

# Profiling mLearning students according to cultural dimensions: Is that possible?

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## ABSTRACT

Mobile learning (mLearning) is a buzzword in education due to the widespread adoption and prolific use of mobile phones worldwide. Contextualisation, location and culturalisation are important issues in designing and selecting learning content in general but these issues become crucial in mobile devices with small screens and limited resources. Furthermore mobile learners often encounter physical and cognitive constraints imposed by the mobile context. Profiling mobile phone users in order to filter learning content is a prerequisite for a successful mLearning strategy. Objective culture, including language and writing convention is an accepted part of the learner model, although not always specified. This paper investigates subjective culture as an attribute of the learner model for mLearning. The findings from this study indicate that infrastructural, demographic and psychographic factors are more important in determining mobile phone usage than subjective culture. However, despite the conflicting findings in literature and practical problems experienced and noted in researching subjective culture, we believe that subjective culture should be investigated further as an attributes of the learner profile for MLearning.

Author Keywords

Mobile learning design, culture, culturalized user interfaces

## 1. INTRODUCTION

Mobile phones have the potential for connecting people across physical distances and therefore it has been identified as an important technology for supporting learning in Africa. The goal of facilitating learning anytime, anywhere and in every situation is subject to the constraints of mobility. Contextualisation and culturalisation are important issues in designing and managing learning content but these issues become crucial in mobile devices with small screens and limited resources. Becking et al. (2006) recommends user profiling as an approach to filtering content for mobile learning (mLearning). This paper investigates subjective culture, and specifically cultural dimensions, as a possible attribute in the learner model of the user profile for mLearning. We consider the question: Is it possible to identify mobile phone users according to cultural dimensions?

In section 2 we review the concept of mobile learning. In section 3 we discuss the concept of culture and research on cultural-awareness for interactive systems, specifically mobile phones. This section is concluded with the problems noted in designing for cultural awareness. Section 4 describes the research conducted including the interviews and surveys. Section 5 reflects on the findings of this study. Section 6 analyses the results, and interprets the findings against the literature review. We conclude with recommendations on designing for cultural awareness in mobile phones.

## 2. MOBILE LEARNING

Mobile learning has been defined as the intersection of mobile computing and electronic learning which produces an anytime, anywhere learning experience (Leung and Chan 2003). Mobile learning is driven by two factors. The first factor is the mobile and wireless technology revolution and the second is the increasing mobility of eLearning students (Ryan and Finn 2005). Becking et al. (Becking, Betermieux et al. 2006) state the following theses on mobile learning:

- **Time and location independency:** If we assume that the learner carries a mobile device with the appropriate learning material for this media then the mobile phone can provide the infrastructure to make learning independent from time and location.
- **Mobile learning enriches learning:** Mobile devices offer potentially enriching services and possibilities such as connecting to local learning networks, SMS-learning structuring assistance or a adaptable educational 'radio' play.
- **Mobile learning situations are physically and mentally more demanding than local situations:** The term mobile learning situation can be broadened to any situation where one has the time and will to learn, alone or in a group. This means that the mobile learner's surroundings could be uncomfortable, loud, busy and public. The learner may not have access to other resources e.g. references or writing material and the learner might even be distracted and interrupted at regular intervals.
- **Mobile learners need more assistance than local learners:** Given the physical and mental challenges as well as the lack of resources, mobile learners need more support on interacting with the learning material.
- **Mobile learners need filtering functions:** Due to the unpredictability of the mobile learning situation and the physical and cognitive challenges, not all material is suitable for mobile learning. Problem solving or other activities that require uninterrupted concentration or specific equipment are simply out of the question. The mobile learning system should filter out inappropriate learning material so that the learner is provided only with material that makes sense in the special learning situation.

Two different types of profiling have been proposed for the mobile context, namely technical profiling and didactical profiling. Technical profiles describe the state of the infrastructure. The technical profile therefore contains information about networks, bandwidth and specifications of the end-user device (Terziyan 2005). Didactical profiles describe the current status and situation of the individual mobile learner. The didactical profile therefore contains information that describes the environmental conditions, the learner's preconditions and the intended learning process. According to Becking et al. (Becking, Betermieux et al. 2006) much research has been conducted on optimising the technical profile, and therefore this study will focus on the didactical profile and specifically culture as an attribute of the mobile learner model.

### 3. CULTURE

The word culture originally stems from an agricultural root: "culture as cultivation of the soil and plants" (O'Sullivan, Hartley et al. 1994). Applying this to people offers a metaphor for the cultivation of products, minds and social relations. Del Gado (Del Gado 1996) defines culture as learned behaviour consisting of thoughts, feelings and actions, while Hall (Hall and Hall 1990) articulate culture as communication through words, material things and behaviour. The term "culture" is multi-discursive (O'Sullivan, Hartley et al. 1994), therefore it is important to find a definition of culture that serves the specific area of research (Honold 2000). For the purposes of our research we use the Ford and Kotzé (Ford 2005; Ford and Kotzé 2005) definition of culture by defining *culture* as "the patterns of thinking, feeling and acting that influence the way in which users communicate amongst themselves" and with mobile devices.

