparison of Contents

We compared the average number of 1st level categories on the items page of websites on both websites. Since many of website pages contained descriptive information such as a user agreement, privacy policy, events, and store promotions, we decided to calculate the average number of 1st level categories for those only pages that contained items categories. The average number of 1st level categories on items pages of case study 1 was 17.53 (SD ± 18.53), whereas case study 2 had

20.66 (SD ± 15.17) 1st level categories on average. This means that the Malaysian website had a greater number of 1st level categories than the Pakistani website.

#### **4.3.3 Comparison of Classification results**

When comparing the classifications performed by the participants in the two studies, there was no significant difference in term of participants' views, in term of groups of information and information acquisition of classification between case 1 and case 2. Participants made similar numbers of categories of contents in the two groups. When comparing the dendrograms from the participants' classifications in the two studies, participants behaved in a similar manner and there was not much difference in term of participants' agreement between each other.

However, in term of providing information in sub-categories, the participants in case study 2 constructed a greater number of sub-categories than the participants of case study 1. This is where we found qualitative differences in the information classification between the two countries' user groups.

#### **4.3.4 Comparison of Information acquisition results**

In the participants' information acquisition activities in case study 1 and 2, there was a positive correlation between the optimal path clicks required to reach to the target information, and the average time it took for successful participants to find that information. In 'Goal A' in case study 1, the information acquisition time was high despite an optimal click path of 1. The participants of study 1 pointed out that the text size and the location of the information was not appropriate, making it difficult to find the information despite it having an optimal path of 1. We noticed that in case study 1 the central members of categories, in the users' view were presented in some categories which were not central. Participant 1 expressed that:

*There was lots of confusion when I was searching for information on the website. [These categories of] electronic, kitchen electronic and home electronics, I thought that electronic MUG should be available on the website in the category KITCHEN ELECTRONICS, but it was not available in any of the categories. They provided lots of names of same category. It should have been in general ELECTRONICS category. [Participant no. 1, Pakistan]*



In ‘Goal 4’ of study 2, the information was placed at an optimal click path depth of 3. The information was placed deep in the website’s hierarchy, and the success rate of the participants was correspondingly low (45%), with a goal completion time of 151 seconds.

#### **4.3.5 Comparison of website use in local language and English language**

In terms of the use of the websites in local languages, in case study 1 (Pakistan) half of the participants did not use any websites in their local language. However, in case study 2 (Malaysia) only two participants (5%) stated that they did not open local language websites. When asking the participants about their preference for English language websites, they stated that there was more information available in English, and that they did not have problems with searching for information in English language because local language (Urdu) websites had inferior search algorithms. In case study 1 (Pakistan) the participants also expressed that they looked for information in English generally because they were students and most of their studies were conducted in English.

## **5 Discussion**

The results from our study indicate that we can explain users’ information classification and acquisition behaviour in Pakistan and Malaysia by taking into account both within-case and cross-case patterns. These will be discussed here in relation to the theories introduced in the background section of this article. Our focus will in particular be on the cultural-fit of website structures, language use on websites, and regional differences in information classification and acquisition behaviour.

### **5.1 Cultural fit of website structure and information acquisition behaviour**

In the card sorting study of information classification, we found issues regarding users’ views of central versus non-central members of categories. For example, when studying how information was placed on a website, we found that users in Malaysia saw non-computer items such as hardcover files, staplers, and calculators as *central* members of a category of ‘Office Stationary’,. This and similar cultural specific classification behaviours regarding website structure go back to a fundamental concern in the theory of information classification. The prototype theory of information classification points out that some members of a category are more central than others in a categorical system (Bowker & Star, 2000). The less-central members of a category are a

challenge for designers as they plan information placement. Bloor (1982) explained the philosophical description of categorization by stating that no categorization can stand alone – when a new member is added to a class, this has ramifications both for the class and for the larger system of which it is part. This position of philosophical understanding supports the idea that classification is shaped by the conventions of a community of practice. Therefore, if the classification of one community is brought into another social setting, the classification system will have to change and adapt. These classifications change further when new members or information are added, such as into the structure of websites.

We found both differences and similarities in information acquisition behaviour between Pakistani and Malaysian student users of ecommerce websites. The Pakistani users could acquire information nearly as fast and as well as their Malaysian counterparts despite there being fewer items available on the Pakistani website's first level category. One reason for such similarity in information acquisition behaviour between two culturally different user groups may be that the users' culturally specific information classification preferences may vary across the two user groups, but that the website structure does too – thus, the fit between users' classification and the website's structure would remain within the same range. Any differences between the two user groups will then be small.

We found that users in Pakistan had problems with inconsistent website structure design. The structure of the studied website in Pakistan did not display information items in categories with a consistent set of properties. The structure seemed to follow neither Rosch's (1978) prototype approach nor a defining attribute approach. Instead, items were displayed according to different properties. For example, when a Pakistani user searched for a fax machine of a particular brand on the website, he expected this to be under the category of 'Telecommunication', but it was instead located under 'Office equipment'

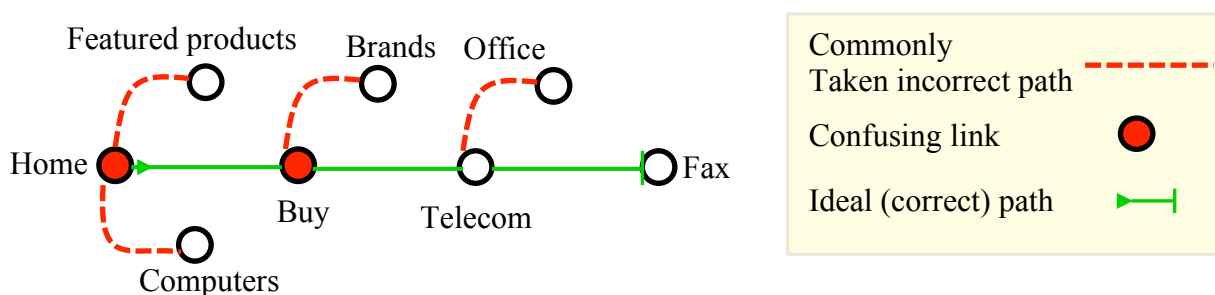
*Thinking of Fax machine, I think it can be found in office appliances category but on the other hands; I also use it in my home so I should be able to find information in home appliances.*

(Participant 16, Pakistan)

Similarly, when Pakistani users tried to find an electrical trimmer of a particular brand, it was not placed in the website structure under that brand. However, other items which users might find similar to an electrical trimmer were actually located under the brand category. Again these items

were only displayed under the brands and were not displayed under the category of ‘electrical appliance’ and also not under ‘beauty and care’. One possible explanation for such an inconsistency could be that website designers of ecommerce sites may frequently try to place items according to a ‘natural order’ (Norman, 1991) to encourage customers to buy them – much as with the sequence of buying experienced in physical supermarket in which the customer is encouraged to move through the space in a specific order. However, we found in our study that for Pakistani users such inconsistencies in terms of how items with multiple characteristics were placed in a category was confusing and increased the navigation burden.

Figure 5 illustrates users’ information acquisition behaviour on the Pakistani website in our study. It illustrates that many users clicked on confusing or incorrect links in the process of finding the required information.



**Fig.5.** Overview of user’s information acquisition behavior

Users have various approaches to acquiring information (Norman, 1991). For example serial manner strategy of information acquisition brings the issue of serial or repeated failure, increasing users’ navigational burden. On the other hand, random inspection information acquisition with replacement provides users cues about the web pages they have already visited. These cues can be seen through the color-change of clicked links.

## 5.2 Bilingual users and the importance of language in websites

The study showed that every second local user never uses a website in their local language. There is a relationship between the users’ language preferences for websites and those languages’ status in the wider society. In case study 1, although the official languages of Pakistan are Urdu and English, users spent far less time on websites that only had information in Urdu. This was not because of fluency, however, as there was no significant difference in their reading and writing in English and Urdu and users preferred to speak Urdu rather than English. Thus, the choice of language is not simply due to comfort levels with one language over another. In Pakistan, the users also used

English more because it was seen as a language of upward mobility. The usage of information in English helped users in developing their English language skill. Other factors such as ‘availability of information’ also played important role in users approaches. For example one of the users in case study 2 was of the view that:

*I use English website for longer period of time compare to the Malay [language websites] because it takes me more time to go and find information on English [language] website. Still I like to find information in English because most of the things can be found on the English website. (Participant 7, Malaysia)*

Bilingual users who use websites in two languages understand the information structure in a standardized categorical system (Nielsen, 1999). The standardizations of the categorical system help to achieve which Nielsen (1999) calls consistency in the integration of websites. It helps users to remember the positioning of information in two different languages. One user stated that:

*The information in two websites should not affect the location of the items on different websites because it does not change the characteristics of the product. For example, if we are searching for a fax machine, the characteristics of the fax machine will remain same, because it is used in the offices and it is related to communication, electronics. (Participant 27, Malaysia)*

The issue of bilingual users brings users’ reasoning behind their language choice and priorities when visiting local and global websites into focus.

### **5.3 Information classification and acquisition on websites: Pakistan/Malaysia versus Denmark**

When comparing our findings on information classification and acquisition on websites from Pakistan and Malaysia to the previous study ( ), it appears that the structure of the websites in the two Asian countries did not fit well with the user’s view of the world when comparing with previous study. The users’ navigation burden was higher compared to the findings on in Denmark and they found it harder to find information on the particular local websites studied. Our study points out that the localization of contents not only includes the contents themselves, but is also a process of developing and tailoring information to the users’ culture. Using the norms and metaphors prevalent in a certain cultural group, for example, provides an understanding of a

website's standardization to a population that goes beyond mere information structure standardizations.

#### **5.4 Beyond Information Classification**

In recent times, the optimization of search algorithms has changed the way users seek information. During the interviews, many participants stated that they usually looked for information through keywords because information retrieved through keywords them from navigational burdens.

*I usually use search option to find information. I use the keyword to save time. (Participant 1, Malaysia)*

Digital fluency may help users to prioritize their preferences in their use of technology in different languages (Wang et al., 2012). In that regard, even though the classification system may not fit with a user's mental model, the use of a system over a period of time may make it easier to memorize information locations. This again results in a decrease in the user's navigational burden. Two of the participants in Malaysia expressed related thoughts:

*When I went to South Korea.... so I joined their social networking website... it took me some time to learn the pattern of the website. There were plenty of information in each page but once I learned the pattern and locations, it made it very quick to search information. (Participant 27, Malaysia)*

*If I can give you the example of Apple [consumer electronics] products, I think it is the same, the users have to go through their patterns, and once the users go through the locations, it makes it faster for them to search information on different location. (Participant 28, Malaysia)*

As people are increasingly acquiring information from their smart-phones and tablets, designers are expanding beyond using menu-based structures to provide users with information. For example users are provided with tagged information. Tagging systems can be customized and can structure the way users interact with the systems. This approach also comes with own limitations, however. For example, in the presence of a large number tags, users find it difficult to recall the tags relevant to their task, even though they are of basic nature (Ravendran et al., 2011). It should, therefore, be possible to customize and modify information to suit individual needs and preferences to increase the cultural fit between users and IT systems (Clemmensen, 2012). We recommend that

there should be a cultural-fit for websites that takes users' information classification into account and at the same time, educate users by providing a universally known website structure.

## **6 Conclusion**

We conclude that taking users' views of information classification into account can be seen as a simple and practical way to improve the usability of local websites for culturally diverse user groups, such as are present in Malaysia and Pakistan.

The study has shown that for information classification, users in these two cases constructed information in a similar way. The study has also shown that there are subtle differences in users' preferences for use of language for websites. In Pakistan, participants used websites in English as it was seen as the language of upward mobility. The interaction of users with websites helped them not only to find information, but also polished their English language skills. The study has also shown how the card sorting technique can be easily used in studying cross-cultural users' views of information structure.

From a theoretical perspective, the study endorses the idea that information classification and information acquisition are not merely a classification problem. Rather, they are tied to the things people do in a local culture. The tension between standardizing versus contextualizing the classification of items in a website always remains a question to explore in information systems. People draw their conception of classification from the social activities they perform and their navigational burden on a website increases when they are forced to use a classification which does not fit their view of the system.

Finally, the study indicates that the localization of information does not only concern the contents of a website, but is rather a process of developing, tailoring and addressing users' cultural market issues such as information structure, colors, language of website. It is a process of using the norms and metaphors practiced in a group. Other issues, such as font size and the presentation of contents in categories aligned with users' view of categories, should also be considered. Digital fluency and users' frequent use of a classification system might also change their navigation burden and behaviour on websites.

