Reflecting on the usability of research on culture in designing interaction

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REFLECTING ON THE USABILITY OF RESEARCH ON CULTURE IN DESIGNING INTERACTION

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Abstract. The concept of culture has been attractive to producers of interactive systems who are willing to design useful and relevant solutions to users increasingly located in culturally diverse contexts. Despite a substantial body of research on culture and technology, interaction designers have not always been able to apply these research outputs to effectively define requirements for culturally diverse users. This paper frames this issue as one of understanding of the different paradigms underpinning the cultural models being applied to interface development and research. Drawing on different social science theories, the authors discuss top-down and bottom-up perspectives in the study of users' cultural differences and discuss the extent to which each provides usable design knowledge. The case is made for combining bottom-up and top-down perspectives into a sociotechnical approach that can produce knowledge useful and usable by interaction designers. This is illustrated with a case study about the design of interactive systems for farmers in rural Kenya.

1. Introduction

This paper reflects on the perspectives that have been used to study culture in the production and use of interactive systems, with a particular focus on human-computer interaction (HCI) research and design practice. The last ten years have seen a significant increase in the number of studies about the effect of culture in HCI (Kampuri, Bednarik, & Tukiainen, 2006). However, the contribution to design practice of these studies based on national culture models (Hofstede, 1991) remains controversial as these have not always proven effective in predicting user behaviour or obtaining culturally relevant requirements. This paper frames this issue as one of understanding of the different paradigms underpinning the cultural models being applied to interface development and research.

We start by looking at contrasting conceptions of culture and how they have been used by researchers, including those in HCI. We then go on to look at some of the approaches used to study human diversity in systems production and use. Then the case is made for combining bottom-up and top-down perspectives on culture into a sociotechnical approach that can produce knowledge useful and usable by interaction designers. This is illustrated with a case study about the design of interactive systems for farmers in rural Kenya. The final section highlights the key elements of the two

main concepts on culture discussed in the paper (culture as „software of the mind' and culture as „meanings') and argues for a cultural assessment of the different levels of interface development and research , from the most technical to the most social.

2. Defining culture

Researchers in HCI (e.g. Evers, 2001; Nielsen, 1996) and in the wider area of human factors research in IT (e.g. Calhoun, Teng, & Cheon, 2002; El-Shinawy & Vinze, 1997) have applied the concept of national culture as proposed by Hofstede (1991) to explain and predict how people of certain nationalities will interact with computer systems. A common aspect of these researchers' work is the application of Hofstede's dimensions to explain users' actions or preferences. These dimensions are based on a definition of culture as shared cognitive characteristics of users that could, in principle, be measured, analysed, typified, quantified, and catalogued: from this point of view, culture is already there (Kampuri et al., 2006).

This understanding of culture has allowed researchers to categorize user behaviours according to pre-established dimensions. The meta-model of framing this definition of culture is the „onion' model of Trompenaars (1993) in which core assumptions about life belong to the centre, followed by norms and values in the middle layers and the perceptible outer layer, which represents symbols, rituals and artefacts.
This meta-model is common for Edward Hall (1989), David Victor (1992) and Hofstede [2] in supporting their well known cultural models (Hoft, 1996). All these cultural models have a function and serve the purpose of identifying international variables, according to Hoft (1996). Despite mentioning other forms of culture, Hoft emphasises the association of culture with nations, reducing cultural problems to a matter of national differences rather than conflicts at other organisational or group levels.

All these perspectives convey the underlying idea of culture being the corpus of collective and shared values that „program' the mind, in Hofstede's (1991) terms. This is different from understanding how people construct culture, which would involve exploring the dynamics in which meanings, values and beliefs that people share are created, reproduced, challenged and transformed. Beyond a cognitive-centred conception of the user, these perspectives do no address the sociocultural dynamics that help users define how useful interactive systems are from a situated perspective. This interest reflects a vision of the world typical of the social constructionist paradigm (Guba, 1990). From this paradigmatic stance, the study of culture has been more concerned with how people construe and build their own social world and is in stark contrast with the culture as „programming of the mind'. This conception of culture is well depicted by Geertz:

> Man is an animal suspended in webs of significance he himself has spun, I take culture to be those webs, and the analysis of it to be therefore not an experimental science in search of law but an interpretive one in search of meaning. (Geertz, 1973)

It is a concept of culture that is congruent with the work of Mead et al. (1967), in which interaction and the (re)creation and transformation of symbols – values and meanings – are the basis of the social world. In these perspectives the relationship of culture and the individual is not causal – as in the case of Hofstede (1991) –, but more integrated and co-constructed.