The basic models of culture are mostly based on some form of ethnic culture even though they may apply to the business environment. The term 'ethnic' is defined as 'relating to a group of people having a common national or cultural tradition' (Oxford 1999). Nevertheless, business and other organizations also have cultures that have an impact on a range of micro and macro-organisational phenomena (Boyancigiller and Adler 1995). Hofstede (1995) uses the word 'culture' in the sense of 'collective programming of the mind' when referring to organisational culture. Organisational culture is based on the organisation's sense of identity, its goals, core values, primary ways of working and shared assumptions (Scott and Gable 1997). Membership of organisations and social groups is usually partial and voluntary, while the association with a nation is permanent and involuntary. National cultures differ at the level of basic values while organisational and group/peer cultures are composed of practices (like symbols, heroes and rituals) rather than values. The purpose of organisational structure is the co-ordination of activities and therefore common practices, not common values, keep the members together (Hofstede 1995). Therefore employees tend to adapt their values to organisational needs to some extent but cannot change the personal values acquired over a lifetime.

When considering designing for culture we have to distinguish between objective and subjective culture (Stewart and Bennett 1991; Limaye and Victor 1995; Hoft 1996). Objective culture is related to social and material institutions and artefacts, manifesting in concrete things that are visible, tangible and easy to examine, for example language, date and time formats, currency, colour preferences, infrastructure and technology. Subjective culture is related to the psychological and sociological features manifesting in people's assumptions, beliefs, values, attitudes, and patterns of thinking.

Culturalization, i.e. preparing an object for use by a variety of cultures, requires two steps: internationalization and localization. *Internationalization* involves identifying and isolating the culturally specific elements of the object, e.g. the market specific features, the platforms and systems to support language specific requirements, currencies, character sets, date and time formats, etc., isolating them and converting them to international standards (Russo and Boor 1993; Sun Microsystems 2001). In software development this involves making program code generic and flexible so that it can be easily adapted to specifications from around the world. Part of internationalization is making the object localizable, i.e. allowing the interface to be translated with a minimal impact on the software code. *Localization* thus refers to the “process of infusing a specific cultural context into a previously internationalized object” (Russo and Boor 1993). Most attempts to culturalization seems to focus primarily on objective rather than subjective cultural issues (Ford 2005).

### 3.1 Global Culture

There is a school of thought that the advent of the global market and the ability of information technology to distribute products and services through web interfaces make it important to design interfaces that are consistent with the cultures of the target users (Marcus and Gould 2000). Shneiderman (2000) contends that universal usability will be met when affordable, useful and usable technology accommodates the vast majority of the global population by addressing challenges of technological variety, user diversity, and gaps in user knowledge.

In 1990 Jonathan Grudin wrote a seminal paper on the history of interface design listing five levels of interface focus (Grudin 1990), each level expanding on the earlier ones. Grudin argues that the focus of interface design in the 1950’s was hardware and from there it expanded outward in about one-decade intervals. At the second level the focus was software, followed by usability on the third level. The fourth level focused on interface as dialogue and the fifth on interface as work setting. Kamppuri et al. (2005) note that one of the main reasons for the transition between the levels has been the changes in user base. In the 1950s the primary users were technicians, in the 1960s programmers, hobbyists in the 1970s, individual end-users in the 1980s, and finally groups of users in the 1990s.

Throughout this development computer systems were improved for “end-users”. In order to be effective, designers also have to understand and be aware of the cultural priorities and the value system of the end-users, i.e. identify factors that are relevant and sensitive to cultural differences. Therefore Kamppuri et al. proposes designing for cultural awareness in interactive systems as the sixth level of interface design which extends Grudin’s five interface focus levels. Kamppuri et al. believe that at the sixth level the focus will be on “interface as culture” and they see the principal users as multi-cultural. They do not, however, distinguish between objective and subjective culture. A scaled down version of Grudin’s model extended with Kamppuri et al.’s ideas depicted in Table 1.

Level	Interface Focus	Principal Users	Period
1	Hardware	Engineers / programmers	1950s
2	Software	Programmers	1960s-1970s
3	Terminal	End-users	1970s-1990s
4	Dialogue	End-users	1980s
5	Work setting	Groups of end- users	1990s
6	Culture	Multicultural users	2000s -

**Table 1: Section of Grudin’s Model with addition of sixth level as recommended by (Kamppuri, Tendre et al. 2005)**

Creating the notion that cultural sensitivity must be incorporated into the standard development processes is also driven by a marketing initiative as this may boost sales where markets have been saturated. On the other hand, the influence of the drive to a homogeneous global culture is undeniable (Plocher and Honold 2000; Brandon 2001). Globalization gives rise to the argument that we are all gradually moving toward one homogenous, standard world culture in which characteristics of national culture will have little importance. The base concept of standardisation is sameness (Stathisa and Sergotb 1998). Standardisation is a key issue of globalization, on the premise that globally marketed software must be uniform in order to offend as few users as possible. The drive for standardisation is supported from the financial aspect since localization increases the cost of product development (Huang and Tilley 2001). The extent of any improvement in user performance due to culturalization needs to be established. Marginal increases caused by localization may not be considered justifiable in terms of cost and time (Ford and Gelderblom 2003).

