Exploring cultural differences in HCI education

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EXPLORING CULTURAL DIFFERENCES IN HCI EDUCATION

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Abstract. The discipline of human-computer interaction has become a subject taught across universities around the world, outside of the cultures where it originated. However, the intercultural implication of its assimilation into the syllabus of courses offered by universities around the world remains under-researched. The purpose of this ongoing research project is to provide insights for these implications in terms of the student and teacher experience of HCI. How this subject is socially represented across the different universities studied is a key question. In order to develop intercultural awareness of these questions universities from UK, Namibia, Mexico and China are collaborating in a multiple case study involving students and lecturers engaged in evaluation and design tasks. Findings will then be used to propose an international HCI curriculum more supportive of local perspectives. This paper describes the initial steps of this study and some preliminary findings from Namibia, India and Mexico about cognitive styles and cultural attitudes.

1. Introduction

Human-Computer Interaction (HCI) is a well-established and important subject in computing, technology and design in universities across the world. HCI is taught in order to explore, understand and aid in improving the usability and user experience of interactive systems and products. Though each educational community refers to similar methodologies and frameworks in order to teach this subject, little is known of the student experience and how local perspectives have influenced their content and approach to teaching. In addition, different levels of 'maturity' in the adoption of HCI among different countries suggest that its representation and experience can take many forms. Therefore, a current challenge for this discipline is making visible the possible tensions created between local cultures and the assumptions, priorities and values embedded in HCI concepts and methods mainly developed under particular paradigms.

This project proposes to explore how HCI is socially represented, taught and experienced in different institutions spanning four continents in China, Namibia, Mexico and the United Kingdom. The project will begin by investigating how each

educational community perceives what a usable system is through observation, discussion, and interviews in the context of a common evaluation and design task. An international and multilingual science education portal supporting middle school children will be focus of these activities. These will provide data on their benchmarks for what they view as good usability as well as identifying similarities or differences with other institutions and their attitudes to this subject.

The project will then progress to investigate their teaching approaches and methods, gathering data on all aspects such as the structure of their modules, the learning outcomes, the content, choice of literature, assessment methods, use of technology and their conduct in day-to-day teaching. Close attention will be paid to their perception on how HCI issues such as colour and metaphors are delivered, which will also offer data on the influences culture has had on their delivery.

The short duration of this project and its methodological design make it impossible to report on longitudinal accounts of appropriation of HCI by teachers and students. However, we hope to provide insights on the nature of HCI education as an intercultural encounter and the opportunities this can bring to locally validate, question and enrich some of its key concepts and methods. Including these insights into an international HCI curriculum will form designers better prepared to support intercultural collaboration.

2. HCI Education in Different Countries

Though there are numerous articles on HCI education and a few in relation to a country's delivery of the subject, there is no substantial body of literature which offers a thorough investigation into the influence that culture has on its delivery and in comparison with other countries/cultures. There are however a number of studies that discuss HCI education delivery in certain countries such as New Zealand (Sharkey & Paynter, 2004), Sweden (Gulliksen & Oestreicher, 1999), South Africa (Kotze, 2002), Brazil (Souza *et al.*, 2008) and Costa Rica (Calderon, 2009).

These studies offer a brief view into HCI education. Sharkey & Paynter (2004) investigated the need and coverage of HCI in relation to their educational courses in New Zealand. Their research came to the conclusion that the use of design tools was the most common topic followed by task analysis. This contrast with Sweden (Gulliksen & Oestreicher, 1999) where design principles, processes and cognitive psychology are the two subjects deemed to be the most important. Both countries had different approaches in their decisions but it would be interesting to investigate this factor especially regarding the time lapsed since these papers were published. Also, students in Costa Rica (Calderon, 2009) offered their view that HCI should include more graphical design and heuristic evaluations, which the institution amended to accommodate.

In Brazil, a multicultural and developing country, challenges such as illiteracy and digital illiteracy impact on how HCI is implemented and ultimately how it is taught without discriminating against their fellow citizens being a important issue (Souza *et al*., 2008). Souza confirms semiotics has had a stronger influence, unlike traditions in Europe and North America, and that along with social inclusion are the two key areas that define Brazilian attitudes towards HCI. They are however disadvantaged in the fact

that Portuguese HCI educational material is limited and is hindering understanding and development of this subject, a complaint shared by Gulliksen & Oestreicher (1999) and Calderon (2009) in regards to Sweden and Costa Rica.