In future research, the issue of navigation burden needs to be studied further. In terms of the classification of artefacts in information systems, we need to study how classifications on websites can be modified over a period of time in such a way as to take input from users' strategies of information seeking, gathering and consumption.

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## **Appendix 1d: Research Article 4**

### **A Comparison of Card-sorting Analysis Methods.**

**Nawaz, A.** (2012). A Comparison of Card-sorting Analysis Methods. Proceedings of the 10th Asia Pacific Conference on Computer-Human Interaction (Matsue, JP, August 28-31). pp. Vol. 2, pp. 583-592. ACM Press, New York.'

# A Comparison of Card-sorting Analysis Methods

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## ABSTRACT

This study investigates how the choice of analysis method for card sorting studies affects the suggested information structure for websites. In the card sorting technique, a variety of methods are used to analyse the resulting data. The analysis of card sorting data helps user experience (UX) designers to discover the patterns in how users make classifications and thus to develop an optimal, user-centred website structure. During analysis, the recurrence of patterns of classification between users influences the resulting website structure. However, the algorithm used in the analysis influences the recurrent patterns found and thus has consequences for the resulting website design. This paper draws an attention to the choice of card sorting analysis and techniques and shows how it impacts the results. The research focuses on how the same data for card sorting can lead to different website structures by generating different set of classifications. It further explains how the agreement level between the users can change for similar data due to the choice of analysis.

## Author Keywords

Card sorting; website structure; Method; Comparison; HCI; Classification

## ACM Classification Keywords

H5.2. Information interfaces and presentation

## INTRODUCTION

A number of studies of user-centred design (UCD) for websites use card sorting in the design, development and evaluation process of website structure. UCD approaches put the users of a website at the centre of the design, development and evaluation. Different approaches to evaluation, such as focus-groups, usability testing, cards sorting, participatory design, questionnaire and interviews are used as part of this process [1].

The choice of card sorting technique in usability studies has implications for the results of the resulting website's structure. The card sorting method is used to understand how users classify and structure website content. Data collected from multiple participants is compared between participants and with existing website structure. The comparison of the card sorting results between different participants is intended to achieve the best website structuring for a given domain of website. The domain of

websites may include e-commerce websites, academic websites, healthcare websites or other such domains. The best structure of the websites is achieved by evaluating how users agree on structuring contents into categories. This users' intended structure and attributes for the website is compared to the existing content structure of websites.

## Card Sorting and Analysis

The term card sorting applies to a wide variety of activities involving ordering, grouping and/or naming of objects or concepts. Card sorting is an established, intuitive method for understanding users' mental models of website structure. It is used frequently in software development, evaluation, and product design to understand the clustering of information and relationships between information from the users' perspective. Card sorting is used to group items into categories and to understand users' mental models of organization of website contents. In brief, in card sorting each card has a statement or product written on a card that relates to a page of the website, and these cards are then sorted by participants into relationships they find meaningful.

This paper argues that the choice of techniques and tools for card sorting has consequences for the ascertained website structure. In analyzing card sorting data, the data of multiple people is combined to determine an appropriate website structure. Thus, the data of multiple participants is analyzed in a variety of ways to come up with the aggregative sorting. Some studies use qualitative methods to analyze the data, looking for patterns in the sorts [2]. In this case, attention is paid to synonyms, concepts and themes in the sorting. Quantitative analyses for card sorting, on other hand, use different tools to interpret the users' sorting. These tools use algorithms such as cluster analysis and similarity matrixes to arrive at an interpretation [3]. A result can also be obtained by considering how far users place their cards from each other and how many steps are required to change one user's sorts to another user's sorts [4]. All such tools look for agreement in the patterns of uses' sorts. The most agreed-upon pattern is then used as the basis for the new website structure. In these sorts, there are number of cards for which users do not particularly agree on a specific placement. The choice of analysis for card sorting affects these cards most of all where users do not agree between each other.

There are two major types of card sorts used in most studies, the open card sort and the closed card sort. In an open card sorting study, users are presented with unsorted packs of index cards. They are asked to sort these cards according to their understanding and to label them. In a

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closed card sort, predefined groups are provided and users are asked to sort cards into these groups.

A problem which may arise during card sorting is that the choice of analysis and tool might impact on the resulting website structure. Most studies provide an analysis and visualisation of users' classifications that explains the agreement of users on the clustering of groups, but does not examine the logic used to conduct the analysis.

In fact, when determining the information structure of any website through card sorting, there is often considerable disagreement in the way users organize the cards into groups [2]. Despite their general similarities, users may vary in their mental models for organising concepts in a structure.

There is a need to understand the card sorting analysis and logics used in card sorting analysis because many of the websites determine their structure after conducting analysis of card sorting experiments. Still users find it hard to navigate on the websites despite adopting user-centred design approaches. The information architecture of websites represents the underlying structure that give a shape and meaning to their content [5]. Regarding the structure for navigation, the focus should therefore be given on users' view of the world for websites structure and understanding users' view of the world is vital to design optimal information structures of websites. The website structures are getting very large, and interaction is seriously limited by the available resources of the space of the screen. The users always look to get to the information quickly. A better understanding of how users conceptualize website structure can improve the quality of websites.

The perception of webpages' quality can also differ according to culture. Therefore, card sorting is also used to elicit cross-cultural perceptions of web page quality and structure [6] and to understand the attitude of different groups of users to a given system [7]. The use of different analysis in card sorting such as edit distance analysis, cluster analysis through similarity matrixes, and comparative analysis (i.e., thematic vs. taxonomic analysis) is common in the research studies of card sorting [2, 4, 8, 9]. Studies of website design use a variety of analysis for card sorting to come up with the user-centered structures for websites. Some of the studies conducted usability analysis of card sorting tools. However, few studies have conducted a comparison of the logic behind these tools used in card sorting.

### **Research Aims**

This research paper aims to document how the choice of technique for card sorting has implications for the resulting website structure. The results produced through analyses of three techniques not only show different patterns of agreement by the users for the same data; but also different explanations of the data. This study shows that the choice of three methods of analysing data (analysis of edit distance, analysis of best merge method and analysis of actual merge method) has consequences for the resulting structure of the websites. These three analyses for card sorting are chosen because they are

interesting from a research point of view. All of these techniques claim to determine an optimal solution for website structure in their own ways. Analysis of actual merge method (AMM) and best merge method (BMM) combine multiple card sorts into an aggregated card sort. The AMM and BMM are derived from cluster analysis. These two techniques are widely used in the industry to see the patterns of users' card sorting. AMM and BMM explain visual aspects of data with the analysis. Edit distance is used in academic circles to reflect on the variation in users' card sorts. It counts the difference between two sorts at a time and looks for one or more sorts that are central to all other user sorts.

The article is organized as follows. We begin by explaining why different structure matters. Different analyses for card sorting will be described afterwards. We then examine the data of 38 users through the analysis of edit distance, AMM and BMM. Finally we conduct a comparison on how data reveals different aspects of users' agreements. Then we will discuss the effect of number of users on the card sort and the threshold effect on the structure produced through card sorting.

### **RELATED WORK**

#### **Different Structures Matter**

Different website structures matter to people's ability to navigate and find information. According to different structures, the contents of a website go into different levels of hierarchies. Different levels of hierarchies and locations of contents affect users' response time and success in finding information. Website structure becomes important when users look for information on a website at different levels of hierarchy. Allen investigated the effect of information depth on the response time and error rate at each hierarchical level of a website [10]. Response times became longer for searches deeper into the website, and users made more errors when the information to be retrieved was at deeper levels. Our previous study showed that there is some disagreement in how the users structure the contents of a website [2]. Further, websites often use different classification and navigation structures such as linear, tree, network, and global structures [11, 12].

Different structures matter because users have a tendency to perceive website structures in different ways. Users may perceive and group information in a thematic or taxonomic structure, for example, grouping items in a thematic classification are related to each other through a coherent story or situation [2]. In a thematic classification of a banana, monkey and panda, the two items banana and monkey go together via a classification based on eating habits and a coherent story of the situation of a monkey eating a banana. In a taxonomic structure, users classify items into groups according to the function or inferences drawn from the items in the group. The items are related to each other through higher level abstractions, or property [2]. Using previous example, in a taxonomic classification, monkey and panda go together in the same group because both are mammals.

Some studies have conducted analyses of card sort through comparison of different tools for card sorting [3, 5, 6]. Chaparro et. al. compared commercially available electronic card sort applications [3]. The study focused on user satisfaction, performance, usability and preference of card sorting tool. Results of the study indicated different preferences for the two user groups. Researchers who participated in the study preferred WebSort for creating and analysing the card sort. The end users preferred OpenSort for completing the card sort exercise. The study focused on the interface and functionalities of tools and did not look into the method which is used to conduct the analysis of card sorts. Katsanos et al. used semantic similarity between words, phrases and passages of user data to come up with an aggregative sort of webpages [5]. Katsanos et al. introduced a computational tool, autoCardSorter, which supports clustering of the web pages of a site. Petrie et al. investigated the difference between online card sorting and on-site card sorting [6]. Their study looked into the preferences between online card sort and offline card sort and found that online card sorting took significantly longer for non-native English speakers than native English speakers.

Most of studies which conducted analysis of card sorts did not look into the techniques and logics which are used in the card sort tools. Instead these studies tested the usability of tools, efficiency and effectiveness of users and preferences of user groups between online tools for card sorting and offline card sorts.

#### **Card Sorting Analysis Work in Different Ways**

There are different ways in which the card sorts of different participants can be compared in order to create an aggregative sort. Here we discuss some of the ways used to carry out this process.

A number of studies have used different techniques to analyse card sorts. Some of techniques examine the difference between the users' sorts. The University of Illinois at Chicago library redesigned their library website by conducting open card sorting studies and analysed the card sorts through factor analysis [13]. The study pointed out that qualitative analysis of data is also important in addition to Factor analysis. In the Katsanos et al. study the clustering during the design was built through taxonomical, statistical and hybrid techniques [5]. The taxonomical technique calculated the path length between two node-words. The taxonomical technique ensured a certain quality of the results because it involved human coding in the clustering of the words. It made it possible to model multiple synonym words. The statistical analysis used the probability of co-occurrences of captured text and clusters them together. The statistical analysis relies on machine learning of synonym words. The hybrid analysis combined the taxonomies of concepts with statistical properties of a text [5].

Petrie et. al. conducted a comparison of onsite card sorting data collection with the offsite data collection [6]. The onsite data collection was conducted through open card sort without using online tool for users' input. The offsite data collection used web portals and online card sorting tools for data collection. The outcome of the

studies showed that the online version of data collection took a significantly longer time to complete than the onsite version. Kralish et al. compared card sorting results across Malaysian, Russian, British and German students [14]. The study used ranking of cards to come up with the final aggregative sort. The aggregative grouping was based upon the users' ranking of which information on the cards was most useful. Nawaz et al. conducted a qualitative analysis of card sorting to see if individual users grouped items according to a thematic classification or a taxonomic classification [2]. Martine and Rugg used co-occurrences matrixes to assess the similarity of webpage designs through card sorting [15]. The co-occurrence matrix shows how often a respondent places any two cards in the same group. Curran et al. investigated podiatrists' perceptions of expert systems in relation to their perceptions of other diagnostic of diseases through card sorting [7]. The study used multiple criteria to come up with an optimal sorting of expert systems. Petrie et al. used edit distance to see how users group items in a similar or different way [6].

#### **Best Merge Method**

The best merge method (BMM) is a technique based upon similarity matrixes and is the industry-standard. In brief, the similarity matrix counts the frequency of co-occurring pairs in the cluster [18]. Once all groups are broken into pairs, the method finds the most frequent pairs in all groups and constructs new groups out of those pairs. In other words, the best merger method accumulates the pairs of cards which are placed by the different users in the same group. The best pairs in the users' sorts are found and merged to form a group which is then assumed to be consistent.

#### *Scenario 1:*

X: [a, b, c] (1 group with 3 cards)

Y: [a], [b], [c] (3 groups with a card each)

Z: [a], [b], [c] (1group with 1 card)

Result of BMM = 1 x [a, b], 1 x [a, c], 1 x [b, c]

#### *Scenario 2:*

X: [a, b], [c]

Y: [a, c], [b]

Z: [a], [b, c]

Result of BMM = 1 x [a, b], 1 x [a, c], 1 x [b, c]

The pair reduction process in scenario one and scenario two has produced identical results for two different scenarios. The BMM only works by merging the pairs, so it does not reconstruct the original data.