## 3.2 Designing for Culture

Having considered the general views on cross-cultural design we now turn our focus to cultural awareness in designing interactive systems. The feasibility of culturalization in interactive system design has been questioned for reasons such as (Waldegg and Scrivener 1996; Marcus and Gould 2000):

1. the tendency to stereotype cultures;
2. the difficulty in determining the user based on cultural grounds;
3. insensitivity to bi- and multilingualism and other forms of cultural heterogeneity; and
4. the inappropriateness of the design of interfaces intended to be shared by culturally different users.

One of the best-known and most cited studies was done by Hofstede (Hofstede 1995; Marcus and Gould 2000; Hofstede 2001). In the 1970s and 1980s Hofstede did a survey at IBM that dealt with employee's personal values related to the work situation. He investigated cultural variations on five different parameters:

1. *Power distance*, denoting the extent to which less powerful members expect and accept unequal power distribution within a culture, and scaling from *high power distant* to *low power distant*.
2. *Masculinity vs. femininity*, referring to gender roles, not physical characteristics, as commonly characterized by the levels of assertiveness or tenderness in the user, and scaling from *masculine* to *feminine*.
3. *Individualism vs. collectivism*, referring to the role of the individual and the group, and is characterized by the level of ties between an individual in a society, and scaling from *individualistic* to *collectivistic*.
4. *Uncertainty avoidance*, referring to the way in which people cope with uncertainty and risk, and scaling from *high uncertainty avoidant* to *low uncertainty avoidant*.
5. *Time orientation*, referring to people's concerns with the past, present and future and the importance they attach to each, and scaling from *short-term orientation* and *long-term orientation*.

Baumgartner (Baumgartner 2003) used a heuristic evaluation to rank 50 cultural dimensions related to human-computer interaction, which include Hofstede's dimensions. The first 10 dimensions are: context, technological development, uncertainty avoidance (Hofstede), time perception, power distance (Hofstede), affective vs. neutral, face-saving, activity orientation, nonverbal communication, and individualism vs. collectivism (Hofstede). Hofstede's time orientation dimension came in at number 11 and his masculinity vs. femininity dimension at number 14. We briefly define the non-Hofstede dimensions (Baumgartner 2003):

- *Context*, referring to the amount and specificity of information in a given situation, and scaling from *high context* communication, which has most of the meaning in the context, to *low context* where the complete meaning is in the message.
- *Technological development*, referring to the rate of technological development, and scaling from *advancement* to *backwardness*.
- *Time perception*, where *monochronic* time perception is characterized by schedules, promptness and compartmentalization of activities. The other end of the scale represents *polychronic* time perception which is characterised by people doing several things at a time. Schedules may be changed and time commitments are desirable rather than absolute.
- *Affective vs. neutral*, refer to the way humans express their emotions, and scaling from *high affective* (expressing feelings openly) to *low affective*.
- *Face-saving*, referring to the act of reserving one's prestige or outward dignity, and scaling from *high face saving* to *low face saving*.
- *Activity orientation*, referring to the extent to which activity is valued within a culture. Human activity can focus on *doing*, *being* or *being-in-becoming*.
- *Nonverbal communication*, referring to differences in behaviour as expresses in: “*kinesics* (body movement and facial gestures); *proxemics* (distance); *oculesics* (eye movements and eye contact); *haptics* (touching behavior); *paralanguage* (tone of voice and non-language sounds); and *appearance* (dress and grooming)”.

### 3.3 Studies on the usability of culturalized user interfaces

We reviewed the literature for studies conducted to compare the usability of culturalized interfaces. We found two main groupings of studies: African and international. We briefly describe a few examples of these studies to illustrate the general trends of these studies.

#### 3.3.1 INTERNATIONAL STUDIES

1. Straub et al. (Straub, Keil et al. 1997) investigated the possible effects of Hofstede's cultural dimensions on the user-acceptance of e-mail systems by studying users from the USA, Switzerland and Japan. They found that users' subjective cultural profile would influence their acceptance of certain technologies to perform particular tasks. They found that high power distant, high uncertainty avoidant, feminine and collectivist individuals would reject communication media that are not information rich or do not support social presence. On the other hand, low power distant, low uncertainty avoidant, masculine and individualist people would accept such media. They did not consider the time-orientation dimension.
2. Sheppard & Scholtz (Sheppard and Scholtz 1999) conducted a study based on Hofstede's cultural dimensions with two user groups in the USA, one with 5 users born in the USA and another with 5 users born in the Middle East. They found no user preference rating differences in cultural-aware web sites, but indicated some user performance differences.
3. Smith and Chang (Smith and Chang 2003) studied the influence of Hofstede's dimension on Chinese users' acceptance of website interfaces. They found that only some dimensions have a significant impact on usability, with power distance the largest influence and uncertainty avoidance the least. Like Straub et al. (Straub, Keil et al. 1997), they did not study the effect of time-orientation.