These ideas point to the need for more comprehensive research on culture and technology, as has been suggested by previous empirical studies on cultural fitness of IT (Abdelnour-Nocera, Dunckley, & Sharp, 2007; Gobbin, 1998; Shen, Woolley, & Prior, 2006). The study of culture and users is of interest not only to HCI but also to other disciplines. In the field of information systems (IS), Eason (1988) examined the concept of culture and the social implications of technology use and change in organisations. His work became influential in the field of human factors research, especially in IS. In the Sociology of Technology, the social and cultural frames of users are a primary focus of research (Bijker, 1995; Latour, 1986).

In order to understand the role of interactive systems as culturally mediated and mediating entities, the study of interpretation becomes crucial (Suchman, 1987). This reinforces the definition of culture as „webs of significance' and relates to the process of interpretation of users as discussed by Suchman (1987) and Winograd and Flores (1986). In this sense, culture refers to the diverse interpretive frames of users.

2. Approaches to Cultural Diversity in the Design of Interactive Systems

The HCI community has developed different methods and tools to elicit requirements and evaluate the use of interactive systems. These have been developed in the western world under particular assumptions about what constitutes relevant knowledge for the design lifecycle (Clemmensen et al., 2007; Yeo, 2001). These methods and tools are usually based on iterative prototyping models, scripted evaluations and protocols to obtain user feedback and measure user perception and performance. Following these methods, HCI researchers have used national cultural dimensions, such as power distance or collectivism (Hofstede, 1991), as independent variables in the study of the usability of systems (del Galdo, 1996; Smith, Dunckley, French, Minocha, & Chang, 2004). This type of research into cross-cultural user interface design has established the existence of a cultural effect in the use of ICT that goes beyond language differences. While the methods used by these researchers can improve and facilitate the communication and interaction between the user and the system, these cannot fully assess whether the design of the technology will contribute to its successful adoption and integration into the users' practices and interactions (DePaula, 2003). At present, the validity of Hofstede's national cultural dimensions remain as controversial and questionable (Ratner & Hui, 2003) as their effect on usability and predicting user behaviour (El-Shinawy & Vinze, 1997; Fang, 2003; Kampuri et al., 2006). For instance, in a study about Group Support System the hypothesis of the cultural behaviour of a Singaporean user group and a US group predicted from Hofstede's model was not fully supported (El-Shinawy & Vinze, 1997); research about the introduction of automatic teller machines in India also found that Hofstede's dimensions were not sufficient to

make sense of the all the cultural factors shaping the process of technology adoption in that country (De Angeli, Athavankar, Joshi, Coventry, & Johson, 2004).

In contrast to use of national culture models, semiotic studies in HCI (Bourges-Waldegg & Scrivener, 2000; Onibere, Morgan, Busang, & Mpoleleng, 2001) locate the problem of cultural „fit' to a matter of meaning-matching – e.g. understanding and liking icons and words – between the interface and users' interpretation. There is a clear reference to culture as a frame that enables the decoding of elements, but not in terms of social and symbolic practices that constitute and transform culture, namely traditions (Gadamer, 1975) or domains (Winograd & Flores, 1986). There are authors that explore these traditions as spaces of intersection between the system and the cultures of the workplace or context of use (Bødker & Strandgaard, 1991; Suchman, 1987)