#### **Actual Merge Method**

The actual merge method (AMM) works by looking into whole groups, rather than pairs, taking an inheritance perspective on information architecture and applying it to card sorting.

#### *Scenario 3:*

X: [a, b, c]

Y: [a, b], [c]

Z: [a, b], [c]

Result: of AMM = 1 x [a, b, c], 3 x [a, b]

$$\text{Disagreement \%} = \frac{\text{Avg. Neighbourhood Distance}}{\text{Total Number of cards}} \times 100$$

The AMM counts each instance of a complete group from every user. Each group with a non-zero score (a "real group") inherits the base score (i.e. before inheritance) of all superset groups. The group with the highest score is taken, and all conflicting groups are eliminated. The scores that the AMM analysis provides give an exact account of "X%" of users agree these should be grouped together.

#### *Edit Distance*

Edit distance is based upon a distance function that measures how far apart two card sorts are. The distance is considered to be the minimum number of stages required to convert one sort into another sort, where one stage consists of moving one card from one group to another group.

Consider the following example with two sorts A and B, both consisting of four groups of cards:

A = [A1, A2, A3, A4] and B = [B1, B2, B3, B4]

A1 [1; 2; 3]    B1 [1; 2]

A2 [4; 5; 6]    B2 [3; 4]

A3 [7; 8; 9]    B3 [5; 6; 7]

A4 [ ]            B4 [8; 9]

Sort A can be converted into sort B by moving items between groups. A minimum set of moves is as follows: move 3 from A1 to A4, 4 from A2 to A4 and 7 from A3 to A2 [4].

After the moves:

A1 [1; 2]

A2 [5; 6; 7]

A3 [8; 9]

A4 [3; 4]

Thus, the 'D' function has a value of 3 because there were three moves needed to convert A into B. The most immediate application of the edit distance metric is for determining the similarity between two sorts. This is particularly useful when looking at sorts that use similar criteria [4] and is conducted through finding the "neighbourhood". A neighbourhood is a process of finding the sorts most closely related to a user's sort or to a websites' sort. Neighbourhood provides a measure of the dissimilarity between all sorts and shows which of the sorts is the closest to all the users; whereas AMM and BMM combine multiple card sorts into an aggregated card sort. In the end, all three sorts look to find an ideal user-centred website structure representation. If a single sort has many close neighbours, it may be part of a

common theme in the overall data. Neighbourhood and edit distance are sometime mixed with each other. The edit distance is the method which explains the distance between two users and it uses neighbourhood as a way of analysing the distance between the sorts.

Among other methods, Hierarchical cluster analysis or cluster analysis is used to analyze card sorting. Hierarchical cluster analysis is an individual-directed method [16]. It is a method for assigning items into groups in such a way that the items whose themes are similar to each are grouped together. It focuses on the relationship between the individual items, and items can only appear in a single place in the hierarchy. Hierarchical cluster analysis is used in card sorting studies to see how different users group content. Hierarchical cluster analysis is best suited for data where a clear hierarchical organization already exists [17]. For example, plants are naturally organized into species, then genera, orders, etc. We focused mainly on Edit Distance, AMM and BMM because they are aligned together and can be explained with an approach and scenarios which are common in Edit Distance, AMM and BMM.

#### **METHOD**

In the first stage, data from users is collected onsite through open card sorts. The card sort data of users is analysed using edit distance, AMM and BMM to see how the users' structure provides different organisations of website structure. For the analysis of edit distance, we used UW Card Sort Analyzer<sup>1</sup>, a Windows application. For the analysis of AMM and BMM, we used the web-based tool OptimalSort<sup>2</sup>. In the second stage of the analysis, we interpreted and compared the results collected with the three methods.

#### **Procedure**

Graduating students' organisation of website content was elicited using open card sort. Participants were asked to complete a background questionnaire regarding their computer use, internet use, language use on websites and educational background. They were later asked to perform open card sorts. The participants were given 15 minutes to sort the cards into groups. The time of 15 minutes was decided after conducting a pilot study with 5 participants.

#### **Material**

The participants in the study were provided with 37 2x2 cm cards with a home appliance's name mentioned on each. The cards represented the content taken from a local internet auctions website<sup>3</sup>. The information are organised on the website as shown in Table 1. We took contents from a local website which would most likely present the contents that are common in the studied group. The participants were asked to organise the cards in groups that made sense to them and were asked to write down a group name for specific groups of cards. The participants of the study were told that one card can be placed in one

<sup>1</sup> <http://www.cs.washington.edu/research/edtech/CardSorts/>

<sup>2</sup> <http://www.optimalworkshop.com/>

<sup>3</sup> <http://www.lelong.com.my/>

group and they can make as many groups as they would like to make.

<b>Electronics and Appliances (7)</b>	<b>Kitchen (7)</b>
White iron steamer Home theatre system Karaoke system Air conditioning Black VCR player Calculator Video camera	White oven glove Black non-stick paella pan Bamboo Chopsticks White Chop-board Kenwood Toaster Kenwood Hand mixer Bread maker
<b>Electronics (7)</b>	<b>Personal Accessories (6)</b>
Golden touchscreen-watch White LED Clock Black Analogue watch Metal Alarm Clock Black Tablet PC Apple iPad 2 white iPod white	Black micky mouse-necklace White Guitar Necklace Gold Locket Black sunglasses White Scratch proof-Bracelet Gold Swarovski Bracelet
<b>Phone (5)</b>	<b>Office (5)</b>
Black walkie-talkie Answering machine Pager VoIP-phone white Fax machine	Stapler Water dispenser Window Curtains Computer desk Hardcover file

Table 1. List of cards provided to the participants

Table 1 shows the list of items that were provided to the participants. All the cards were numbered randomly to be used for the analysis. Table 1 shows the items grouped as they are on the original auction website.

### Participants

The participants were 38 undergraduate students at a Malaysian university. The call to participate in the study was advertised on the university notice board. We also applied the snowball method by asking each participant to recommend another participant for the study. Each participant received USD 5 to participate in the study. The study had twenty four (63%) female and fourteen (37%) male participants. Data were collected during summer 2011 following a standard protocol established for earlier study in Denmark and Pakistan [2].

## RESULTS

### Screening Criteria for selected Participants

During the screening of all participants to be used for the analysis of Edit Distance, AMM and BMM, we selected those participants whose classification was easily identifiable for top level group. This screening was conducted because each of tools could not handle multiple level groups. Among all participants, 40% of the participants (15 of 38) made only top-level groups, while the remaining 60 % (23 of 38) participants also made second level groups. We selected the 15 participants who made only top-level level groups because their data was easily identifiable for top-level groups. We further selected 10 participants from those who also made second

level groups in one of the parent groups and treated all the cards in the second level groups under the parent group. We did not treat the cards of all those participants with second-level groups under the parent group because some of the participants made many second level groups under the parent group and treating all the cards in second level groups under the parent group would adversely affect the results. The selection of only 10 participants was conducted through qualitative analysis of the data to see that it would not affect the result by treating the cards in second-level groups under the parent group. With this screening we were left with 25 participants' data.

### Analysis through Edit Distance

In order to evaluate the similarity and difference in the card sort data, we first used edit distance to see how much participants agreed with each other. On average, there were 14 moves taken to change one participant's sort into another participant's sort. Each of the sorts has a closest neighbour at a distance of 14 (SD  $\pm$  3.82) when comparing participants' sorts with each other. The analysis further shows that participants' disagreement was 38% from the original website sort.

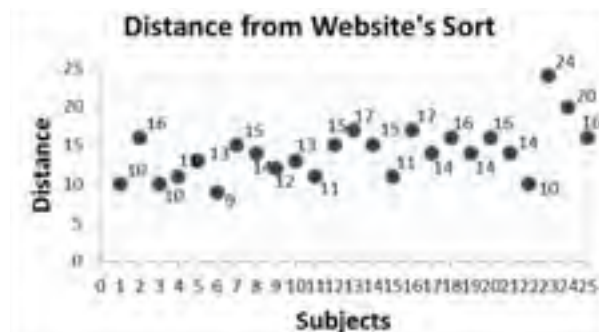


Figure 1. Distance of participants from original sort

Figure 1 shows the distance of the 25 participants' sorts from the original list as it was provided on the website and clearly shows that participants cluster the data considerably differently. The neighbourhood of edit distance provides a general understanding of whether the participants' sorts are close to the original sort as provided on the website. It can also provide information on how far apart each participant is from other participants. We performed analysis between the participants to see how close participants within the studied group were to one another.

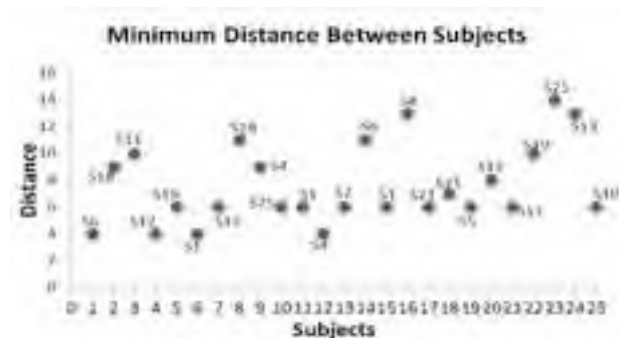


Figure 2. Minimum distance of the participants from another participant in the data

Figure 2 shows the minimal distances from each participant to another participant in terms of neighbourhood. Horizontal line shows each participant and vertical line shows the nearest participant in term of distance. The dots with annotations in figure 2, for example S6 stands for subject 6 or participant 6. It shows that participant one has a distance of 4 from participant 6 in the sort.

The analysis of neighbourhood shows each participant's closest participant of the study. On Average, each participant has a closest neighbour at a distance of 13 (SD  $\pm 2.73$ ). The average disagreement between the participants is quite high, calculated as 35%. The analysis between two participants about the closeness of a single participant with the nearest peer shows those participants who have similar way of clustering contents. On the other hands, it does not provide concrete information about the contents of the data which could be transformed into recommendations for the website structure.

### Best Merge Method (BMM)

We performed an analysis using the best merge and actual merge methods. In both methods, we used a threshold of 60% agreement of items between participants, in keeping

Group 1 (7)	Group 2 (6)
Oven glove Bamboo Chopsticks Kenwood Toaster Non-stick paella pan Bread maker Kenwood Hand mixer Chopping-board	Sunglasses Guitar Necklace Locket Micky mouse necklace Scratch proof Bracelet Swarovski Bracelet
Group 3 (2)	Group 4 (2)
Apple iPad 2 white iPod white	Answering machine Fax machine
Group 5 (3)	Group 6 (3)
Hardcover file Calculator Stapler	Home theatre system Karaoke system Black VCR player
Group 7 (2)	Group 8 (2)
Touchscreen watch Analog watch	Metal Alarm Clock LED Clock
Group 9 (2)	
Computer desk Tablet PC	

**Table 2. List of agreed groups by participant through BMM analysis**

The group names for groups are suggested by participants and established by online tool used for AMM and BMM as: Group 1: *Gadget, Office and Entertainment*; Group 2: *Kitchen, home appliances, Kitchen items*; Group 3: *Accessories, personal accessories, Jewellery*; Group 4: *Clock, Others, Personal accessories*; Group 5: *Stationary, Office, and Office Appliance*.

with Katsanos et al. [5]. A single card is included only if at least 60% of the participants have agreed to group it in the same group in their individual sorts.

The analysis of cards using BMM shows that for almost all of the cards (35 of 37, or 95%), participants agreed 60% and more for card placement in the same group. The participants clustered items in 5 groups with an average of 7 cards ( $M \pm S$ ) ( $7.0 \pm 4.1$ ) in a single group.

Table 2 shows the list of agreed groups by the participants through analysis of best merge method. The analysis of BMM shows that participant substantially agree and that there were only two cards on which the participants of the study did not agree 60% or higher.

### Actual Merge Method (AMM)

The analysis of cards using AMM suggests that with an agreement of 60% for the cards where the cards have been grouped in the same group by all participants in their individual sorts, the participants do not agree greatly between each other and sort the items in groups with small numbers of cards. The participants agreed 60% and above for card placement in the same group for relatively fewer cards (29 of 37, or 78%) in comparison to the BMM (35 of 37, 95%). With an agreement of 60% and above about the grouping of cards in the similar group by individual participants and above for the cards, the AMM analysis showed that participants clustered the items in 9 groups with an average of 3 cards ( $M \pm S$ ) ( $3.2 \pm 1.9$ ) to a group.