#### 3.3.2 AFRICAN STUDIES

1. Onibere et al. (2001) conducted a nationwide survey among computer end-users in Botswana. They found a desire for a localised interface, but little need for localised icons and no agreement as to which language should be used.
2. Walton et al. (2002; 2003) studied a group of 20 students in a basic computer literacy course. The findings of their research suggested possible cultural dimensions of the interpretation of common visual navigational convention used on web pages. The problem was not attributed to the use of icons (such as tabbed files, folders or mailboxes), but rather to the meaning of hierarchical information structures in their 'home cultures'. They also found differences in 'source literacy' and 'awareness'. Their overall finding was that students from a disadvantaged background had difficulties in making the transition to web use, but not due to the stereotyped notion of ethnic and national cultures.
3. De Wet et al. (2002) performed an empirical study on the usability of localised web sites in South Africa. Their findings indicate that African users prefer to search for information in English and perform better than when they have to do so in their mother language (Sesotho in this case). One reason provided was that some technical English terms could not be translated since the corresponding term did not exist in Sesotho. These terms were then substituted by an explanation of the term, which made the text lengthy and time-consuming to read.
4. Ford and Kotzé (2005) studied web interfaces designed for Hofstede's different cultural dimensions. They state that interface design characteristics favour certain subjective culture dimensions, i.e. that high power distance; high uncertainty avoidance, masculinity and short-term orientation would provide a more usable interface than one designed to accommodate the opposing sides of these dimensions. Their test subjects were multi-cultural users from Southern Africa.
5. Heukelman (2006) did a study on user interfaces for rural communities. The participants were divided on the question of whether the Zulu interface promoted or inhibited understanding. They also found that the Zulu text was more lengthy and some participants complained that they already knew the English terms and did not like relearning the terms.

It is interesting to note that the international studies were all across national boundaries, while the African studies were all within-country studies. The international studies were all based on the premise put forward by Hofstede that certain cultural dimensions can be attributed to people from a particular country, i.e. they all focussed on subjective culture. The African studies were all in sub-Saharan Africa, notably in Botswana and South Africa, both multi-cultural societies, though the latter more extensively so, and these studies focussed more on individual cultural attributes than on cultural profiles for a larger population. Apart from the Ford and Kotzé study, all these studies' main focus was on objective culture, although subjective issues were included.

Based on the findings of these studies we can conclude that there is a definite interest and drive towards the culturalization of user interfaces, i.e. cultural diversity is being embraced. The findings did, however, show that the culturalized product is not always more usable, more acceptable, or the preferred use choice. However, it is difficult to generalise the findings as the problems are often unique to a community and cannot be oversimplified. Several of these studies might also have fallen into the trap of not using appropriate test interfaces or unrepresentative test subjects (Ford and Kotzé 2005).

### 3.3 Designing for Culture in Mobile Phones

The mobile device market has widened to a global scale and consequently mobile devices are distributed throughout the world (Kim and Lee 2005). One can argue that as the use of cell phones pervade the world, the globalization of user interface (UI) design is becoming more crucial to business success and building a loyal customer base. Globalization of mobile devices mean that usability and user-interface designers need to design for cultural-awareness (Kim and Lee 2005). In order to be effective, designers therefore have to understand and be aware of the cultural priorities and the value system of viewers, i.e. they must identify factors that are relevant and sensitive to cultural differences.

The following studies represent the general trends on research in culture related mobile phone preferences:

1. Choi et al. (2005) looked at cultural influences on functionality design of mobile data services by comparing 24 Korean, Japanese and Finish users. They found 52 attributes considered important by mobile data service users and identified 11 critical attributes related to the user interfaces of mobile data services devices. The critical attributes such as minimal keystrokes, iconic menu style, logical ordering of menus items, variety of fonts and font colours, etc., all showed a clear correlation with characteristics of the user's country culture (as identified by Hofstede).
2. Kim & Lee (2005) investigated cultural influence and mobile interface design to clarify the relation between cultural traits and mobile phone interfaces. Their subjects came from the USA and Korea. The results suggest a possibility of cultural impact on icon recognition. They found that Korean subjects performed better using concrete representations, while American users preferred the abstract icon representations. This study was again based on the Hofstede premise.
3. Lee et al. (2005) studied multi-cultural usability in cell phone navigation in a laboratory-based usability experiment with participants from the USA, West Africa, Eastern Europe and South America. They collected cross-cultural usability information in the product development process to determine universal and to-be-localized components, detect mistakes that lead to critical miscommunication, and assess the usability of cross-cultural user interfaces. Their study was again based of Hofstede's premise, but combined with the work of Jordan (1998) on pleasurable products . They found no real differences between the various cultures for the issue of supportiveness, but found evidence that the perception of the same icons differs across cultures.

These studies provide some evidence that culturalization is being investigated and could be an important issue for mobile phone design. However, these studies were all fairly small and performed on individual elements of the mobile device interfaces and not the interface as a whole. All of these studies were again based on the Hofstede model, i.e. on the premise that there is a country specific cultural profile.

