Cultural Representation for Multi-culture Interaction Design

Javed Anjum Sheikh, Bob Fields, and Elke Duncker

Interaction Design Centre, School of Engineering & Information Sciences,
Middlesex University, London, UK
{j.anjum,b.fields,e.duncker}@mdx.ac.uk

Abstract. This research works towards the integration of cultural factors in global information systems like the Web or digital libraries to enhance global access to information and services. In this context, we study cultural differences in categorization and classification by means of card sorting experiments in combination with observations and interviews. An initial analysis of data collected in Pakistan and UK reveals a number of differences between Pakistani and British participants as to how they classify every-day objects. The differences found suggest a number of design solutions for cultural inclusion.

Keywords: Cross-cultural design, cross-cultural classification, classification systems, human–computer interaction, globalisation, localisation, cultural inclusion.

1 Introduction

The potential of the internet as a tool for global access to knowledge, goods services is undisputed. However, this globalisation potential cannot be fully realised, as long as information and services of one culture are less accessible to other cultural groups. Problems do not only arise from obvious matters such as language translation, currency translation, formats of numbers and dates, etc. but from deeply rooted cultural differences that can cause non-understanding and misinterpretation of user interfaces and information given.

A question of recurrent interest is how easily certain groups of users can retrieve information from web-based information sources. A wide range of online classification schemes can be found, of which some seem to have a wider applicability and acceptance than others. For example, UK online stores do not only sell different products compared to similar German online stores, they often classify their products differently[1]. Similar things can be said for classification systems in libraries. The Dewy decimal system is used world-wide and yet, it classifies books differently to the German library classification systems in general and in particular to specialty related classification systems [6][12]. This means that not only the content but also the way this content is organised and classified reflects the values and interpretive practices of the culture in which it was produced. Therefore, problems can arise, when content

[1] For a comparison see for instance the Galeria-Kaufhof website and the Debenhams website.

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designed, organised and classified by members of one culture is used by members of another culture. Typically, web content, its organisation and its classification reflect values and interpretations of western cultures rendering it less appropriate to non-western cultural user groups.

As part of a larger study, this research focuses on cross-cultural classification practices. It examines

- the way how people classify representations of every-day objects
- the differences in classification practices and classifications
- the cause for these differences

In what follows, we review related works on culture and design in section two. In section three we describe our research methods. Section four presents the results of our study and the analysis thereof. Following a discussion of links to interaction design in section five, our conclusions and directions for future work are presented in the last section.

2 Background

Globalisation faces major challenges, when it comes to localising the organisation and classification of globally available information. Cultural aspects of classification play an important role in these difficulties. Some scholars have studied the influence of culture on classification systems [2], but many questions remain unanswered, particularly with regards to online information systems that are not digital libraries.

Researchers and designers sometimes unintentionally apply their own cultural values when designing and developing computer applications. Although Microsoft and other development organisations consider cultural issues, they mostly involve language translation and visual aspects of the interface instead of the underlying structure of the application. Therefore, users who are culturally different from the researchers and designers face difficulty in using computer applications [6][17]. Cross-cultural research is time-consuming and expensive, relatively few studies have looked at cultural differences in computing systems.

However, most studies focus on language translation [14] and attitudes towards and acceptance of technology [8] and various cultural issues for example of nationalism, language, social context, time, currency, units of measure, cultural values, body positions, symbols and aesthetics [3]. Cultural models (for example, see [7][18] are widely studied but it has been argued that such models are used inappropriately [11] and do not have enough potential to fulfil the requirements of every culture [19]. Consequently, the above research is not well suited for computer scientists. Therefore, it is essential to consider designing for different cultural groups [20].

Culture-specific study is an important tool in research, but computer scientists have sometimes tended to downplay the importance of the user in general, and of their culture in particular [3][15]. The rapid growth of computing raises issues of cultural representation. As there is inadequate representation of non-western culture, user from these cultures is deprived of the true benefit of computing. Several studies [10][16] show a strong inclination of users to use their own language and cultural environment. Other studies show developers face difficulties in the successful integration of culture into interface design [4][14].

3 Methods

In order to investigate the question of how different cultures organise their knowledge differently, we employ a research method based on card sorting. In a card sorting experiments participants are asked to arrange cards into groups. On these cards one finds pictures or the names of objects. Card-sorting experiments can reveal different ways in which participants organise their understanding of the world.