Kotze (2002) looks at HCI education in South Africa, which in many ways shares cultural similarities with Brazil in terms of the range of ethnic, cultural, language and educational background issues. Kotze argues that HCI is a critical subject that needs to be taught but South Africa has been slow to embrace it. This is due partly to the ICT industry, which is characterised by systems development with little consideration for human factors. There seems to be a problem with institutions and cultures taking HCI seriously. This is echoed by Smith *et al.* (2003) who indicate that in India where a large IT industry exists, HCI education has been neglected which is having an effect on the population and on India's global marketability. Though India produces high-class engineering graduates, very few courses address HCI. However, over the last few years the HCI community in India has grown and the topic begins to be addressed at national level through events such as the India HCI conferences taking place annually since 2010.

With the need for HCI apparent in order to aid the usability of systems at home and abroad, what are best strategies for teaching this subject? Smith *et al.* (2007) suggest that western HCI tools and techniques might not be effective in developing countries and that some degree of localisation or adaptation are required. Lazar (2011) has utilised community-based projects to enhance HCI education in Canada and has discovered that if students are involved with users they are in a better position to appreciate their needs.

Ultimately the literature available offers glimpses into HCI education in different environments though the papers vary in depth, content and publication dates. An aim of this project is to add consistency and contemporary analysis to this body of research, and to make sense of cross-country variations, convergences and emergences from a cultural perspective. In the next section we describe the main theories driving this perspective for us.

2. Culture and Cognition

One area of consideration when discussing teaching and learning is that of the individual cognitive style of the learner. Cognitive, or learning style theory is a complex and contentious subject area with many conflicting theories and very many instruments to determine the different perspectives of cognitive style (Coffield et al. 2004; Cassidy 2004) and in addition, the cultural background of an individual may affect the outcome of any cognitive test (Witkin 1967). However, researchers in the fields of both culture and cognitive styles have identified a correlation between cultural characteristics and the holistic or intuitive versus analytical dimensions of cognitive style (Nisbett & Norenzayan 2002; Hayes & Allinson 1988).

Nisbett's investigations into the relationship between culture and cognition investigate the cultural differences between East Asians and people from the Western world (Nisbett & Norenzayan 2002; Nisbett & Miyamoto 2005) and discuss how an inclination towards holistic or analytic reasoning is influenced by cultural identities.

Building on Witkin's definition of subjects as 'field dependent' or 'field independent' (Witkin et al. 1954), Nisbett differentiates between holistic and analytic reasoning, defining holistic thought as 'an orientation to the context or field as a whole' and analytic thought as 'detachment of the object from its context'. (Nisbett & Norenzayan 2002, p.19). A later study that further focused on attention and perception discovered that the exposure of the subject to particular cultural icons or practices influenced the analytic versus holistic perception, particularly amongst bicultural subjects, concluding that the relationship between culture and cognition is not fixed, but flexible and dynamic (Nisbett & Miyamoto 2005).

Hayes and Allinson tested the hypothesis that culture would account for differences in learning style in a study involving managers from East Africa, India and the United Kingdom. Using Hofstede's (1991) four dimensions of Power Distance, Uncertainty Avoidance, Individualism-Collectivism and Masculinity-Femininity, and the Theorist/Pragmatist and Activist/Reflector scores of Honey and Mumford's Learning Style Questionnaire, Hayes and Allinson identified two dimensions of learning style, Analysis and Action (Hayes & Allinson 1988). Further work in this area resulted in Allinson and Hayes' Cognitive Style Index (CSI) (1996), a compact questionnaire which is designed to test whether individuals tends more towards an intuitivist (right brain dominant) or analyst (left brain dominant) approach.

3. Methodological Strategy and Initial Analysis Model

The case study in each country includes a visit to a university where a group of around 15 undergraduate HCI students will be asked to engage in a workshop, which includes evaluation and design tasks for a science education portal for school children between 10 and 18 years old. The activity given to students will act as a cultural probe (Gaver et al. 1999) as it contains elements with different cultural affordances, e.g. heuristic evaluation as stimulating analytic thinking and prototype sketching as stimulating holistic thinking. The visit will also include meetings and interviews with lecturers and staff in charge of curriculum design. In addition, documents and course materials produced by the university will be analyzed.