### 3.4 What can we conclude from these studies?

The studies quoted either focused on objective culture, i.e. comparing language, colours and surface elements, or they considered subjective culture, such as the cultural dimensions of Hofstede. According to Ford and Kotzé (2005) designing for objective culture in HCI has been greatly mastered and global standards exist (although the studies by Onibere et al., (2001), De Wet & Blignaut (2002) and Heukelman (2006) all showed that the issue of language is not as clear cut as it is made out to be). Subjective culture on the other hand, has not been explored and mastered to the same degree.

Many questions come to mind when analysing the results.. One of these relates to using Hofstede's premise incorrectly by assuming that all users in a particular country will show similar cultural dimension values. If the subjects for a research project is not chosen carefully and specified precisely, results may incorrectly be generalised to apply to a wider population. An example of such a problem can be found in the study by Shimameni and Dunkley (2005) who assumed that their subjects from Namibia were representative of the "Namibian culture". The software product used (a guide to become self-made millionaires) might be appropriate for the test subjects (English speaking IT literate group) but not the remaining majority of the population who is most likely not computer-literate, could come from a totally different socially-aligned cultural group, or who could belong to another primary language group than English (93% of the remainder of the population who would not

fall in this category as 50% of the population belong to the the Ovambo tribe, 9% to the Kavangos tribe 7%: Herero, 7% Damara, 5% Nama, 4% Caprivian, 3%, Bushmen, 2%, Baster., 0.5%, Tswana 0.5%)(CIA 2006; Wikipedia 2006). Any findings from this study would therefore not be generalisable to the wider multi-cultural population.

We have learnt from research in other areas of HCI than interfaces for mobile devices that users may prefer some aspects of culturalization but on the whole still want the original interface (De Wet, Blignaut et al. 2002; Heukelman 2006). Therefore it cannot be concluded from these studies alone that the users would prefer the culturalized alternative when interacting with a mobile phone.

## 4. RESEARCH DESIGN AND EXECUTION

We have found that user profiling is an important issue in supporting mobile phone users in the face of the physical and cognitive challenges inherent to the mobile phone context. We also established that culturalization is an important, yet unresolved issue and that it has not been included in mobile learner profiling. We believe that culture could be an important attribute for profiling the mobile learner, but before we can propose this, we need to ascertain if it is possible to profile students according to cultural dimensions. This leads to the research question: *Is it possible to profile students according to cultural dimensions?* The research consisted of interviews as described in section 4.1, followed by a pilot survey as described in section 4.2 and a data gathering survey as described in section 4.3.

### 4.1 INTERVIEWS

We designed a questionnaire to capture the user profile, uses and user preferences in using a mobile phone. The questionnaire was based on an existing questionnaire by Ford (2005) which classifies participants according to Hofstede’s dimensions based on human-human interaction. A discussion of models and metamodels of culture are beyond the scope of this paper but we considered Hofstede’s cultural dimensions as appropriate since all the studies on subjective culture we could find related to our studies, and referred to above, used Hofstede’s dimensions. We also used literature on mobile usage (Marcus and Chen 2002), and commercial information on mobile phone functions and services, to add questions on mobile phone interaction.

The interviews focused on determining whether the questionnaire was usable, effective and efficient in capturing biographic detail, user cultural profiles and mobile phone usage.

The second part of the study focused on mobile user behaviour including their uses, priorities in purchasing a mobile phone and the frequency with which they used specific features. The interviews involved nine people.

1. The first three included one male in the age group 20-29, one female each in the age group 30-39 and one in the age group 40-49. The results of the first three interviews were not “scored”, as the sessions were unstructured and adapted according to the responses of the test participants. The questionnaire changed drastically after each of the first three sessions.
2. The next six test participants were selected to include both a male and a female in the following age groups: 20-29; 30-39 and 40-49. The test participants were selected to represent three different ethnic groups namely European, Asian and African. The participants were all exposed to the same methods and instruments. They were briefed that the aim of the study was to evaluate the questionnaire and to obtain information about how they use their mobile phones. The test participants were observed in a usability laboratory and videotaped while completing the questionnaire which also required them to get some information from their phones. They were encouraged to voice their opinions about the questionnaire, to ask questions and make recommendations. The questionnaire was followed by a short interview to gain a richer understanding of the way they use their phone and to provide the opportunity to respond outside the structured format of the questionnaire. The results of the interviews are indicated in Table 2.

Participant (even number of males and females)	1	2	3	4	5	6
Age below	50	50	40	40	30	30
Monochronic (M) or polychronic (P) time perspective	M	P	M	M	M	P
High (H), medium (M) or low (L) uncertainty avoidant	H	H	M	L	H	L
Long-term (L) or short-term (S) time orientation	L	L	L	L	S	S
Individualist (I) or collectivist (C)	I	I	C	I	C	C
Low (L) or high (H) power distance	L	L	L	L	L	L

Table 2: Cultural profiles from qualitative study

None of the participants could be identified as high power distant. All were working in a low power-distant environment and we speculated that their work culture could have influenced their responses. On all the other dimensions we did find participants from both sides of the scale. A combination of the information about the way they use their mobile phone, informal feedback from participants and observations made during the sessions was used to adapt and refine the questionnaire before the pilot survey.