The approach is widely used for initial exploration, in the field of knowledge acquisition [13]. It helps to develop and identify concepts, models, attitudes, trends, patterns and values for capturing information from the mental model of the participants. This mental model suggests possible taxonomies.

Card sorting is widely used in the field of Human Computer Interaction, psychology, and knowledge engineering for knowledge elicitation. It helps to evoke participants' domain knowledge [14], distinguish the level of the problem [1], and reflects ideas about knowledge [20]. Furthermore, card sorting is often used to gather data about personal constructs, for instance menu structure specifications and to understand users' perceptions of relationships among items.

This research uses card sorting as a method to identify categories of food items. In contrast to the above card sorting experiments, which always use one layer of grouping cards, we allow the participants to use as many layers as they find adequate, so that groups can be subdivided into lower level groups.

This layered approach is closer to people's every day use of classification, but also poses quite a challenge for the analysis, particularly for large data sets. For this reason we automated part of the analysis, i.e. the measuring of the difference between two classifications as edit distance. Other differences were observed and analysed manually, such as the width and the depth of the classification. Furthermore, we employed cluster analysis (K-means) to determine, whether the cultural backgrounds of participants are a potential explanation for the observed differences.

3.1 The Study

The card sorting experiment was conducted in this way: Thirty-nine cards with names of a variety of food items were used. Participants were asked to group these cards. Subsequently, they were asked to label each group. Then they were asked for each group of cards, if they would like to subdivide the group. The participants labelled the subgroups as well. The process was repeated until participants no longer wanted to subdivide any groups. While the participants were grouping cards and labelling the groups the researcher recorded the emerging tree structures. As the study was a cross-cultural one, the food items were translated into the participant's first language.

The data collection generated hierarchical tree structures representing the classifications that the participants revealed by grouping the cards. The analysis of the data revolves around the discovery of similarities and differences between the hierarchies, and whether those similarities and differences are aligned with cultural identity. The investigation proceeded informally at first, looking for patterns in the data that were suggestive of culturally aligned classificatory practices (see Section 4.1). The initial analysis pointed the way for a more systematic analysis that lent itself to automated support (see Section 4.2).

3.2 Participants

A total of 160 (PK n=80 and UK n=80) subjects participated in this study and were selected based on the ethnicity. They were literate, over 18 years of age and were familiar with all the items on the cards. Pakistani participants are from Karachi, Lahore, Islamabad, and Bahawal Pur. UK participants live in London and their grandparents are also UK born.

4 Findings

4.1 Observations

The initially observations were conducted informally and manually, with a search for patterns of similarity and difference between the hierarchies produced by members of the different groups. Figure 1a and 1b shows, that Pakistani participant's categorisation is relatively flat, where as the UK participant added an extra layer of categorisation.

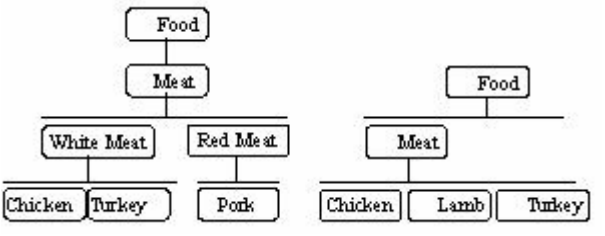

Fig. 1a & 1b. The UK and Pakistani categorisation

The observations showed that Pakistani and British participants differed in their categorisation judgments. However, they shared a common representation structure in some categories. The differences are also noticed within each culture. Observations suggest clear differences between the categorisations produced by Pakistani participants and those produced by their British counterparts. For instance, fragments of typical categorisations produced by a Pakistani and British participant are shown in Figures 2a, and 2b respectively.

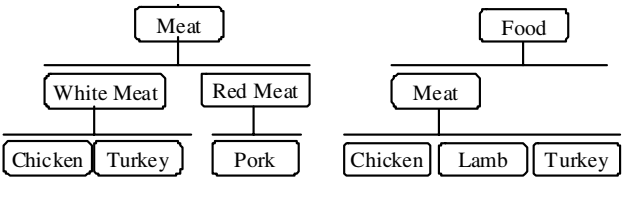

Fig. 2a & 2b. Sample categorisations produced by members of different cultures

However, Figure 3 shows a fragment of the categorisation that was generated often, being common to many participants, irrespective of their cultural background.