Group 1 (13)	Group 2 (9)
Video camera Tablet PC Pager Computer desk VCR player Home theatre system Karaoke system Answering machine Fax machine VoIP-phone white walkie-talkie Apple iPad 2 white iPod white	Iron steamer Water dispenser Chopping-board White oven glove Bamboo Chopsticks Non-stick paella pan Kenwood Hand mixer Kenwood Toaster Bread maker
Group 3 (6)	Group 4 (4)
Sunglasses Guitar Necklace Gold Locket Scratch proof Bracelet Micky mouse necklace Swarovski Bracelet	Touchscreen watch Analog watch Metal Alarm Clock LED Clock
Group 5 (3)	
Calculator Hardcover file Stapler	

**Table 3. List of agreed groups by participant through AMM analysis**

The analysis of AMM indicates that participants did not agree as substantially with each other. The participants



grouped most of the cards in fragmented groups and the agreement for 8 of 37 cards ( Video camera, VoIP phone, Walkie-talkie, Pager, Window Curtain, Water dispenser, Air conditioner, iron Steamer) was below 60%.

Table 3 shows the list of agreed groups by the participants through analysis of actual merge method. The group names for groups are suggested by participants and established by online tool<sup>1</sup> as: Group 1: *Kitchen appliance, Kitchen Household, Kitchen*; Group 2: *Jewellery, Gold Accessory, Accessory* ; Group 3: *Apple*; Group 4: *Machine*, Group 5: *Stationary, Office items, Personal*; Group 6: *Entertainment, Electrical Equipment, Living room appliances*; Group 7: *Watch*; Group 8: *Clock*; Group 9: *Study room, Computer Laptop* In analysing the same data with is used with two different methods (AMM and BMM). The results show different interpretation of how participants grouped items. Appendix A1 shows the comparison of AMM and BMM. The results show the variation in the agreement and the outcome of the users' sorts for website structure.

## DISCUSSION

The comparison of card sorting analysis techniques revealed how the choice of technique can have an impact on the resulting structuring suggestions for a website. It also revealed that different techniques not only highlighted the different aspects of the data, but also confused the results for taking action and implementing a website structure. Secondly, in card sorting analysis, the eventual design of a website structure depends a great deal on the basis of structures created by the participants in a study. When different tools are used to analyse the data, the limitation created by the tools may potentially obscure or confuse insight into the users' sorts.

As the results of studies show, users tend to place information in different orders. Therefore the information classification on a websites should match the local users' way of perception for information classification. From usability aspect of website structure on the basis of card sorting, the structure of the websites should not merely come from the analysis of card sorting, but should be evaluated by subsequent usability testing.

The result of three techniques reveals that edit distance is slightly different from AMM and BMM. Edit distance provides a measure of the dissimilarity between all sorts and shows which of the sorts are the closest when compared with all other users. It points towards those user(s) who are central in card sorts, having the most in common with others. The analysis of AMM and BMM shows that it combines multiple card sorts into an aggregated card sort and approximates an agreement between different users on each card of the card sorting study.

The analysis of edit distance presented the data of users in two ways: a) comparing each of the users' sorts with other users' sorts and b) comparing each user's sorts with the original website's sort. To compare each of the users' sorts with other users' sorts provided an understanding of how some users were close to each other in terms of their mental models of the structure of the website. This

information also highlighted the dissimilarity of users in their structuring approach and their disagreement as a whole but it did not highlighted each card's agreement level by the users as it could have been done through the visualisation of AMM and BMM. The neighbourhood did not provide the level of agreement of each item in the sort between different users of the study; it only showed the general level of agreement between users. Comparing users according to edit distance thus provided a general picture of the level of disagreement between users.

The minimum distance of a user from another user in the data indicated their level of agreement or disagreement, indicating the closeness of each user's sort. The analysis of edit distance was useful in understanding the impression of what extent the users were different in their structure from each other and to what extent the users were different in their structure from website structure. However, the interpretation of the results was difficult transform into a meaningful recommendation. The meaningful recommendation could not easily be determined because analysis of edit distance did not provide the contextual understanding of the result for each card. It was therefore difficult to translate information into meaningful representations which could be used to make decisions concerning website structure. Edit distance does not produce an aggregate categorization on the basis of multiple categorizations, but rather focuses more on the distances between users and websites.

The best merge method (BMM) looked for pairs in each user's sort and finally added up these pairs of sorts. The major issue with BMM was that it required reducing groups into pairs. If a user grouped [a, b, c] together, then BMM recognised it as if the user had placed [a, b] [a, c] and [b, c] together (i.e. 3 pairs). These pairs were then added up. This result was a fundamental loss of information, because once these pairs were added together, it became impossible to reconstruct the original data.

The actual merge method (AMM) looked for agreements in whole groups, rather than pairs, which made the natural disagreement promising when comparing it with BMM. AMM improved the result; it did not take the pair but it considered grouping together and showed it into a single group.

When comparing AMM with BMM, AMM not only take the pair but it also considered more than two items grouped together and showed into the group. On Surface, AMM did not show promising agreement between the users about their level of agreement. In reality, AMM provided a better picture of how users of the study agreed between each other and to what levels their agreement changed for each card because it not only looked for pairs but it considered more than two cards as a group if they were similar across different users' sorts.

### The effect of threshold on BMM and AMM

The threshold of 60% agreement between users appeared to be an important factor in the resulting structure. The threshold of 60% and above explained that a single card

was included only if at least 60% of the users agreed to group it in the same group in their individual categorizations. We wanted to see how the level of threshold affects the number of groups and average cards in a group if the threshold is changed in AMM and BMM. We also wanted to see at what level of threshold the structure produced and cards used by AMM becomes similar to the BMM.

	BMM	BMM	AMM	AMM
<b>Threshold</b>	60%	50%	60%	50%
<b>Number of Groups</b>	4	4	9	8
<b>Avg. Cards in a Group</b>	9	9	3	4
<b>Card used</b>	35 of 37	35 of 37	29 of 37	35 of 37

**Table 4. A comparison of threshold of BMM to AMM**

Table 4 shows the comparison of AMM and BMM at different thresholds and its impact on number of groups and average cards in a group. It shows that a decrease in threshold to 50% has no impact on BMM. Decreasing in the threshold for AMM to 50% changes in the number of groups and average cards contained in a group, although not greatly. In other words, even if the level of agreement between the users is decreased from 60% to 50%, it does not impact on the number of groups and average number of cards for BMM and AMM. It changes slightly for AMM when the threshold is decreased but it does not become equal to the number of groups for BMM if the threshold is decreased.

#### **The Effect of Number of Users on Agreement**

This study used 25 users in its investigation. The number of user may also have had an effect on the agreement levels, so we selected 5, 10, 15, and 20 users at random to generate AMM and BMM groupings and compared them to groupings generated on the basis of the data from all 25 users.

For BMM, a random subset of 20 and 15 users subsequently generated 4 groups with an average of 8.75 cards in a group, which is very close to the results achieved with 25 users. By selecting 10 users, the number of groups increased from 4 to 5. This suggests that in order to use results generated by BMM, the recruited users should be more than 15 to generate stabilized results.

For AMM, the random subset of 20 users generated 7 groups which varied from the groups generated by 25 users. By selecting 15 random users, the AMM results that the users made 6 groups. By selecting 10 random users, 8 groups were generated. This attentively indicates that in order to rely on results of AMM, more than 25 users are required for the study to generate stable results. This argument is aligned with the statement mentioned on the website of online tool providing company OptimalSort<sup>4</sup> which says that AMM is recommended for

more than 30 participants and BMM is recommended if fewer than 30 participants are available.

#### **Comparison of three analyses**

Contrasting the three analyses, it seems that AMM provided a better understanding of the groupings determined by participants, which could be transformed into meaningful steps for a website's structure. The information visualisation of AMM and BMM provided a better understanding of the AMM and BMM analysis. The edit distance helped to understand the subjective distance of users from each other, although the information was difficult to leverage for specific decisions concerning structure.

When choosing between AMM and BMM, AMM seems to produce a larger number of groups in comparison to BMM. Such a difference in the number of groups explains the methodological issues with the choice of analysis for card sort. Appendix A1 shows the comparative scheme of AMM with BMM.

One of the implications of this study is that it is important to understand the methodological differences in each of the analysis when using them to construct website structures. Studies may have different requirements and this can affect the choice of analysis for card sorting. Researchers and practitioners need to conduct different analysis for card sorting. This would provide an overview of how these techniques and analyses of these techniques shape the results. The study indicates that information structure of the websites should also be evaluated by subsequent usability testing.

In one of the limitation of the study, the data for multiple level groups could not be handled by these analyses. Each of the three techniques could not deal with information in multiple groups. By not selecting the second level groups we introduced a fundamental loss of information which will have changed the outcome of the study. Tools to handle multiple level groups do not currently exist and therefore used here appear to be among the most suitable techniques available.

#### **CONCLUSION**

This study shows how the choice of analysis technique for a card sorting study can impact on the resulting information structure for a website by analysing the same data according to three techniques. It also suggests that the choice of analysis for card sorting has consequences for website designs because the agreement level for different methods varies for the same data and different method suggests different structures for web content. Finally, it also reveals that agreement levels for similar data changes if a different analysis for the same data is conducted. The study indicates that information structure of the websites should not merely come from the analysis of card sorting, but should be evaluated by subsequent usability testing.

The study concludes that it is important to understand the methodological issues for card sorts analysing tools. Card sorting tools have a great potential to use and understand users mental models because it can help to understand remote users view of information classification. However,

<sup>4</sup> <http://www.optimalworkshop.com/help/>

these benefits will only be realized if the card sorting applications visualization of analyses is understood by researchers and practitioners.

#### ACKNOWLEDGMENTS

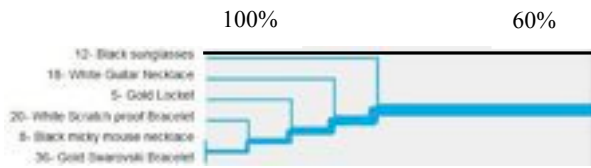
I would like to thank Morten Hertzum from Roskilde University, Denmark and Torkil Clemmensen from Copenhagen Business School, Denmark whose valuable feedback made it possible to write this article. I would like to thank Dr. Alvin Yeo from University Malaysia Sarawak (UNIMAS) for his support in collecting data for this study. I would like to thank the participants in the study from the University of Malaysia Sarawak in Malaysia. Finally I would like to thank Optimal Workshop for providing the licencing to analyse the data for study.

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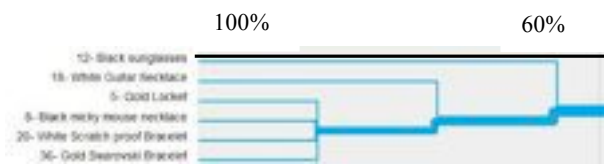
# Appendix A

## Best Merge Method (BMM)



**Grouping names:** Accessories, Personal Accessories, Personal

## Actual Merge Method (AMM)



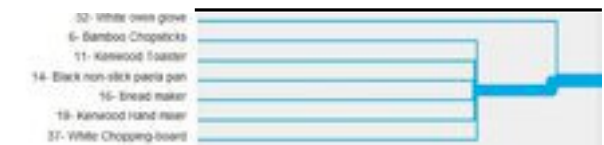
**Grouping names:** Accessories, Jewellery, gold Accessories

100% 60%



**Grouping names:** Kitchen, home, home items, communication, electrical, gadget

100% 60%



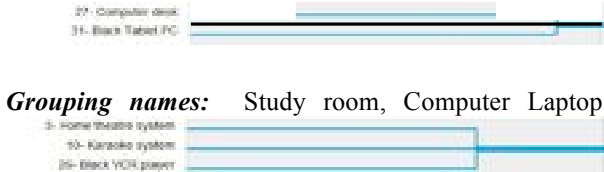
**Grouping names:** Mixer, Kitchen appliances, kitchen households

100% 60%



**Grouping names:** communication, electrical, gadget

100% 60%

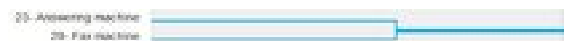


**Grouping names:** Study room, Computer Laptop

**Grouping names:** Entertainment, Electrical Equipment, Living room appliances



**Grouping names:** Apple



**Grouping names:** Machine

### A.1. A comparison between the results of Actual Merge method and Best Merge method

## **10 Appendix 2 – Manual for studies**

### **The manual for the card sorting experiment in this thesis**

The first part of document elicits the instructions that test leader (author) of the experiment will give to the participants of experiments. The second part of the manual comprises of instructions that will be handed over to the users for experiment.