These spaces of intersection between systems and people are also addressed by Suchman's (1987) Situated Action approach. In this approach, the significance of user-computer activities will always be indexical to their unique conditions and circumstances. It is at this level that the challenges of human diversity and culture are faced by technology designers. Suchman's approach has been shared by a number of researchers of HCI (e.g. Carroll, 2000; Nardi, 1996) and Computer Supported Cooperative Work (CSCW) (e.g. Hughes, King, Rodden, & Andersen, 1994; Shapiro, 1994) to understand diversity, and this includes, at least implicitly, the notion of culture. CSCW as a discipline places an important emphasis on contextual and social aspects of technology use. The fact that these phenomena have not been labelled as 'culture' does not mean it is not interesting to understand the relation between technology and people, as socially and culturally different

Another alternative to Hofstede's model adopted in HCI is Activity Theory (Leont'ev, 1978). This theory does not include pre-established cultural dimensions that could obscure other more relevant cultural factors. Research approaches based on Activity Theory look at how relevant aspects of the context shape computer-mediated activity instead of expecting to find, to a certain extent, some given objective structures. These approaches rely strongly on the implementation of plans and goals of people's actions. A clear limitation of Activity Theory that is recognised by Leont'ev's followers (Kaptelini, 1996; Kaptelini, Nardi, & Macaulay, 1999) is that it was developed from psychology and serves different objectives to those of interactive system design. It studies the cognitive-behavioural aspects of tool-mediated activities and tries to explain everything from the minimal operational details to high level issues of social and cultural nature. However, the conception of artefacts as historically and culturally embedded in the practices of a group (Kaptelini, 1996) provide a useful perspective for HCI researchers that is much closer to users' practices and, hence, more usable by interaction designers.

All these perspectives on design and culture highlight two important notions: the relations between designers and users as intercultural and the interpretive flexibility of technology, both of which we now discuss briefly.

Intercultural research on the consumption of technology has found evidence of the integration of artefacts into the everyday life of consumers in ways that differ from those intended by its producers (Honold, 2000; Howes, 1996; Miller & Slater, 2000). Supposed global products go through a creative process of use and interpretation that

will differ to some extent from its built-in meanings and uses. A key insight from this body of research is that studying the cultures shaping designers of interactive systems is as important as studying users' culture. This defines the relation between designers and users as an intercultural one at different levels, not necessarily or only national.

Authors in the Sociology of Technology (Mackay & Gillespie, 1992; Pinch & Bijker, 1987; Woolgar, 1991) define computers and systems as interpretatively flexible. This means that there is not only a process of encoding or production, but also a process of decoding. This flexibility resembles to what Sorenson, Aune, & Hatling, (2000) called the „symbolic work' involved in the domestication of technology, in which the actual uses of systems are not finalised until appropriated by users. This echoes findings by many researchers that local culture, organisational practices and improvisations play a more important and evident role in defining the acceptance and uses of interactive systems than Hofstede's national culture dimensions (e.g. Krumbholz & Maiden, 2001; Rugg & Krunbholz, 1999; Soh, Kien, & Tay-Yap, 2000).

All these considerations lead us to propose a sociotechnical approach to cultural diversity in HCI able to provide usable and useful cultural knowledge for designers.

3. A Sociotechnical Approach to Cultural Diversity in HCI

What is so attractive to the HCI authors using the term „culture' based on national models (e.g. Hofstede) and social psychology theories (e.g. Rotter's locus of control) is the possibility to predict and control user behaviour, an expectation grounded in a positivist scientific paradigm. HCI research on national culture has been used to provide direct guidelines on how to gather requirements, design and evaluate technology, but as soon as designers start working with abstractions other critical aspects of the local culture and context start being overlooked. Thus, these methods, apart from offering an initial realisation that culture does matter, have proven not to be so effective in informing decisions at lower design levels, as already discussed.

Ironically, the tools to understand user diversity at a richer and more granular level come from perspectives cited in the previous section, concerned with sociotechnical change and grounded in contrasting paradigms such as constructionism, usually not so attractive to HCI researchers with stronger roots in computer science and software engineering.