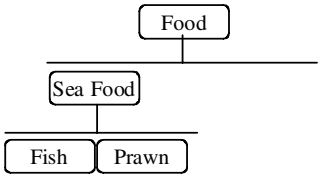

Fig. 3. Sample categorisation produced by members of different cultures

In other cases, participants produced structurally identical classifications, but used different terminology to refer to parts of the classification tree, as illustrated in Figure 4a and 4b.

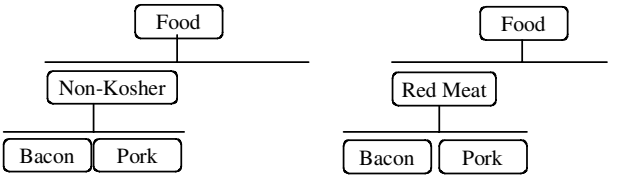

Fig. 4a & 4b. Sample categorisations produced by members of same cultures

The study gave valuable insights regarding food classification with relation to different cultures (Pakistani and British), suggesting that members of different cultures systematically organise and categorise items differently. Additionally, the informal analysis was sufficient to suggest that a more systematic analysis of similarity and difference would be a profitable line of inquiry.

4.2 A Systematic Approach to Analysis

The initial analysis of the study indicates a cultural difference in food categorisation among people belonging to different cultures that appears to be greater than the differences between people within the same culture. The studies suggest that both the 'national culture' and the 'belief system' of a participant shape the way they categorise items. By 'belief system' here, we refer roughly to religious background as this is a highly significant factor in the way people understand food and the various domestic practices that surround it. It seems likely that other elements of culture, such as professional cultures or membership of communities of practice would gain greater significance.

4.3 Hypotheses

Based on our findings, we can more confidently assert that categorisation is influenced by culture and belief, and several open questions exist as to the nature of this influence.

A first step towards conducting analysis in a more rigorous manner was to formalize the complimentary notions of 'similarity' and 'difference' that are at work. A number of possible formulations are possible, but the one that proved to be most promising was the notion of 'edit distance': the difference or distance between two tree structured hierarchies is considered to be the number of editing steps necessary to transform one tree into the other. This measurement of distance was implemented in software based on a freely available framework called SimPack.[2]

The algorithm for computing the 'edit distance' between trees facilitated the construction of a 'distance matrix' that encodes the edit distance between the hierarchies produced between all pairs of study subjects, and the discovery of structure in the population of subjects entails an exploration of this distance matrix.

Two approaches to this exploratory task were employed. A more traditional statistically-based approach was implemented using a variant of the k-means cluster analysis algorithm to discover clusters of subjects who were 'close together' in that they produced similar hierarchies. This formal style of analysis was complemented with a more exploratory tool that produces a visualization of the distance matrix, based around the physical analogy of data points joined by a collection of springs whose length is determined by the edit distances[3]. A simulation of such a system yields a dynamic network that tends to settle in a 'low energy' configuration. The latter technique provides a useful visual way of seeing how a structure emerges from the confusion, as similarly similar trees tend to gravitate towards one another.

The results obtained from the cluster analysis algorithm are, informally, at least, in accord with the graphical simulation. Figure 5 illustrates this by showing the graphical display in which subjects are shown as numbered nodes in the graph. The physical distance between nodes in the figure is a reflection of the network of edit distance relationships. Overlaid on the figure are the four clusters found by a run of the cluster analysis algorithm.

5 Towards Interaction Design

A starting assumption for this research was that no scheme for organising information is likely to be equally effective for a range of cultural groups. The current research aims to make a contribution in this area, not by finding a universal way of classifying information, but by providing a method for investigating classification in a locale in order to generate localised interface designs. The expected solution will be based on local user access needs and capability of the local users.

The analysis so far has given a way of identifying clusters of related structurings of a set of objects. A number of strategies exist to take this forward into interaction design. An obvious approach is to provide a localized user interface for each cluster, choosing a representative element from a cluster (for example, using the edit distance metric to find the most central element in a cluster) to guide the structure of navigation elements on an interface.