#### **10.1 Instructions for Test leader**

The test leader (author) will control all the phases of card sorting sessions with participants from introduction of the card sorting experiment to interview with the participant of the experiment and writing down the participant's sorts into a hierarchy so that it can be used to analyze the data.

##### ***10.1.1 Execution of Card based Brainstorming/ Scenario Based Card Sorting***

The test leader will index blank cards. On the back of each card is a letter/number combination. The letter/number combination will be used during analysis. The blank cards are shuffled prior to participants entering the room. The shuffled cards, a stack of 100 blank cards, and an ink pen are placed on the table. One participant is brought into the room and given an introduction with some basic instruction.

The participants of the experiments are provided with 3" x 5" cards. The test leader will demonstrate to the participant about the first experiment of card sorting session. The test leader of the session should provide an atmosphere to the participant where they do not anticipate the session as a test of their skills but an exploration of the way they arrange the contents of the website. Test leader can demonstrate the participant that they have to perform small tasks during experimental session.

##### ***10.1.2 Execution of Open card sorting***

The participant of the experiment is again provided with cards containing the contents of a website. The cards are shuffled prior to participants entering the room. The shuffled cards, stack of cards with description and some blank cards and an ink pen are placed on the table.

#### **10.2 Plan**

The plan for this test consists of two parts. The test leader will first provide the Informed Consent Agreement to the participants. The participant will read the details and then sign it. The test leader will conduct the card based brainstorming session/ scenario based card sorting and open card sorting. In the end of each activity, the participant will explain the organization of contents and what he/she was thinking about during the construction of structure. The test leader will provide the five tasks one by one to the participants. The test leader will ask the participants to find information on the website. The participant notifies it to the test leader, once the information is found. The participants will be provided with evaluation survey and a retrospective interview will be individually conducted in the end

### **10.3 Demonstration of Test leader to participants**

#### **10.3.1 Activity 1**

First of all, we'd like to thank you for coming. As you may be aware, we're in the initial stages of (re)designing a (web site, product, and intranet) according to the way you think. In order to make it as easy to use as possible, we'd like to get some input from the people who will be using it. And that's where you come in. We're going to ask you to perform a very simple exercise that will give us some great insight into how we can make this (web site, product, intranet) easier to use.

You are asked to think about the contents of a university website. What are the content information that you would like to see in your university website. Here's how it this experiment works. In front of you is a stack of blank cards. You should try and sort the cards into groups that make sense to you. You can choose your own way of groping the cards. You should not be concerned about organizing information as it is organized on your university website. We're more interested in seeing how you would organize it into groups you would expect to find things in. You are free to choose whatever language you want to use on cards. You can choose either of your local language or combination of local and English language on same page.

Oh, and one last thing. Feel free to ask questions during the exercise if you feel the need. I can't guarantee that I can answer them during the exercise, but I'll do my best to answer

them when you're finished. You have 15 minutes to think, write and sort out cards and put them into categories.

### **10.3.2 Activity 2**

In the second activity, you have stack of cards in front of you. Those cards represent the content and functionality for a website that are taking from a university website and also provided with basic categories name. You should try and place the cards these into any of the categories that that make sense to you. If you feel something is missing, you can use a blank index card to add it. Additionally, if a label of a category is unclear, feel free to rename and write a better label on the card.

You should not be concerned about how information is organized on the page of your university website. We are more interested in seeing how you would organize it into groups you would expect to find things in.

Once more, feel free to ask questions during the exercise if you feel the need. I can't guarantee that I can answer them during the exercise, but I'll do my best to answer them when you're finished.

### **10.3.3 Activity 3**

In this activity you will be handed over 5 tasks and you are asked to go through tasks one by one. For each task, you will get 3 minutes to complete the task.

### **10.3.4 Feedback of participants**

After each open and semi-closed session of experiment, the participant of the experiments will be asked to give their view on the session and what do they think about the structure of the categories which they have constructed

### **10.3.5 Time distribution for a single participant**

The table below provides the time distribution of a single participant and progression of the activities.

*Table: Time distribution for a single participant*

<i>Tasks</i>	<i>Time duration</i>
Introduction	5 Minutes
<b>Session 1: OPEN CARD SORTING</b>	
Card sorting 1 ( Open card sorting)	15 Minutes
Noting down participants sorts	5 Minutes
Interview related to card sorting 1	10 Minutes
Break	5 Minutes
<b>Session 2: SEMI-CLOSED CARD SORTING</b>	
Card sorting 2 ( Semi-closed card sorting)	15 Minutes
Noting down participants sorts	5 Minutes
Interview related to card sorting 2	10 Minutes
Break	5 Minutes
<b>Session 3: TASK EXPLORATION</b>	
5 Tasks	15 Minutes
Qualitative interview about whole experiment	15 Minutes
<b>Total time ( aprox.)</b>	<b>100 Minutes</b>



## **11 Study 1 (Denmark), Study 2(Pakistan) - Data collection**

### **11.1 Informed Consent Agreement of Study**

Welcome to our research lab. You are invited for a card sorting experiment. This experiment is a part of PhD research studies held by Ather Nawaz in Copenhagen Business School, Denmark. In order to decide whether or not you agree to be part of this study, you should understand its potential risks and benefits to make an informed judgment. This process is known as “informed consent”. This consent form gives you detailed information about the interview session or research study. Once you understand the study, if you still wish to participate, you will be asked to acknowledge this by signing this form.

#### **11.1.1 Purpose of study and participation requirements**

- The interviews after the card sorting session will be audio-taped and videotaped. These tapes will only be used for recalling about what has been said in the session.
- These tapes will help to analyse the data gathered from the card sorting session.
- The data generated from the card sorting experiment will be anonymized. The data can be used for publishing purposes.

#### **11.1.2 Anonymity and Confidentiality**

All recordings, all your answers to questions in the post experiment session and comments noted by us will be treated with confidentiality. The recordings will not be distributed to third parties. The recordings will not be used for other means than for data analysis. Your name or identity will not be linked in any way to the research data. Your individual responses will not be revealed to anyone except to members of the research team without your express permission. Your responses will be combined with those from other participants when results are published or shared with other researchers.

#### **11.1.3 Participation Agreement**

By signing this form, I agree that:

- I understand that participating in this study is voluntary and that I have the right to withhold or withdraw participation in the study at any time.

- I understand that participating in this study does not expose me to any additional discomforts or risks beyond those that can generally occur when working with computer systems.
- I have read this entire form and I understand it completely. All of my questions regarding this form or this study have been answered to complete satisfaction. I agree to participate in this research.

Date: .....

Name: .....

Your signature: .....

## 11.2 Study 1, 2: Participants information

Name: \_\_\_\_\_

Gender: Male / Female

Age: \_\_\_\_\_

City, Country: \_\_\_\_\_

Please check the box  that is appropriate to you.

1) How often do you access the Internet?

- Once a week or Less  
 Every day  
 Several times a day

2) Approximately how much time, in minutes, you spend on university website during last week.

---

Monday      Tuesday      Wednesday      Thursday      Friday      Saturday

**Time in  
Minutes**

3) What type of degree and program are you enrolled into?

PhD in \_\_\_\_\_

Masters in \_\_\_\_\_

Bachelor in \_\_\_\_\_

Others \_\_\_\_\_

4) How many years of study program, mentioned in question 3, have you completed.

- less than 1 year  
 1-2 years  
 3-4 years and more

## 11.3 Instructions Provided to Participants

### 11.3.1 Activity 1 – Scenario Based Card sorting

Think about a university website that is intended for all kind of users such as students, teachers, and visitors. Think about a webpage/ WebPages of university website that provides all important information that can be relevant to any of the visitor of website. How you would like to see information in different categories of your university website.

You are provided a list of blank cards in front of you.

1. Write down a single a name/concept/information/ on a single card.
  2. Write down a category name and put the card with name/concept/information into that category.
- There is no restriction of making number of categories and putting number of cards into a category
  - Give a name to a category
  - One card can only come into one category
  - Try to write as many cards as you can and put them into categories
  - Sort cards into different categories which you feel are related to each other
  - **Time duration for Session 1: 15 minutes**

*A category, in card sorting, is a representation of groups of cards that make sense to the users*

Sort out the cards into groups that make sense to you. You can choose your own way of groping the cards. You should not be concerned about organizing information as it is organized on your university website. We're more interested in seeing how you would organize it into groups you would expect to find things in. You are free to choose whatever language you want to use on cards. You can choose either of your local language or combination of local and English language on same page.

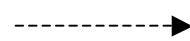
**Examples of card sorting:**



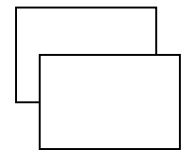
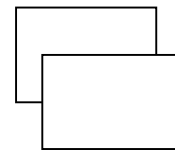
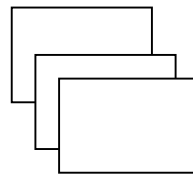
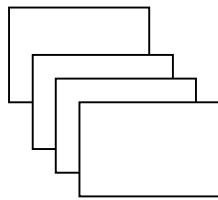
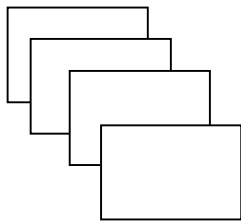
Category A

Category B

Category C



Category Z



An example of card sorting for participants of the study

**11.3.2 Activity 2- Open Card Sorting**

Welcome to the second experimental session. You have stack of cards in front of you. Those cards represent the content and functionality taken from a university website. You are also provided with basic categories name. You should try and place the cards these into any of the categories that that make sense to you. Additionally, if a label of a category is unclear, feel free to rename and write a better label on the card. Finally, if you think something doesn't belong, you can make an "Other" category and place cards there.

- You are provided with a list of cards and also category names.
- Place these cards into list of categories
- One card can be placed in one category
- You have to place all cards in any of the category
- You can rename/update category name
- You can add a category name

**11.3.3 Card used for study 1 in Pakistan**

Services & Facilities	Student Life
-----------------------	--------------

School of Science and Technology	Doctoral Programs
Center for the Globally Responsible Leaders	Useful Links
FAQ's	Centre for Law and Policy
Introduction	University at a Glance
History	Charter
Event Calendar	E-books
Library FAQ's	Engineering Labs
Staff directory	Career Building Program
How to Apply	Admissions
Hostels	Diplomas
Library Policy	Jobs@UNIVERSITY
Even Gallery	Participants Handbook
Academic Calendar	Learning Resources
Authorities of the University	Fee Structure
Academic Programs	Registration
Contact Us	Graduate Programs
Feedback	Why This University
School of Professional Advancement	Alumni Directory
Digital Resources	School of Business and Economics
Undergraduate programs	About Us
Transfer	Admission Process
Introduction	Participants Help Desk

About us	Mission
Academic Programs	Institute of Audit and Accountancy

#### **11.3.4 Card used for study 2 in Denmark**

Cafes	Events
Jobs at University	Undergraduate
About Campus	Study Environment
Renewals	Partnership
Find Us	Canteen
Learning Lab	Photos
Blogs	Book search
Parking	Application process
International Staff	Entrepreneurship
Campus Facilities	Book store
Students going Abroad	Contacts
Facts and Figures	Continuing Education
Loans	International Collaboration
Graduate School	For Companies
Print & copy center	Price and Fee
Digital Resources	Student counseling service
Conferences	Regulations
Contact us	Accommodation
Group rooms	International Staff

Virtual Tour	Library cards
Study Help	Quality
PhD	Remote Access
FAQ	Podcasts
E-Resources	Summer University
Study place and rooms	Opening hours

### **11.3.5 Activity 3: Task Exploration**

In this session, you are provided with a number of tasks and you will be asked to find information on your university website. This session is not test of your skills but it is about the usability of your university website.

- Take your time as you normally take during the university website visit
- You will spend 3 minutes for each task exploration



## 11.4 Task Exploration Tasks used for Study 1

### **TASK 1**

Please find the Course code of "Mechanics and wave motion" which is offered to BS computer science students in their first semester of academic session 2009-2010

*Please notify the instructor when you finish the task.*

### **TASK 2**

Please find the Contact information of the person/ Secretary who can provide you further information about Hostels.

*Please notify the instructor when you finish the task.*

### **TASK 3**

Please find the webpage with the information that shows the information about Fines that you have to pay if you do not return a book of library.

*Please notify the instructor when you finish the task.*

### **TASK 4**

Please find the webpage that shows the information about collaboration of UMT with other foreign universities.