The socially constructed and mediating characters of interactive systems, only finally defined once they are deployed in their context of use, are difficult to assess only in terms of national culture (Abdelnour-Nocera & Dunckley, 2008). This is even more critical at a time when interactive systems are increasingly pervasive and ubiquitous.

Adopting a „sociotechnical' approach responds to the need to carefully consider the social and technical implications of design decisions (Sommerville & Dewsbury, 2007) while helping multidisciplinary project teams to reach a common understanding of the problems being solved with ICT (Hansen, 2006). This includes the recognition of the cultures of designers and users and their contextual diversity in designing interactive systems. Such an approach requires qualitative methods to complement the quantitative survey tools and analysis models usually applied by HCI researchers looking at national culture. These methods are not only ethnographically inspired but also include artefacts

that can act as probes (Gaver, Dunne, & Pacenti, 1999) or facilitators (Camara, Abdelnour-Nocera, & Dunckley, 2008) in eliciting cultural knowledge, specially in those areas of intercultural conflict or misalignment between designers and users.

In order to briefly illustrate a sociotechnical approach to address culture in interaction design, we describe a project aimed at bridging the global digital divide; enabling Kenyan rural farmers to use technology and exchange farming knowledge. This project provides an example of how we applied top-down and bottom-up approaches to culture to identify relevant cultural knowledge for designing interactive system.

3.1. VESEL

The Village e-Science for Life (VeSeL) is a multi-disciplinary research project that aims to identify and design novel and customised ICT solutions for two distinct farming communities in Kanya: Kambu and Kiangwaci. These were chosen because they are characteristically different in terms of their geography, climatic conditions, farming practices and types of crops.

In Kambu, agriculture is relatively poor and constantly in decline due to the lack of good farming knowledge suitable for this type of arid condition. In Kiangwaci, despite its more fertile condition, farmers also have poor agricultural and market knowledge. Schools in both communities remain very disadvantaged and have minimal teaching and learning resources.

The overarching aim of VeSeL is to identify suitable and useful ICT to improve these conditions via a participatory design approach with all relevant actors (community members, researchers, local and national government officials and other interested third parties). To do so, an understanding of context and culture of the communities along with knowledge of existing infrastructure, level of technology and needs were of paramount importance. In other words, a sociotechnical approach to identifying key cultural factors in our choice of technology and subsequent design was needed.

Using quantitative and qualitative methods, we engaged in a contextual inquiry with the communities to unravel their expectations, ways of life and perceptions. Formal surveys, semi-structured and open interviews were conducted taking into consideration local procedures and sensibilities. Some researchers lived with communities for a number of weeks and gained a level of trust and acceptance towards understanding the context *in situ*. Guided by our local partners, researchers took notes, videos, photographs and used some technology probes (Hutchinson et al., 2003) to provoke reactions and elicit tacit cultural knowledge. The analysis of data included top-down and bottom-up perspectives for the elicitation of the cultural knowledge needed.

From the top-down, the analysis was informed by Hofstede's cultural dimensions. However, researchers remained open-minded at all times to findings that contradicted or complemented the dimensions suggested by Hofstede's or his models for East African countries. We had within VeSeL a local partner in the University of Nairobi (UoN), Kenya. In addition, two of the researchers from UK partners were African with one them being Kenya. These partners influenced our initial cultural discovery and understanding of the communities. For instance, in deciding on ethnographic methods or technology probes they would initially advise on the social rites and level of

technology in the communities to expect: requesting meeting through local self-help groups rather than local government/authorities; complexity level and availability of ICT resources on the ground. Previous to our fieldwork different documents and reports on implementing interactive systems rural sub-Saharan Africa were read, some of which confirmed Hofstde's values while others only did it partially.

We found farmers were collectivists by nature since they were well organised into self-help groups that buy and sell agricultural products, make decisions for and within the groups and learn/disseminate information within a group. They showed high uncertainty avoidance: for instance, during some probing exercises with small digital cameras and MP3 players, users would not perform any other actions than those they had been shown. If a camera screen went off, they would come back to the researcher asking if he could fix it. Contrary to Hofstede's scores for East Africa, the communities studied showed low power distance traits since leaders are elected and often this role rotates. Each leader must explain and justify his actions and decisions at every group meeting. Nonetheless, these high level insights into their cultures were not complete and refined and situated enough to inform design and needed of methods and artefacts that would facilitate decisions at more detailed level.