Quantitative data on culture for each student group will be collected using Hofstede's VSM instrument, and Hayes and Allinson's CSI survey will be used to situated each student in an intuitive-holistic scale. We acknowledge the limitations of Hofstede's model on national culture (McSweeney 2002) and are very careful not to make stereotypical interpretations or generalizations from the data collected. Even more we are not expecting students to match the national culture scores 'predictions' for their country. The fact that they are in different countries make them more likely to be contrasting. However, we still believe that it will be useful to find out the mean scores for each group on each cultural dimension, e.g. power distance, masculinity and collectivism, to enrich our comparative analysis of quantitative and qualitative data. Qualitative data will be analyzed for manifestations of national culture dimensions (Hofstede, 1991), cognitive styles (Nisbett & Miyamoto, 2005) and high and low context cultures (Hall, 1993). While these different cultural models give us a top-down framework for analysis, a bottom up analysis of this data will also be developed. In this

case the aim will be to uncover cultural patterns, themes and dimensions exclusively emerging from the HCI education domain.

Data gathering can be structured in three levels looking at different types of culture markers per group:

a) Student experience will be studied through completion of VSM 94/08 and CSI surveys, individual 'expert' evaluation and interface design tasks producing quantitative and qualitative data on students' performance and views on the use of heuristics, scenario and persona development richness and content, usability and user experience goals; focus groups aimed at exploring perceptions of the task given to them and HCI concepts and tools in the local context. Students' evaluation and design rationale statements and sketches will be analyzed in terms of the dimensions holistic-analytic, and high and low context as well through development of emergent themes.
b) Teacher experience will be studied through interviews and analysis of HCI course materials. We expect to obtain information on their role as HCI educators, the challenges and indigenous perspectives on the discipline. Qualitative data obtained at this level will be analyzed in terms of the dimensions holistic-analytic, and high and low context as well through development of emergent themes.
c) HCI in the curriculum: through interview and document analysis quantitative and qualitative data will be obtained with a view to find out about how HCI as a subject is represented in the course offer and discourse of each university. Its relative importance will also be measured in terms of its presence in the pathways of different courses. The teaching and assessment methods used and their rationale will also be studies and analyzed. We will look for evidence of holistic-analytic dimensions, and high and low context as well through development of emergent themes.

These activities will help us answer the following questions:

a) How does culture influence delivery of HCI education?
    i. How is selection of teaching material influenced by cultural differences?
    ii. Which topics do an institution choose to deliver in HCI curriculum – why? Any correlation to Hofstede dimension scores for the country and/or cognitive styles found?
    iii. Institutional perception/representation in computing curriculum of HCI education.
    iv. What is the HCI teacher perception?

b) How does culture influence the experience of studying HCI?

    i. What is the Student perception of HCI tools and concepts?
    ii. How do cultural dimensions and cognitive styles correlate with students' preferences for learning HCI?

iii. What are the perceptions of HCI tools and methods vis-à-vis findings for cultural markers?
iv. What is the community's understanding of what constitutes a usable system?

4. Workshops

So far, workshops have been conducted at the Polytechnic of Namibia, the Instituto Tecnológico Autónomo de México (ITAM) and the Indian Institute of Technology Guwahati (IITG). All 3 institutions are well respected within their country. According to the 4 International Colleges & Universities website (http://www.4icu.org), the IITG is ranked 44th out of 505 Indian universities, the ITAM 12th out of 374, and the Polytechnic of Namibia top out of 3, and both IITG and ITAM appear in the QS World Universities Ranking, (http://www.topuniversities.com) with the IITG being ranked at 296 for Engineering and IT. Within these institutions, HCI was a core subject in Namibia, an option in Mexico, and embedded within the whole curriculum in India.

The workshop involved the student in evaluating a learning node in the SEED science portal (www.planetseed.com), specifically Porosity. The target audience of this portal is schoolchildren aged between 10 and 18, and the HCI students were required to evaluate the node in this context. The SEED portal was selected as particularly appropriate for a multi-cultural project of this nature as it supports a number of different language options, allowing students who do not have English as their first language to use their preferred language option and concentrate on the task in question. The specific section of the SEED portal that the students evaluate was selected with two main considerations in mind. The subject matter should be equally relevant to all cultures, and the material provided in the learning node should be both diverse, and rich in multimedia content, allowing extensive interaction with the website. Topics such as malaria were rejected as being of more interest to regions where the disease is prevalent, and other topics were rejected as the supporting learning resources on the site were not sufficiently diverse.

These activities included a heuristic evaluation of a learning task in the portal to determine whether the design satisfied certain predefined characteristics, which requires an analytical approach. In addition, the students were asked to analyse and comment on the case study scenario. The next tasks required a more holistic and intuitive approach: the students were required to develop the persona of both a student and her teacher, and to redesign the portal in view of their findings from the heuristic evaluation. The final tasks related to analysing their redesign in relation to standard HCI theory and concepts.