The following observations were made during the interviews:

- Participants *over* the age of 30 used less than 40% of the available features on their phones; thought of a mobile phone mostly as a mobile version of the traditional phone and often preferred to keep the old phone when their mobile phone contracts were renewed.
- Participants *under* the age of 30 used between 40% and 50% of the features on their mobile phones; viewed the phone as a tool for communication, organization and entertainment; and demonstrated a keen interest in exploring all the features available, but were inhibited by cost.

An interesting finding relates to time orientation: all the participants over the age of 30 were long-term oriented, while those younger than 30 were short-term oriented. This might mean that people change their perspectives as they grew older and that a cultural profile is not necessarily for life.

The findings from our interviews support the notion that infrastructure (Kleijnen, Wetzels et al. 2004) and demographic factors such as age and education (Kwon and Chidambaram 2000; Bina and Giaglis 2005) are important in mobile phone adoption and use. This means that participants had to be selected for age, education and socio-economic status in order to do meaningful comparisons.

## 4.2 Pilot survey

The pilot study had 40 participants (26 male and 14 female) all students at the MONASH University (South Africa Campus). The original questionnaire was adapted to include the dimensions of technological development, individualism vs. collectivism, uncertainty avoidance, time perception and time orientation. These dimensions were selected by looking at Baumgartner's (2003) list and selecting the top dimensions that would most likely influence behaviour in using a mobile phone. Technological development is more than computer literacy since it includes web and email use. We could not find sensible ways of testing *context* on a mobile phone where low context could be seen as contradictory to affordance. Based on the knowledge gained through the interviews and other studies on mobile phone questionnaires (Kiljander 2004) we changed the questions to reflect the mobile context. The questions for categorizing users into dimensions were originally based on human-human interaction. We now changed these to reflect human-computer (mobile phone) interaction. The aim with the questionnaire was to classify participants into the selected cultural dimensions and then look for correlations between dimensions and mobile phone behaviour. There were five questions for each dimension.

The results of the reliability analyses for the pilot study are depicted in Table 3. This analysis was done to find if the questions measure the same construct. Considering the values in Table 3 it is clear that only the dimensions of "computer literacy" and "uncertainty avoidance" have correlations above 0.6. A value of 0.6 was taken as a cut-off point (Field (2005) notes that when working with psychological constructs values below 0.7 can be expected for Cronbach's Alpha because of the diversity of the constructs being measured). For "individualism", "time orientation" and "time perspective" the internal validity of the items was unacceptably low. This means that the constructs "computer literacy" and "uncertainty avoidance" could be measured by this questionnaire but not those of "individualism", "time orientation" and "time perspective".

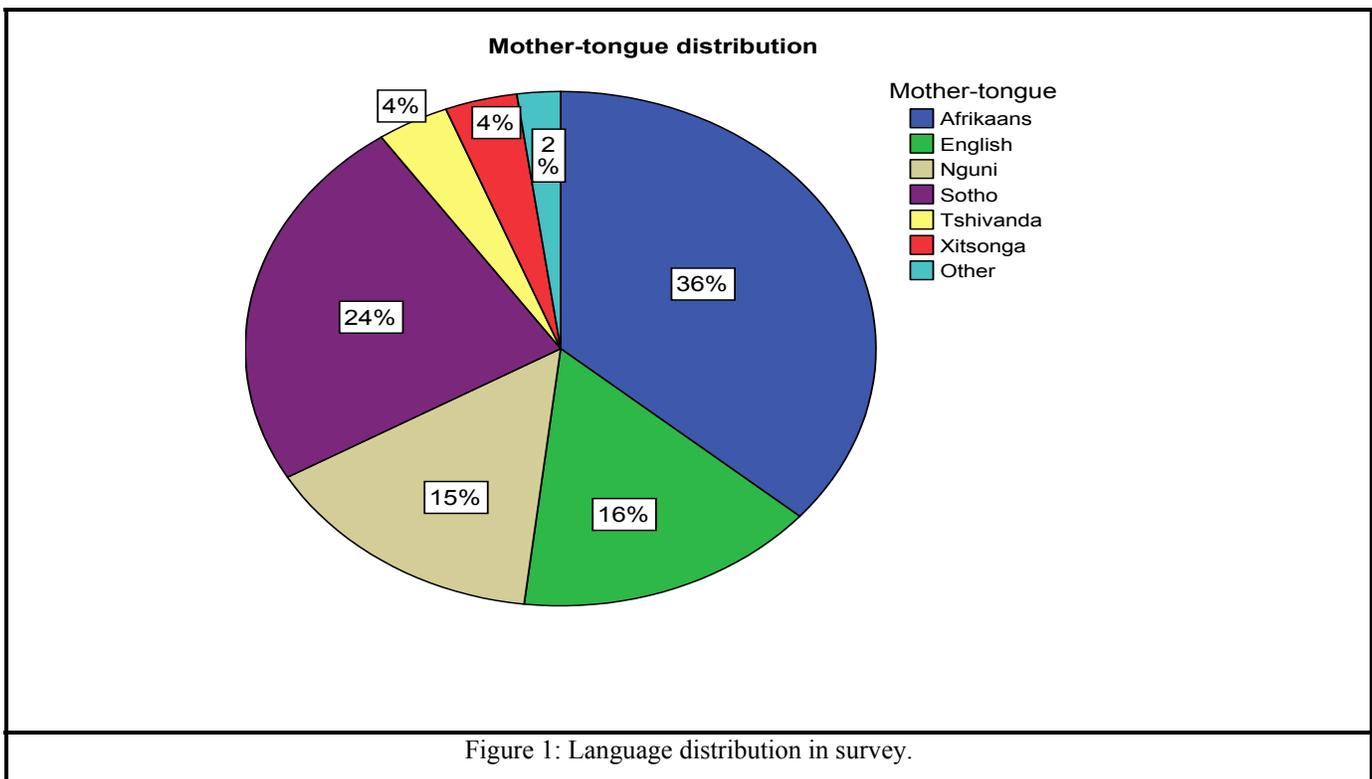
Dimension	Cronbach Alpha Coefficient	
	Raw	Standardised
Computer literacy	0.731244	0.731047
Time Perspective	0.250291	0.182336
Uncertainty Avoidance	0.654830	0.679292
Time Orientation	-0.732048	-0.873414
Individualism	-0.086748	-0.057296
	Standardised	