From the bottom-up, the analysis of field notes and qualitative data in general also provided useful findings about their lifestyle and values driving the farming practices. These findings were not focused only on culture manifested in behavioural patterns or measurable responses but on culture as a qualitative phenomenon based on the shared interpretive frames of the user communities. For instance, a semi-structured interview was prepared to be conducted with each of the self-help groups identified. In Kiangwaci, the self-help group (Kaaria) had 19 members and in Kambu there were 16 members (Mtito-Andei Development Initiative). The interview questions for each member focused on their farming activities and resources; types of crops grown; problems they face; their ambitions and objectives; their choice of self-help group; what they see/understand within the group in terms of decision making, leadership and management, benefits, problems; their preferred learning patterns (time and place); where precisely they think VeSeL should help them and their communities; what they see as successes of the group and also individual success stories; etc. It is also important to mention that these activities took place in farmers' home comfort and sometimes while carrying on their farming or showing researchers around.The interview provided much ethnographic information of the community in terms of its characteristics, environment, tasks, values and views. Some of the most pertinent findings were that:

- Farmers expressed a great deal of trust and valued the self-help group as it allowed them to make the most of their crops.
- For those who did not own land and were forced to rent from other community members, they expressed the hardship and effort they had to put into their farming activities to make ends meet.
- A great disparity existed between farmers based on their education level and means. Those who had a higher level of education, tended to have bigger shambas (fields) and more tools such as motor pumps for irrigation, water tanks, better storage units (seed banks) and thus bigger and better houses.
- In Kiangwaci, farmers practiced mixed farming to make the most of their time, resources and continuous production rota. For example, while one set

of French beans was maturing, another one was germinating. After the harvest, another type of crop was grown in its place to re-fertilise the soil.

- All farmers interviewed expressed the difficulty of getting a better return on investment in their produce.
- While some farmers trusted agricultural extension officers sent by the government or buyers who advised on pesticides and practices, others had mixed feelings after a single experiment or advice had gone wrong. Richer farmers coped easily with a bad experiment and tended not hold a grudge, but poorer ones had deep resentment and doubts about any similar initiatives.
- Due to the self-help group initiative, farmers all tended to grow the same crop for income generation even if this practice might lead to abandoning subsistence crops (crops for their own food).

Because of these group activities and practices (collectivism), it was hard at times to identify farmers' individual interpretation of their context and culture with regard to the perceived farming and group dynamic.

Should there be some hidden individualism or silences and sensibilities, what it is and how significant it is need to be explored and made explicit. Card sorting was therefore envisaged after all interviews were conducted to help validate and further explore members' mental model.

While conducting the interviews, researchers were also taking pictures to illustrate as much as possible community members' responses. Pictures of farms (crops and livestock), pests, water resources, school activities, aid activities, homesteads, etc. were all reviewed by researchers to identify a sample set for the sorting exercise. In total 23 pictures were selected with a minimum of two or three in each category identified. Since the focus of VeSeL was in farming and education, these two categories were predominantly represented according to the responses from the interviews. For example, the farmers consistently reported pest control or water management issues. The pictures therefore showed different types of infested crops and water flows. Other pictures of successful crops were also included.

The result of this sorting served to validate the interview results in terms of understanding and interpretation of meaning attached to the view we had of the communities through the interviews. Nonetheless, further analysis revealed another dimension of the community's mental model. Some of the categories showed clusters of cards based on their economic value or impact within community life. Four of the five participants created categories such as "high value crops" or "commercial crops", "consumed locally", "exported" and "survival crop". When we explored the cards associated with these categories, we observed that high value or commercial crops were more respected than those consumed locally or survival crops. Also, we noticed that during the interviews, farmers spent more time demonstrating the extent of their knowledge about these crops than anything else. We did not explicitly identify this meaning attached to their farming practices in the interviews.