5. Preliminary Findings from Namibia, Mexico and India

In this section we report some of our findings in relation to the cognitive styles and culture surveys with the student groups in these three countries.

HCI practitioners act as an interface between the developer and the users during the development of computer application or website. In terms of cognitive styles this

means they need analytical skills to understand the functionality of the website or application, but at the same time, they need to be able to see the 'whole picture' and put themselves in the shoes of the user. Some HCI evaluation techniques such as heuristic evaluations require an analytical approach. Others, such as the production of a persona need a more intuitive approach. In addition, whilst the developer may be more concerned with the functionality of the application, the HCI practitioner also needs to balance the need for the interface to be user friendly, and the layout, appearance and aesthetics of the interface will contribute to this. Given this, we would expect the most typical styles to be found in successful HCI students to be more balanced, ranging from quasi intuitive and intuitive to quasi analytic.

With the above expectation, the CSI was administered to a total of 70 HCI students in Namibia (n=21), Mexico (n=25) and India (n=23). Of these, 9 surveys had missing responses and were disregarded. Of these remaining 61 students, 82% were found to fall in the category of Quasi Intuitive (n=18), Adaptive (n=16) and Quasi Analyst (n=16). The remaining 18% were split between Intuitive (n=6) and Analyst (n=6). However, what is particularly interesting is the difference between the 3 cohorts. Namibia and Mexico have 78% and 73% respectively falling in the categories of quasi intuitive, adaptive and quasi analyst; however, in the case of the Indian students, 95% fell into this range.

One possible reason for the difference in profile could be due to the unique nature of the programme at the IITG. The IITG has both a Department of Computer Science and Engineering *and* a Department of Design, and the students who took part in these workshops were Design students. Cohorts from Namibia and Mexico originate in engineering faculties. In the case of ITAM, a small proportion of students were enrolled in financial engineering courses, which might explain the lowest percentage.

Cloninger (2000) differentiates between usability (the masculine, the left side of the brain, rational, and logical action) and design (the feminine, the right side of the brain, emotional, and intuitive action), and with these particular cohorts we would expect to see both dimensions represented, which goes some way to explaining the unusual CSI profile where 95% of Indian students demonstrate styles around 'adaptive' middle point. After all, they are scientists with an aptitude for design.

The VSM data gave us interesting findings in terms of cultural dimensions for the student groups we studied. We do not claim in any way the scores are a reflection on national culture, but mainly use the scores obtained as top-level indicators of students' attitudinal trends in particular dimensions such as power distance and collectivism. The groups of students who completed the survey were nationals of the same country, except in Namibia where we had two Angolans and one South African. However, our interest is on the mean scores for each cultural dimension per cohort rather than as nationals of a country.

For the cohort in the Polytechnic of Namibia (N=21), the mean scores for the VSM94 survey indicate the group is individualistic with very low power distance. This is in contrast with Hofstede's scores for most of sub-Saharan Africa indicating collectivistic societies with a tendency to a high power distance. They seem to be consistent with South Africa's scores but the latter represent respondents with British or Dutch background, whereas the Namibian cohort is fundamentally African. This might

be a reflection of the culture of Namibian universities founded and developed by Europeans.

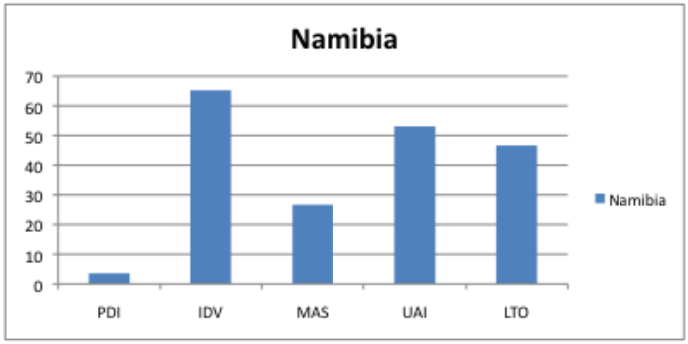

Figure 1. VSM94 Scores for Polytechnic of Namibia

For students in ITAM (Mexico) (N=24) and (IITG) (N=28), VSM 08 was used. The decision to move to a more recent instrument was based on the fact that it offered more flexibility in establishing baseline scores for comparison of the groups. The same will be applied for China, UK and Venezuela. This means, however, we cannot make a direct score comparison with the students in Namibia. Figure 2 presents the results for both countries and there are some contrasts worth noting.