*Please notify the instructor when you finish the task.*

## **TASK 5**

**Please find the Class schedule/  
timetable of BS computer science for  
fall 2009.**

*Please notify the instructor when you finish the task.*

### **11.5 Task Exploration Tasks use for Study 2**

## **TASK 1**

**Please find the course code of the  
course "Corporate Finance" offered to  
BSc in International Business**

*Please notify the instructor when you finish the task.*

## **TASK 2**

Please find the phone number of CBS housing department that can help you finding an accommodation

*Please notify the instructor when you finish the task.*

## **TASK 3**

Please find the webpage with the information that shows the Fee that you have to pay to borrow a book from a foreign library

*Please notify the instructor when you finish the task.*

## **TASK 4**

Please find the webpage that shows the information about collaboration of UMT with other foreign universities.

*Please notify the instructor when you finish the task.*

## **TASK 5**

Please find the Class schedule/ timetable of course 'Design for use and users' offered in spring 2010.

*Please notify the instructor when you finish the task.*

## 11.6 Evaluation and general perception about the website in Study 1 and Study 2

In the next section you will find pairs of words to assist you in your evaluation. Each pair represents extreme contrasts. The possibilities between the extremes enable you to describe the intensity of the quality you choose.

An example:

disagreeable        likeable

This evaluation tells us about participants overall view of website of university

Do not spend time thinking about the word-pairs. Try to give a spontaneous response. You may feel that some pairs of terms do not adequately describe the website. In this case please still be sure to give an answer. Keep in mind that there is no right or wrong answer. Your personal opinion is what counts!

### Please rate the between two extremes

Human	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	technical
isolating	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	connective
pleasant	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	unpleasant
creative	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	conventional
simple	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	complicated
professional	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	unprofessiona l
ugly	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	attractive
practical	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	impractical
likeable	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	disagreeable
cumbersome	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	straightforwa rd
stylish	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	tacky

predictable	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	unpredictable
alienating	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	integrating
brings me closer to people	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	separates me from people
unpresentable	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	presentable
unimaginative	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	creative
good	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	bad
confusing	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	clearly structured
repelling	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	appealing
innovative	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	conservative
dull	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	attractive
undemanding	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	challenging
Motivating	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	discouraging
Disorderly	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	manageable

**Please rate the website on the following aspects**

	Very good	Good	Neither good nor poor	Poor	Very poor	Don't know
Ease of use of the site	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Attractiveness of design/appearance	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Ease of finding information/services	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Information that was clear and easy to understand	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Accurate and up to date information	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Usefulness of site search	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

### 11.7 Post Study 1- 2 Questions ideas

1. Why you use internet fewer times a week ( Pre-test questionnaire)
2. What did you think about your website?
3. What did you think about the design of the site? Colors, pictures, etc.
4. How was it to navigate around the site?
5. How would you describe a Pakistani website/ Malaysian?
6. Which things do you like about this website?
7. Which things do you not like about your university website?
8. Was there anything in the site that you found confusing?
9. Do you think that student's perspective is taken into consideration?
10. What is the information that you want to see up in front of website.



## **12 Study 3 (Pakistan) - Data collection**

### **12.1 Invitation Used to recruit participants of study**

#### **Pakistani UET students searched for experiment concerning PhD study**

I am a PhD student currently in the process of my research at Copenhagen Business School, Denmark. For the purpose of my research, I seek 24 participants for my research.

#### **The purpose of study**

The objective of my study is to get an insight into the user's way of information classification and organization of website contents and how culture shapes the users way organization. The purpose of this study is to explore the way different group of people organize web contents and problematize the notion of culture.

#### **Participant criteria**

- All the participants are of Pakistani origin.
- The participants must have primary and secondary education in Pakistan
- The participants should be aged between 18-35 years
- The participants of the research should be studying in under graduation and graduation.
- An equal number of male and female participants.

#### **Activities for the experiment**

- To find information on a website.
- To sort the small cards in different orders.
- To register the participants' overall Feedback
- The retrospective interview with the participants.



It is for the record pointed out that the study does not aim to measure the individual student's intelligence or other skills. The research is only a contribution to the understanding of how information is perceived and used by a specified group of people. Participants are free to use any language (English and/or Urdu and/or Punjabi) for interview.

**Duration of experiment**

The tasks, interview and feedback will take approximately 90 minutes. Each participant is encouraged to have set aside more time to be on the safe side.

**Gift:**

Participants in the study will be presented with a Cash of 300 PKR

**Location:** Centre for Language Engineering (CLE),  
AI-Khawarizmi Institute of Computer Science, UET, Lahore, Pakistan

.....  
[an.inf@cbs.dk](mailto:an.inf@cbs.dk)  
 .....  
 an.inf@cbs.dk  
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 an.inf@cbs.dk

\*\*The time slots are provided for the convince of the students. The time slot may change on the availability of the space and other changes in the schedule.

May 02-06 - 2011					
Time	May 02, Monday	May 03, Thursday	May 04, Wednesday	May 05, Thursday	May 06, Friday
10-12	1	Review and change	3	5	7
15-17	2		4	6	8

May 09-13					
Time	May 09, Monday	May 10, Thursday	May 11, Wednesday	May 12, Thursday	May 13, Friday
10-12	9	11	13	15	17
15-17	10	12	14	16	18

May 16-20					
Time	May 16, Monday	May 17, Thursday	May 18, Wednesday	May 19, Thursday	May 20, Friday
10-12	19	21	23		
15-17	20	22	24		

I would urge everyone to forward this message to other students, so I can achieve the required number of participants for this study. Feel free to contact me if you need more information

Please write me if you want are interested and would like to participate in the study: [an.inf@cbs.dk](mailto:an.inf@cbs.dk) ( an dot inf at cbs dot dk)

Is it convenient on Facebook? : You can drop your message there:

<http://www.facebook.com/atherawaz>

Ather Nawaz

PhD Fellow

Copenhagen Business School, Institut for Informatik(INF)/ Howitzvej 60,5.sal DK-2000 Frederiksberg

Tel.: (+45) 3815 2396 | Mob.: (+45) 2479 4384 | [an.inf@cbs.dk](mailto:an.inf@cbs.dk)

## 12.2 Pre-Test Questionnaire

### 1. General Information

Participant ID. \_\_\_\_\_

1.1 Age: ____ years Gender: ( ) Male	1.2 Nationality ( ) Danish
--	----------------------------

<p style="text-align: right;">( )</p> <p>Female</p> <p>1.3 What is your religion?</p> <p>( ) Buddhism</p> <p>( ) Christianity</p> <p>( ) Islam</p> <p>( ) Other _____ (please specify)</p> <p>( ) do not want to answer</p>	<p style="text-align: right;">( ) Pakistani</p> <p style="text-align: right;">( ) Malaysian</p> <p style="text-align: center;">Other? Please specify _____</p>
---	--

## 2. Education and Information Literacy

<p>2.1. Years of education</p> <p>( ) 1<sup>st</sup> year at university level, Bachelors</p> <p>( ) 2<sup>nd</sup> year at university level, Bachelors</p> <p>( ) 3<sup>rd</sup> year at university level, Bachelors</p> <p>( ) 4<sup>th</sup> year at university level, Masters</p> <p>( ) 5<sup>th</sup> year at university level, Masters</p> <p>( ) Others _____</p>	<p>2.2. What is your major field of study?</p> <p>( ) Faculty of arts and social sciences</p> <p>( ) Faculty of business</p> <p>( ) Faculty of science and education</p> <p>( ) Faculty of theology</p> <p>( ) Others _____</p>
<p>2.3 What year did you start to use computer?</p> <p>Year : _____</p>	<p>2.4. At university/college/school</p> <p>( ) I had classes on finding and using information</p> <p>( ) I did not have classes on finding and using information</p> <p>( ) Don't know</p>

<p>2.5. Computer facility at home</p> <p>( ) I have access to computer facilities</p> <p>( ) I do not have access to computer facilities</p> <p>( ) Don't know</p> <p><i>If the answer is yes, Please state the year since you have facility at home</i></p> <p>s_____</p>	<p>2.6 .Online Access at home</p> <p>( ) I have online computer access</p> <p>( ) I do not have online computer access</p> <p>( ) Don't know</p> <p><i>If the answer is yes, Please state the year since you have online access at home _____</i></p>

### 3 LANGUAGE

3.1. How you would rate your English Language proficiency						
<b>1. V-LIM: Very limited    2. LIM: Limited    3.ROUT: Routine    4.PROF: Proficient    5. NAT: Native</b>						
	<b>ENGLISH</b>	1	2	3	4	5
	Reading	V-LIM	LIM	ROUT	PROF	NAT
	Writing	V-LIM	LIM	ROUT	PROF	NAT
	Speaking	V-LIM	LIM	ROUT	PROF	NAT
3.2. Beside English, which other language do you understand and what level						
<i>If you understand more languages, you may only state those where your language proficiency is higher</i>						

Language name : _____ proficiency in	1	2	3	4	5
Reading	V-LIM	LIM	ROUT	PROF	NAT
Writing	V-LIM	LIM	ROUT	PROF	NAT
Speaking	V-LIM	LIM	ROUT	PROF	NAT
Language name: _____ proficiency in	1	2	3	4	5
Reading	V-LIM	LIM	ROUT	PROF	NAT
Writing	V-LIM	LIM	ROUT	PROF	NAT
Speaking	V-LIM	LIM	ROUT	PROF	NAT

3.3. Which language do you use for writing report and making presentations

( ) English                      ( ) Danish                      ( ) Malay Variant

( ) Urdu                          ( ) Other \_\_\_\_\_ (please specify)

#### 4. Language on the websites and Internet use

4.1. What percentage of websites you access are non-English	4.2. How often do you use internet
( ) All (close to 100%)	( ) Several times a day
( ) Most (close to 75%)	( ) Once a day
( ) Half (close to 50%)	( ) 2-3 times a week
( ) Few (close to 25%)	( ) Once or less a month
( ) None (close to 0%)	
4.2. How long will you typically spend browsing webpages in a sitting written in a language that is not in English?	4.3. How long will you typically spend browsing webpages in a sitting written in English

<input type="checkbox"/> I do not open <input type="checkbox"/> 30 seconds to 1 minute <input type="checkbox"/> 1 to 5 minutes <input type="checkbox"/> 5 to 10 minutes <input type="checkbox"/> 10 to 30 minutes or more	<input type="checkbox"/> I do not open <input type="checkbox"/> 30 seconds to 1 minute <input type="checkbox"/> 1 to 5 minutes <input type="checkbox"/> 5 to 10 minutes <input type="checkbox"/> 10 to 30 minutes or more
<p>4.4 . What do you find to be the biggest general problems in using the Websites in your local language?</p> <p>(Please check all that apply.)</p> <input type="checkbox"/> Not being able to find the information I am looking for <input type="checkbox"/> Not being able to find a page I know is out there <input type="checkbox"/> Not being able to return to a page I once visited <input type="checkbox"/> Not being able to determine where I am <input type="checkbox"/> Not being able to visualize where I have been and where I can go <input type="checkbox"/> It takes too long to view/download pages <input type="checkbox"/> Do not encounter any problem	<p>4.5. Should the organizations provide local webpages of their web sites?</p> <p><i>Please check all that apply</i></p> <input type="checkbox"/> Yes, because it shows respect for different cultures <input type="checkbox"/> Yes, because it would be useful for more people <input type="checkbox"/> Yes, for other reasons <input type="checkbox"/> No, because language is not an issue for current web users <input type="checkbox"/> No, because it is not worth the expense <input type="checkbox"/> No, for other reasons _____ <input type="checkbox"/> Don't know

### 12.3 Instructions for the participants

The researcher will give you some cards. Each card will have a picture on the card. We would like you to choose a topic or “criterion” for sorting: use one criterion at a time and place the cards in groups or categories and name them. Each time you sort the cards,

please tell us what the criterion was and what the categories were so that we can record this. Repeat this until you cannot think of more criterion.

**Example:** if you are asked to sort different pictures of Houses

The **first criterion** could be “*Price*” and the groups could be “very cheap”, “Expensive”, and “very expensive” etc.

The **second criterion** could be “*Style*”, and the groups could be “traditional”, “modern”, “Scandinavian” and “country style” etc.

The **third criterion** could be “*type*” and the groups could be “apartment”, “Bungalow”, “Cottage”, “Flat”, “Villa” and “Studio” etc.

You can choose any criteria you want and any groups you like (including “don’t know”, “not sure” and “not applicable”). The main thing is to use only one criterion in each sort. Please don’t put two or more in together, for example, “price and type”. If you’re not sure about something, you can ask.

**Please Note:** the cards are numbered only to help us record the results. The numbering is random, so please don’t use that as a criterion for sorting.