Table 3: Reliability analyses results of pilot questionnaire on each user dimension tested

Upon review it was noticed that the questions on collectivism should focus more on family orientation than group orientation they were changed accordingly. However, the questions on *time orientation* and *time perspective* were found in order. The questionnaire was too time-consuming to complete (because it had too many questions) and literature supported our finding that it was difficult to measure time orientations and time perspective. Therefore questions related to these two dimensions were removed. The data gathering survey therefore focused only on three dimensions, namely computer literacy, uncertainty avoidance and individualism vs. collectivism.

### 4.3 Data Gathering Survey

The final study had 136 participants, 68% male and 32% female. Their ages ranged between 18 and 27 with an average age of 20. We selected computer science or information systems students from two South African universities (University of Pretoria and Tshwane University of Technology) with the expectation that they would use technology comprehensively. Figure 1 provides some indication of the language distribution. The category Sotho encompasses Sepedi, SeSotho and SeTswana, while Nguni encompasses IsiNdebele, IsiXhosa and IsiZulu. The students were invited to a session on mobile phone research. The lecturers at the various universities extended the invitation to students but were not involved in the research. Participation was optional and anonymous. The questionnaire completion was followed by a presentation to explain the rationale of the research.



The results from the survey are depicted in Table 5. In this case only the test score for technological development was significant while values for both uncertainty avoidance and individualism vs. collectivism were below 0.6. In all these cases ignoring items (i.e. deleting the contribution of specific questions) could not improve the score to an acceptable level of 0.6. This means that the questionnaire did measure the construct of technological development reliably but it did not measure uncertainty avoidance and individualism vs. collectivism reliably. The Cronbach's alpha coefficient indicates whether the questions are measuring the same construct, i.e. dimension. The results depicted in Table 5 indicate that only the questions on technological development were internally consistent (measuring the same construct).

Dimension	Cronbach Alpha Coefficient	
	Raw	Standardised
Computer Literacy	0.924	0.938
Uncertainty avoidance	0.403	0.388
Individualism	0.336	0.340

Table 5: Reliability analyses results for survey questionnaire on each user dimension tested

## 5. DISCUSSING OUR FINDINGS

If we consider these results against the bigger picture that emerges from the literature review on cultural awareness we note the following. The practical problems pertain to two issues namely problems with the questionnaire as discussed in section 5.1 and problems in categorising participants as discussed in section 5.2. Section 5.3 contextualises our findings within other research

### 5.1 Problems with the questionnaire

In the interviews we found participants at both ends of the scale for all of Hofstede’s dimensions. In the pilot survey we found evidence only for the dimensions of uncertainty avoidance and technological development and in the final survey we could only identify technological development as significant. Taking a closer look at the evolution of our questionnaire we realised that the interview questionnaire was measuring human-human interaction, the pilot survey questionnaire was more focused on human-computer interaction while the final survey measured human-computer interaction. The decreased ability to identify the dimensions can possibly be attributed to the fact that Hofstede’s model was developed to measure human-human interaction and it cannot be applied directly to measure human-computer interaction. Strom (2005) support this argument that Hofstede’s parameters describe how people interact with each other, not how they interact with interfaces or physical objects.

This is not a problem attributed to Hofstede’s or Baumgartner’s models alone, the same is likely to apply to all other cultural models (such as that of Hall (1965), Victor (1992), or Trompenaars and Hampden-Turner (1997), many of them covering related issues, although in different classifications. Turning to the objective culture side, differences in literacy levels and how languages structure information relate to differences in how people organize information mentally, providing a natural bridge into the cross-cultural study of mental models (and the subjective culture issue). However, differences in how people mentally organize their world are difficult to assess, and likely to be related to complex differences not only in cultural dimensions, but also experience, education, environment, and common concerns (Dray, Siegel et al. 2003; Walton and Vukovic 2003).