However, the variety and richness of this analysis makes it difficult to, on its own, tie key findings with design decisions. This is why an approach to make top-down and bottom-up cultural findings usable in the context of design was followed.

The notions of technology as interpretive flexible and the designer-user relation as intercultural underpinned our approach, which led to the creation of sociotechnical

matrices to guide design. More detailed information on how this occurred can be found in (Camara et al., 2008). Matrices supported the evaluation of scenarios and prototypes by highlighting directly relevant elements of users' culture; they also highlighted intercultural differences across the expectations of the different stakeholder groups in the project, e.g. engineers, users, designers, educators, agricultural experts. Without matching the sociocultural factors to the technological factors in one frame of understanding, most of the solutions would very likely have been abandoned as soon as we left the sites.

This sociotechnical approach to the integration on cultural research in interaction design practice provided situated and usable cultural knowledge beyond the cultural dimensions that neither we nor the communities would have been able to identify or reveal in only following a top-down approach. Among other things this sociotechnical analysis exposed the need for:

- Local champions (keen individuals or persons with pre-requisites and an interest in technology) to lead the dissemination of knowledge;
- Matching users' expectations with designers' intentions. i.e. one blog a day Vs one a week.
- Local metaphors to be added to the user interface.

This approach allowed us to evaluate the interaction between the identified cultural dimensions/attributes and the VeSeL kit. It became clear that sociocultural and technological factors had to be evaluated in an iterative process in which primary knowledge was brought back to evaluate new processes or scenarios in subsequent stages (Hansen, 2006).

4. The Use of Cultural Knowledge in the Design of interactive systems

On this paper we have reflected on cultural research in HCI and its relation to design practice. We have referred to broadly two different takes on culture: (1) as „software of the mind' that controls user behaviours and responses, which then can be measured and analysed in order to produce high level predictive models; (2) as meanings and discourse that cannot necessarily be measured, but which is richer and more detailed about users' practices and expectations.

While the former concept helps to introduce practitioners to the fact that cultural differences do matter in designing interactive systems, they have not always proven effective and sufficient in supporting design decisions. The latter concept implies a much richer source of cultural knowledge potentially more useful to designers, but which needs to be streamlined in ways that can be usable by HCI practitioners.

Our approach to cultural diversity tries to embrace both perspectives on culture in ways useful to and usable by designers, allowing them to think of „the interface as culture' (Kamppuri, Tedre, & Tukiainen, 2006); including the „sixth level' of interface research and development, adding to Grudin's five-level classification (Grudin, 1990). The 5th level refers to interface as „work setting' highlighting the need to recognise the social aspects of organisations and groups, that is, recognising them also as local cultures in our terms. The 6th level places an emphasis on culture at a much broader and fuzzier level, e.g. nations, lifestyles, ethnic groups, etc., and its effects on the lower

levels. Kamppuri et al. recognise the difficulties at generalising and, we would say, using the knowledge generated at this level in design practice. As they note, the meaning of culture in interface design at this level remains yet to be fully defined and understood. We have argued in this paper that this is an issue of understanding the epistemological differences in the paradigms driving cultural research. Converting knowledge primarily aimed at understanding the relations between nations and people, and culture and technology into knowledge aimed at informing the design of interactive systems in culturally sensitive and sensible ways remains a key challenge for HCI. In this paper, we have discussed an attempt at tackling this challenge by incorporating our insights on culture in artefacts and processes supporting design practice.

A way forward would be to device methods and tools, such as those mentioned in our sociotechnical approach, that instead of looking for cultural ‚effects', identify what is cultural about the different levels and aspects of interface development, from the most technical to the most social level, and enable practitioners to act on this knowledge. In this approach, a top-down perspective on culture can provide initial guidelines to categorise and make sense of diversity in structured ways; a bottom-up perspective can elicit sound requirements based on solving problems as defined by intended users of interactive systems and not by its designers.

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