**Practice:** the researcher will first give you a selection of cards to use so you can practice the procedure and answer any doubts you have. If you have any comments or questions, then please say, and we will do our best to help you. After that, when you are sure of the procedure, the researcher will start the experiment with the main set of cards.

## 12.4 Activity 1

Think of a website that provides **home appliances** to the customers. The website is selling from **major home appliances** to **small Home appliances**. *Home appliances are electrical/mechanical machines which accomplish some household functions.* Think about the webpages of such a website. How would you organize information in different groups and categories on that website?



You are provided a list of blank cards in front of you. Use these to describe and organize the information you would like to see at such a website.

- Write down a name statement/piece of information on a single card.
- Write down a category name and put the card related to that category under the category name.
- There is no restriction of making number of categories and putting number of cards into a category
- Try to write as many cards as you can and put them into categories.
- You can also make sub-categories
- Time duration for activity is 15 minutes
- You can use any language or combination languages that you think would be suitable on the website

*A category, in card sorting, is a representation of groups of cards that make sense to the users.* Sort out the cards into groups that make sense to you. You can choose your own way of grouping the cards. You can also make sub-category and place further cards into the sub-category. We are interested in seeing how you would organize it into groups you would expect to find things in. You are free to choose whatever language you want to use on cards.

## **12.5 Activity 2**

Welcome to the second experimental activity. You have stack of cards in front of you. Those cards represent the content taken from a website. You should try and place the cards these into any of the categories that that make sense to you.

- You are provided with a list of cards
- Write a category name for a groups of cards that combine make sense to you
- One card can be placed in one category
- You can make as many categories as you want
- You can also make second level categories

## 12.6 Cards used for the Study

Blender	Coffee Makers
Water Purifier filter	Citrus Juicer
Electric Kettle	Cloth Hanger Set
Electrical oven	Knife Set
Vacuum Cleaner	Rice cooker
Steam iron	Sleeping bag
Slice Toaster	Hair dryer
Fan heater	BAR B Q Grill
Table lamp	Sewing Machine
Coffee Grinders	Baby Carrier
Rechargeable fan	Ironing board
water cooler	Hair trimmer
Shaver	Floor cleaner
bed sheet	Insect killer
Pillow	Mosquito-Hitting
shower curtain	cleaning cloth
laundry bag	washing machine
study table	dish washer
body brush	digital Quran
tooth brush	prayer watch

### 12.7 Activity 3

#### Task Exploration Instruction

In this session, you are provided with 4 tasks and you will be asked to find information on the following website <http://symbios.pk>. This session is not test of your skills but it is about the usability of your university website.

- Take your time as you normally take during the university website visit
- You will spend 3 minutes for each task exploration

### 12.8 TASK EXPLORATION

In this session, you are provided with a number of tasks and you will be asked to find that information on you're the website. This session is not about your test of skills but it is about the usability of the website.

## TASK 1

Please find the wireless remote control doorbell on the website.

*Notify the instructor when you finish*

## TASK 2

Please find the delivery time and information if the order is placed within Karachi.

*Notify the instructor when you finish*

## TASK 3

Please find the smart travelling mug with an adopter.

*Notify the instructor when you finish*

## TASK 4

Please find the privacy policy of company's website.

*Notify the instructor when you finish*

### 12.9 Evaluation of website

Please rate the website on the following aspects

<i>Evaluation and general perception about the website</i>						
	Very good	Good	Neither good nor poor	Poor	Very poor	Your rating?
Ease of use of the site	5	4	3	2	1	
Attractiveness of design/appearance	5	4	3	2	1	
Ease of finding information/services	5	4	3	2	1	
Information that was clear and easy to understand	5	4	3	2	1	



## 13 Study 4 (Malaysia) Data collection

### 13.1 Pre-Test Questionnaire

#### 2. General Information

Participant ID. \_\_\_\_\_

Please mark it ( x) where the options suites you

<p>2.1 Age: _____ years Gender: <input type="checkbox"/> Male <input type="checkbox"/> Female</p> <p>1.4 What is your religion? <input type="checkbox"/> Christianity <input type="checkbox"/> Ethicist <input type="checkbox"/> Islam <input type="checkbox"/> Buddhism <input type="checkbox"/> Other _____ (please specify) <input type="checkbox"/> do not want to answer</p>	<p>1.2 Nationality <input type="checkbox"/> Malaysian</p> <p>Other? Please specify _____</p>
---	--

#### Education and Information Literacy

<p>2.1. Years of education</p> <p><input type="checkbox"/> 1<sup>st</sup> year at university level, Bachelors <input type="checkbox"/> 2<sup>nd</sup> year at university level, Bachelors <input type="checkbox"/> 3<sup>rd</sup> year at university level, Bachelors <input type="checkbox"/> 4<sup>th</sup> year at university level, Masters <input type="checkbox"/> 5<sup>th</sup> year at university level, Masters <input type="checkbox"/> Others _____</p>	<p>2.3. What is your major field of study?</p> <p><input type="checkbox"/> Faculty of arts and social sciences <input type="checkbox"/> Faculty of business <input type="checkbox"/> Faculty of science and education <input type="checkbox"/> Faculty of theology <input type="checkbox"/> Others _____</p>
<p>2.4 How long have you been using computers?</p> <p><input type="checkbox"/> Less than 1 year <input type="checkbox"/> 1 - 3 years <input type="checkbox"/> 3-5 years <input type="checkbox"/> 5-7 years</p>	<p>2.4. At university/college/school</p> <p><input type="checkbox"/> I had classes on finding and using information <input type="checkbox"/> I did not have classes on finding and using</p>

<input type="checkbox"/> More than 7 year	information <input type="checkbox"/> Don't know
2.5. Computer facility at home <input type="checkbox"/> I have access to computer facilities <input type="checkbox"/> I do not have access to computer facilities <input type="checkbox"/> Don't know  <i>If the answer is yes , please state the year since you have facility at home _____ (i.e., 2003)</i>	2.6 .Online Access at home <input type="checkbox"/> I have online computer access <input type="checkbox"/> I do not have online computer access <input type="checkbox"/> Don't know  <i>If the answer is yes , please state the year since you have facility at home _____</i>
2.7. Education Medium in primary school is mostly <input type="checkbox"/> Malay <input type="checkbox"/> Chinese <input type="checkbox"/> English <input type="checkbox"/> Malay and Chinese <input type="checkbox"/> Malay and English <input type="checkbox"/> Others	2.8. Education Medium in Secondary school is mostly <input type="checkbox"/> Malay <input type="checkbox"/> Chinese <input type="checkbox"/> English <input type="checkbox"/> Malay and Chinese <input type="checkbox"/> Malay and English <input type="checkbox"/> Others

**LANGUAGE**

You can use following Ranks to answer the questions

1	2	3	4	5
Not at all	Not well	Well	Very well	Native (mother tongue)



Next page

<p>3.1. My <b>English</b> Language proficiency is</p> <p>Reading   1 2 3 4 5</p> <p>Writing   1 2 3 4 5</p> <p>Speaking   1 2 3 4 5</p>	<p>3.2 My _____ Language proficiency is (i.e., Malaysian)</p> <p>Reading   1 2 3 4 5</p> <p>Writing   1 2 3 4 5</p> <p>Speaking   1 2 3 4 5</p>
<p>3.3 My _____ Language proficiency is</p> <p>Reading   1 2 3 4 5</p> <p>Writing   1 2 3 4 5</p> <p>Speaking   1 2 3 4 5</p>	<p>3.4. Which language do you use for writing report and making presentations</p> <p><input type="checkbox"/> Malay    <input type="checkbox"/> Chinese    <input type="checkbox"/> English</p> <p><input type="checkbox"/> Malay and Chinese    <input type="checkbox"/> Malay and English</p> <p><input type="checkbox"/> Others</p>

#### 4. Language on the websites and Internet use

<p>4.1. What percentage of websites you access are non-English</p> <p><input type="checkbox"/> All (close to 100%)    <input type="checkbox"/> Most (close to 75%)</p> <p><input type="checkbox"/> Half (close to 50%)    <input type="checkbox"/> None (close to 0%)</p> <p><input type="checkbox"/> Few (close to 25%)</p>	<p>4.2. How often do you use internet</p> <p><input type="checkbox"/> Several times a day</p> <p><input type="checkbox"/> Once a day</p> <p><input type="checkbox"/> 2-3 times a week</p> <p><input type="checkbox"/> Once or less a month</p>
<p>4.2. How long will you typically spend browsing webpages in a sitting written in a language that is not in English?</p> <p><input type="checkbox"/> I do not open</p> <p><input type="checkbox"/> 30 seconds to 1 minute</p>	<p>4.3. How long will you typically spend browsing webpages in a sitting written in English</p> <p><input type="checkbox"/> I do not open</p> <p><input type="checkbox"/> 30 seconds to 1 minute</p>



<input type="checkbox"/> 1 to 5 minutes <input type="checkbox"/> 5 to 10 minutes <input type="checkbox"/> 10 to 30 minutes or more	<input type="checkbox"/> 1 to 5 minutes <input type="checkbox"/> 5 to 10 minutes <input type="checkbox"/> 10 to 30 minutes or more										
<p>4.4 . What do you find to be the biggest general problems in using the Websites in your local language?</p> <p>(Please check all that apply.)</p> <p><input type="checkbox"/> Not being able to find the information I am looking for</p> <p><input type="checkbox"/> Not being able to find a page I know is out there</p> <p><input type="checkbox"/> Not being able to return to a page I once visited</p> <p><input type="checkbox"/> Not being able to determine where I am</p> <p><input type="checkbox"/> Not being able to visualize where I have been and where I can go</p> <p><input type="checkbox"/> It takes too long to view/download pages</p> <p><input type="checkbox"/> Encountering links that do not work</p>	<p>4.5. Should the organizations provide local webpages of their web sites?</p> <p><i>Please check all that apply</i></p> <p><input type="checkbox"/> Yes, because it shows respect for different cultures</p> <p><input type="checkbox"/> Yes, because it would be useful for more people</p> <p><input type="checkbox"/> Yes, for other reasons</p> <p><input type="checkbox"/> No, because language is not an issue for current web users</p> <p><input type="checkbox"/> No, because it is not worth the expense</p> <p><input type="checkbox"/> Don't know</p>										
<p>4.6. What language do you use mostly to open websites - please <u>circle</u> your option</p> <table border="1"> <thead> <tr> <th>Chinese</th> <th>Malaysia</th> <th>English</th> <th>Mix</th> <th>Other</th> </tr> </thead> <tbody> <tr> <td>Ch</td> <td>my</td> <td>en</td> <td>mx</td> <td>ot</td> </tr> </tbody> </table> <p>Social networking websites ( Ch, my, en, mx, ot)</p> <p>Academic work ( Ch, my, en, mx, ot)</p>	Chinese	Malaysia	English	Mix	Other	Ch	my	en	mx	ot	
Chinese	Malaysia	English	Mix	Other							
Ch	my	en	mx	ot							

) News and media ( Ch, my, en, mx, ot )	
E-commerce and shopping ( Ch, my, en, m, ot)	

### 13.2 Activity 1

Think of a website that provides **home appliances** to the customers. The website is selling from **major home appliances** to **small Home appliances**. *Home appliances are electrical/mechanical machines which accomplish some household functions.* Think about the **webpages** of such a **website**. How would you organize information in different groups and categories on that website?

You are provided a list of blank cards in front of you. Use these to describe and organize the information you would like to see at such a website.

- Write down a name statement/piece of information on a single card.
- Write down a category name and put the card related to that category under the category name.
- There is no restriction of making number of categories and putting number of cards into a category
- Try to write as many cards as you can and put them into categories.
- You can also make sub-categories
- Time duration for activity is 15 minutes
- You can use any language or combination languages that you think would be suitable on the website

*A category, in card sorting, is a representation of groups of cards that make sense to the users.* Sort out the cards into groups that make sense to you. You can choose your own way of groping the cards. You can also make sub-category and place further cards into the sub-category. We are interested in seeing how you would organize it into groups you would

expect to find things in. You are free to choose whatever language you want to use on cards.

### 13.3 Activity 2

Welcome to the second experimental activity. You have stack of cards in front of you. Those cards represent the content taken from a website. You should try and place the cards these into any of the categories that that make sense to you.