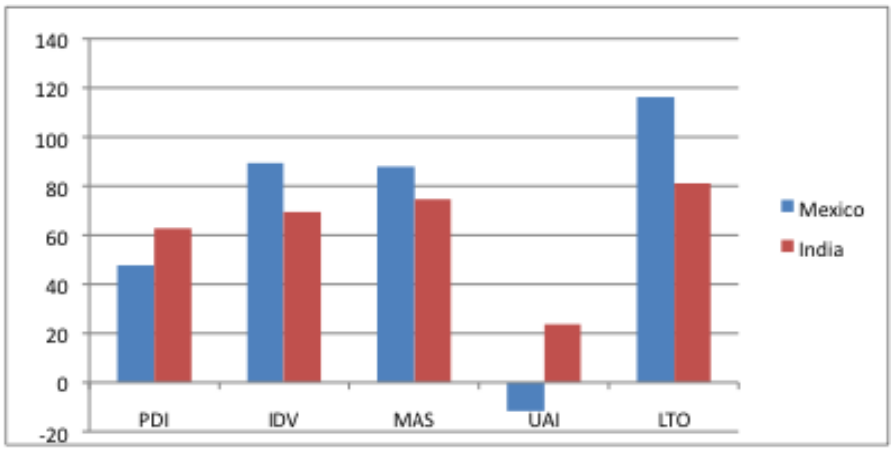

Figure 2. Cultural Dimensions India and Mexico Cohorts

The Power Distance (PDI) dimension was evident particularly in the relationship between the students and their professor or ourselves as researchers. The behaviour of students in Indian and Mexico during the workshops reflects the difference indicated by the survey: Indian (PDI=62) students were more respectful and distant while Mexican (PDI=47) students were slightly more relaxed. This has a direct effect on the reflective

learning process required in concepts and methods in HCI where the student is required to approach users and stakeholders with different levels of authority.

Original Hofstede's scores for Mexico and India indicate that the former is less individualistic than the latter. In our survey we have found the opposite (IDV: Mexico=89; India=69). This can be a reflection of the university culture in ITAM, where a lot of emphasis on individual success is evident in terms of financial awards in the form of fee waivers for the best performing students. While attempting the tasks, Mexican students displayed more independence and less interaction between peers than in India.

Uncertainty avoidance was particularly evident in the difference in the style of teaching between Mexico (UAI= -11) and India (UAI= 23). During the workshop in IITG, certain elements of the theory were revisited prior to the activity taken place. These were delivered by us in the same style that they are delivered to UK, students which was to explain the theory and explain the task in relation to the theory. Feedback from the faculty staff indicated that this would not have been sufficiently structured for Indian students, who would expect a framework of theory, some examples, followed by a worked case study example. In contrast, Students in ITAM completed the activity independently at their own pace after a common induction and required minimum assistance to get them started.

6. Conclusions

In summary, this project intends to enhance our knowledge of HCI Education from an intercultural perspective. It aims to find opportunities and challenges for the dissemination and enrichment of this discipline through eliciting and assessing the importance of local, disciplinary, national and HCI cultures. It does so by exploring the context, performance and views of stakeholders involved in learning and teaching. The preliminary findings presented above are only 'the tip of the iceberg' but help to make visible the values and assumptions shaping the experience of HCI education.

While Hofstede's dimensions have been heavily criticized as valid indicators of national culture, we believe that their use at group level can introduce HCI educators to an initial reflection on the implications for students of the values, relations and interactions scripted in the content and delivery of HCI concepts and methods. In addition, our initial analysis of cognitive styles indicates an interesting tension between HCI as design subject and as an engineering subject. This leads us to another observation: the entry exams for some schools like ITAM will filter a particular type of student who will tend to be more of an engineer than a designer, therefore reducing the number of potentially 'ideal' HCI professionals.

Once the qualitative phase of the analysis of student work begins, we hope to obtain richer insights that connect their outputs with the cultural and cognitive profiles presented in this paper.

This multiple case study project is limited by the short duration of data gathering in each country and by not being able to observe first-hand experience of HCI education happening over a period of time. Nevertheless, this study provides a unique, and probably the first, opportunity to systematically compare and analyse data obtained

from four continents. We are aware that it stands in different epistemological positions as it looks, on one hand, at performance and, on the other hand, at meanings used to represent and experience HCI. However, we see this as an opportunity for triangulation, co-validation and enhanced understanding of HCI education in a multicultural context.

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