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[2] SimPack is an open source collection of software tools for investigating the similarity between 'ontologies'. Available from http://www.ifi.uzh.ch/ddis/simpack.html

[3] The tool is based on the Graph demonstration program that is part of the Java Software Development Kit available fromjhttp://ava.sun.com

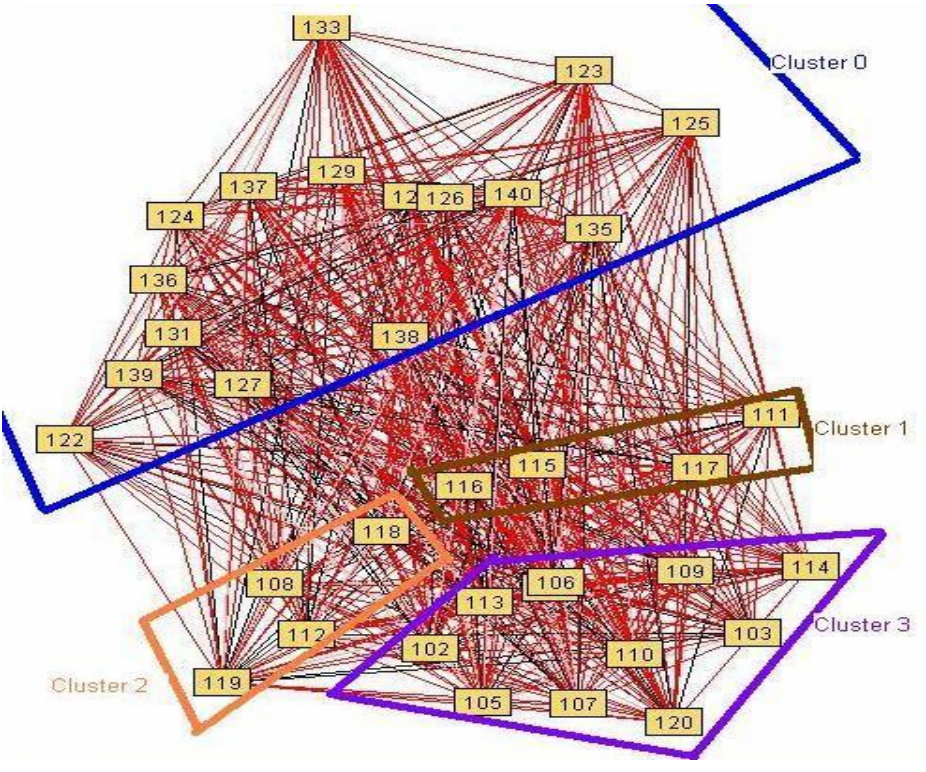

Fig. 5. Overlaying cluster analysis on a graphical representation

6 Conclusion and Future Work

The contribution of this research is to introduce a new analysis technique based on SimPack's modified classes to discover/measure similarity and edit distance. This method will help to understand how different cultures view similar concepts.

We propose a cultural based interface obtained from local knowledge. Our interface will show a common concept which is result of hierarchical clustering analysis of multi cultural representation. It will allow user to explore effectively in comparison to a non-cultural based interface.

The interface is user perspective, which will help the user to interact effectively and close to human to human interaction. When the users visit the main page the interface user will find cultural based navigations/classifications close to the particular culture. If the user clicks on a particular culture for example Pakistan, the user will get additional options from four cities. We hope this will enable the reader to understand the problem and its solution will give them better overview of this research. The aim of this research is to propose a design for all cultures to increase usability enhancement and interaction patterns in categorising that lead to browser design. The result and analysis we presented in this paper is intended to guide design of cross-cultural interface. We used mixed methods to interpret the result. Our studies explored cultural

difference by card sorting and result analysis through cluster analysis to compare both cultures. Significant differences were found in term of categorisation. The result increase usability enhancement and interaction patterns in categorising that lead to interface design

The paper presents a concept of cultural representation for interaction design. The important features of interaction design here are

- Sorting of cultural concepts
- Integration of concepts into categorization
- Interaction design for cultural representation.

This research leads towards culturally-based design and shows how user concepts can be organised. At present, a large scale study has been completed in Pakistan, and in the UK. Our immediate aim is to design a more detailed method for cultural representation and apply it for development of multi culture interaction design. An attempt to validate the approach will address one of the open questions surrounding this approach: does organising a user interface around the cluster of categorizations produced by members of a particular culture yield a more usable or effective interface or a more rewarding user experience? Another collection of challenging questions remain open in the area of scalability. For instance, while it may be possible to use the results of a card sort experiment with a few tens of items to provide localised organization of those very same items, is it possible to scale-up the results of a small study to provide design guidance when faced with a large number of items? Such questions are likely to be of relevance for the design of online stores where the organization of many thousands of items must be based on a more tractable and economically justifiable study.

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