- You are provided with a list of cards
- Write a category name for a groups of cards that combine make sense to you
- One card can be placed in one category
- You can make as many categories as you want
- You can also make second level categories

### 13.4 Cards used for the Study

hardcover file	Video camera
Home theatre system	Apple Ipad2 white
Gold Locket	Bamboo Chopsticks
Golden touchscreen watch	Black micky mouse necklace
Black walkie-talkie	Karaoke system
Kenwood Toaster	Black sunglasses
Black analog watch	Black non-stick paela pan
Air conditioning	Bread maker
Metal Alarm Clock	White Guitar Necklace
Kenwood Hand mixer	White Scratch proof Bracelet
VoIP-phone white	Window Curtains
Answering machine	iPOD white
Calculator	Black VCR player

Computer desk	White iron steamer
Fax machine	Stapler
Black Tablet PC	White oven glove
White LED Clock	Water dispenser
Pager	Gold Swarovski Bracelet
White Chopping-board	

### 13.5 Activity 3

#### Task Exploration

In this session, you are provided with 4 tasks and you will be asked to find information on the following website <http://www.lelong.com.my>. This session is not test of your skills but it is about the usability of your university website.

- Take your time as you normally take during the university website visit
- You will spend 3 minutes for each task exploration

## TASK 1

Please find the fee for the safe trade transaction.

*Notify the instructor when you finish*

## TASK 2

Please find the instructions about Potential Fraud and How to Prevent.

*Notify the instructor when you finish*

## TASK 3

Please find the Panasonic fax machine.

*Notify the instructor when you finish*

## TASK 4

Please find the Panasonic electric trimmer/shaver

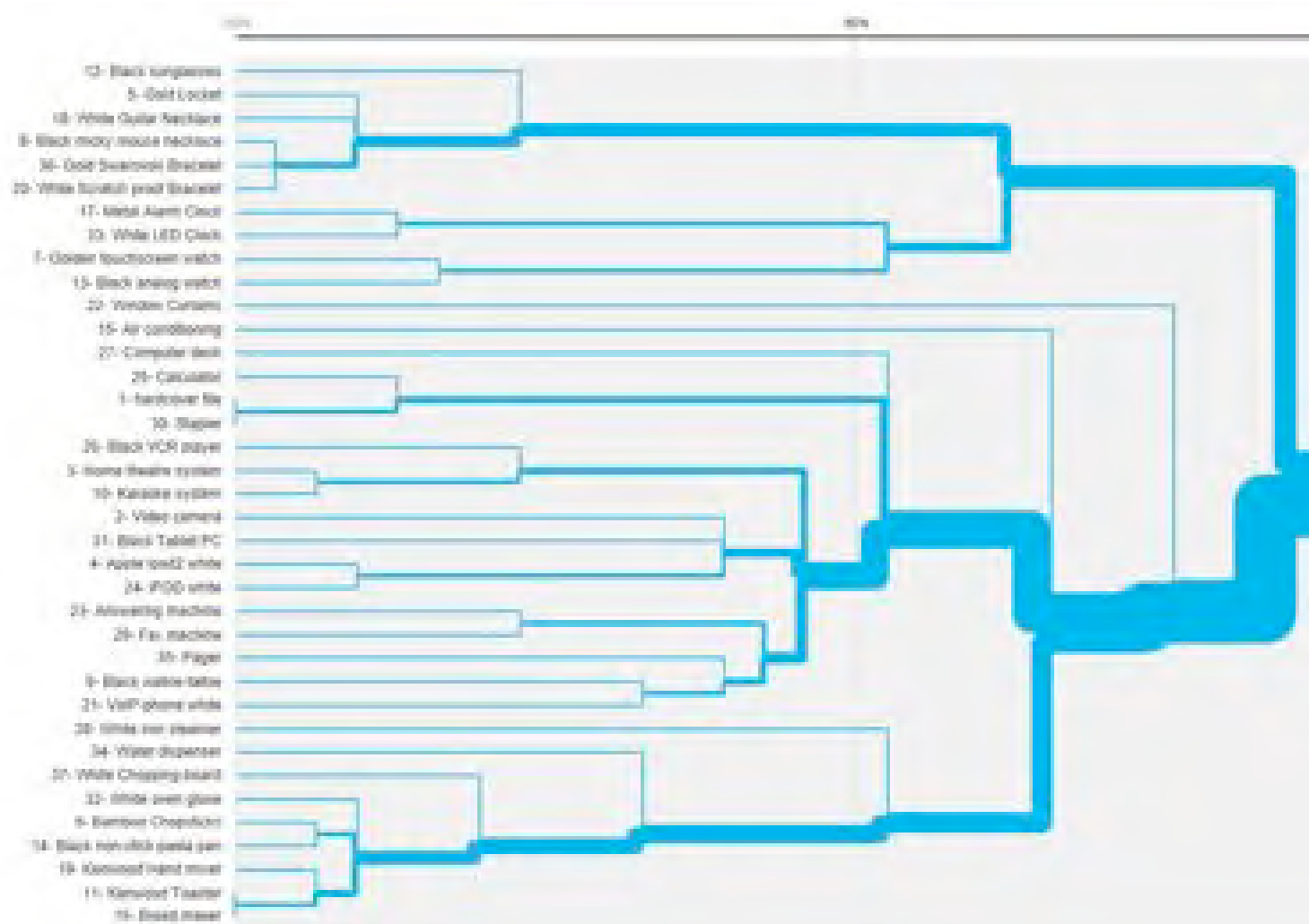
### ***13.5.1 Evaluation and general perception about the website you just visited***

<b>Please rate the website on the following aspects</b>						
	Very good	Good	Neither good nor poor	Poor	Very poor	Your rating?
Ease of use of the site	5	4	3	2	1	
Attractiveness of design/appearance	5	4	3	2	1	
Ease of finding information/services	5	4	3	2	1	
Information that was clear and easy to understand	5	4	3	2	1	

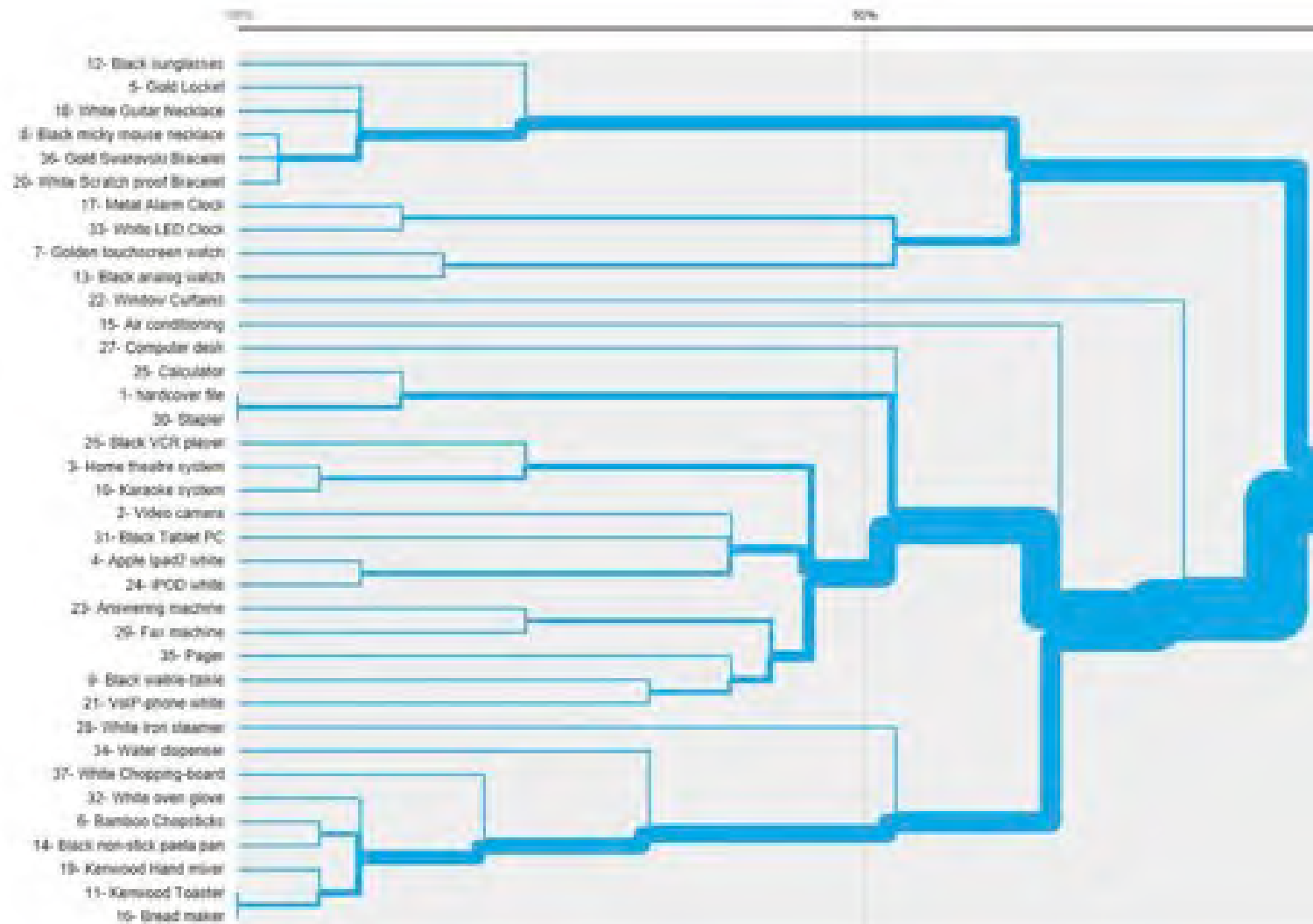


## 14 Appendix 4 – Dendrograms

### 14.1 Dendrogram of Card sort Activity for Pakistan Participants (Study 3)



## 14.2 Dendrogram of Card sort Activity for Malaysian Participants (Study)





## 15 Appendix 5 – Screenshots of studied website



Figure a.: Screen-shot of University website of study 1 in Pakistan



Figure b: Screen-shot of University website of study 2 in Denmark

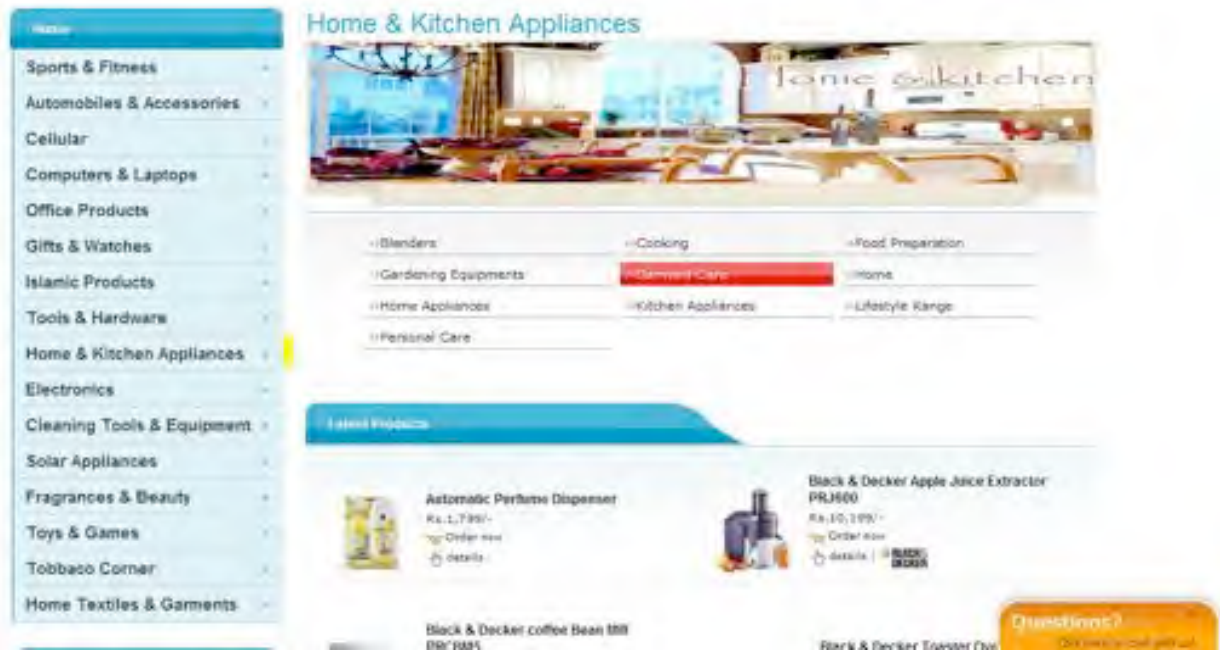


Figure c.: Screen-shot of E-Commerce website of study 3 in Pakistan



Figure d.: Screen-shot of E-Commerce website of study 4 in Malaysia



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