This study is limited by the fact that we dropped two cultural dimensions after the pilot study and did not test all the dimensions throughout. Ford & Kotzé (2005) reported not being able to test individualism since not enough test-subjects could be identified as short-term oriented. It is also interesting to note that a number of the other studies we surveyed (for example Straub et al. (1997) and Smith and Chang (2003)) did not address the time perspective or time orientation issues, but were silent on the reasons for doing so. This emphasizes that it is difficult if not impossible to measure some of the cultural dimensions.

### 5.2 Problems in capturing ethnic origin

We found it difficult, if not impossible, to capture people’s ethnic origin since many people were bi- or multi-cultured. In the interviews some people selected English as their mother-tongue even though that was known not to be the case. One possible explanation lies in the notion of “cultural imperialism”. Cultural imperialism refers to the process whereby certain economically or technologically dominant nations systematically develop and increase their economic, political and cultural power over other countries or nations (O’Sullivan, Hartley et al. 1994). It refers to the ways in which the transfer of certain products, such as mobile devices, from the dominant nations to the dependent markets leads to the creation of particular

patterns of demand and use which are grounded by the cultural values, ideas and practices of the dominant source. In this way the local cultures of the dependent users become invaded and displaced by the dominant cultures. In South Africa, English is the predominant language used in conducting business and therefore the status of English could have influenced people to select that as their mother-tongue.

### **5.3 Contextualisation of the findings**

The findings from the interviews confirmed that demographic and infrastructural factors influence mobile phone usage. Baumgarten lists technological advancement as a cultural dimension but it can also be classified as a demographic dimension as it depends on infrastructure, i.e. people need access to technology in order to be technologically advanced. Therefore the fact that technological development tested so high sustains the importance of infrastructural factors in mobile phone adoption and use.

Jones and Marsden (2005) indicate that computer scientists find the use of Hofstede's cultural dimensions appealing as it implies that culture can be quantified. They, however, warn against this notion stating that besides the ethical issues involved in classifying people, there is the difficulty of assigning a single target culture to a country, an issue clearly illustrated in cultural studies done in multi-cultural and multi-lingual countries and confirmed by our experience. The other issue is that the culturised product is not always preferred. In research on relating cultural dimensions to usability in web site interfaces Ford and Kotzé (2005) found that the interface design characteristics required in design interfaces for high uncertainty avoidance provide a generally more usable interface, no matter the cultural profile of the end-user. However interfaces designed for collectivism was just as usable as those designed for individualism, and for time-orientations the result was inconclusive as not enough test-subjects could be identified as short-term oriented. We have also seen from our review of the literature (Onibere, Morgan et al. 2001; De Wet, Blignaut et al. 2002; Heukelman 2006) that the culture-aware product is not necessarily preferable.

The interviews revealed another issue namely a split between personal culture and mobile phone culture, i.e. that context does matter. For example, a person would not be uncertainty avoidant in general but they would prefer confirmation messages on a mobile phone. Another example is that a person may be collectivist in human-human interaction but they would be individualistic in selecting a phone and would not consider sharing the phone with a family member. Strom (2005) provides a possible explanation by saying that mobile interaction has its own dynamics, mobile phones and the Internet were designed to fit and encourage low power distance, individualism and self-expression: "However, because of the advantages they offer, they are without modifications accepted in cultures with large power distance, collectivism and survival-oriented values". The argument is supported by Dray and Siegel (2003). They found that context of use may matter more than culture. Applications in different cultures and contexts may need tailoring of functionality, content, visual design, and/or overall interaction design to work in the different users' contexts, not only a tweaking of cultural presentations.

## **6. CONCLUSION**

The widespread adoption and pervasive use of mobile phones offer great potential for facilitating learning across distances, contexts and communities. However, given the physical and cognitive constraints of the mobile context, user profiling is a prerequisite for successful mLearning. Culture is an important aspect of learning and therefore we investigated culture as an attribute of the mobile learner model. We found that designing for aspects related to objective culture has been the major focus for internationalization and localization drives in the past, but also that there is currently a definite drive and interest to focus on aspects related to subjective culture.

This paper focused on the problem of categorising users according to subjective culture.

Based on these findings we propose that objective culture, as manifested in language and writing convention is essential part of modelling the mobile user and should be included in the learner model. However, subjective culture has an inherent subjectivity which defies formal classification, e.g. a person's culture cannot be determined from low level context such as country and language, and a person may even be bi-cultural or multi-cultural. Furthermore our findings indicate that Hofstede and Baumgartner's models can be used to classify people in human-human interactions, but that these models do not readily apply to human-computer interaction.

Based on literature, our findings and the practical problems experienced in categorising people according to subjective culture we propose that subjective culture should be further investigated before it can be included as an attribute of the mobile learner model.

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