

**SOFTWARE LIKE A COURTEOUS BUTLER**  
**ISSUES OF LOCALIZATION UNDER CULTURAL DIVERSITY**

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**ABSTRACT:**

The pervasiveness of the Information and Communications Technologies (ICT) results in a tremendous amount of software products being offered, to a large extent via global electronic market using Internet. This forces software providers to market and sell software products in many different countries, bringing many more people into direct (often unexpected) contact with computerized interfaces. These people expect the software product not only 'to speak their language' but also to show a behavioural pattern which is compatible with their cultural expectations and preconditions. They expect reactions from software product like an "intuitive, courteous butler". This involves a great deal more than a pure language translation: it implies the transfer of the software product into another culture taking into account all aspects of cultural divergence. We speak of *localization*.

With respect to the necessary adaptations we identify seven layers of localization of increasing cultural dependency and sensitivity which range from 'Technological Infrastructure', e.g. providing for the correct coding for special national characters, to the 'Cultural Layer' catering for highly complex cultural traditions and expectations like social ranking and taboos. We will only discuss the topmost three so-called socio-cultural levels (Business Conventions and Practices, Transactions, and Culture) describing specific software related instances of localization. We give examples of necessary adaptations of software on the different levels and explain them with the help of C. Hampden and F. Trompenaars's six Cultural Dimensions and/or G. Hofstede and G. Hofstede's five Cultural Dispositions. We present examples for each issue.

We follow with a classification of the various levels of cultural (in)sensibility which a designer of computer system of this kind can exhibit. Some ideas on remedies for cultural mismatches und insensibility close the paper.

**Keywords:** localization, cultural adaptations, user interface, national differences, conventions cultural dimensions, cultural dispositions

**INTRODUCTION**

Today practically every product possessing a minimal sophistication contains software. We speak of *software-intensive systems* (Kossiakoff and Seet, 2003), i.e. systems where software provides an integral and essential part of functionality without necessarily being seen from the

outside. The more sophistication a product has the more software it contains. Thus an ever increasing number of people use such software-intensive products, often without the necessary pre-knowledge about software, also not intending to get acquainted with the "computer's way of thinking". These users only want to perform their job or assignment with the help of the new tools.

For reasons of economy software products have to be marketed and sold world-wide. The seamlessness of global networks (for example e-mail and world wide web) offer access to the electronic world everywhere. Technological progress allows communication via pictures and also via colourful, animated displays showing people in their natural surroundings, presenting software products as part of our daily environment. Computers today execute more complex tasks in closer imitation of human behaviour than ever.

A human communicating with another human expects a certain code of behaviour and a certain world view. Both vary considerably from one nation/culture/ethnic group to another. In today's technocratic world humans tend to ascribe human qualities to complex sophisticated computer interfaces. As a result they "expect good behaviour, etc., ... with the sensitivity of an intuitive, courteous butler" (Miller, 2004). The more realistic the human/computer interface becomes (from simple textual descriptions to animated interactive displays with software agents (avatars)) the more the computer interface has to obey social conventions. People expect the computer to blend into their individual culture.

Thus it becomes necessary to explicitly *transfer* a software product into a geographically (and culturally!) different environment. This implies much more than a simple language translation: we speak of *localization* (Ishida and Miller, 2005), i.e. *the process of adapting a product to reflect the local standards, culture and language of another market* (GSSI, 2000), or *the infusion of a specific culture into an international product*.

In this paper we identify seven layers of localization. We will concentrate on those layers which need a high, conscious interaction of the computer system with the user and will identify problems in adaptation to a specific cultural environment users. We will augment the discussion with some examples (they are identified by "=> " and *italic font*).

Some of the key reasons for the growing need for cultural adaptation are:

**international cooperation** : Global outsourcing of software production induces localization problems both in the product and the production process (Krishna et al., 2004; Winkler et al., 2007).

**more sophisticated applications** : The text-oriented computer interfaces and largely culturally neutral back office applications (ledger, bookkeeping, etc.) of yesterday did not require much localization. Database design and Data warehousing applications are work like Electronic Performance Support Systems (Chroust, 2000a) are depend much more on culture.

**increased non-verbal interaction** : Communication with a computer via keyboard and character text eliminates many other communications channels like intonation and body language available in face-to-face encounters. It increases the danger of misunderstanding but at the same time screens off visual clues relating to cultural specifics.

**user expectations** : An increasing percentage of users is not willing, interested or able to communicate in a foreign language with the system. They expect high-quality communication in their mother tongue (Miller, 2004) compatible with their cultural expectations.

**buyers' market** : Due to the availability of global shopping, there is a surplus in offered software-intensive products world-wide. Emotional factors play a considerable influence in

buying decisions. Customers prefer products that have local branding elements corresponding to their culture. Bad or inadequate localization will diminish the thrust of potential buyers (Lohse and Spiller, 1998). Cultural acceptance will increasingly be a factor in e-marketing.

Above considerations imply that every software product when intended to be exposed to persons from other cultures will need adaptations: localization.

## LAYERS OF LOCALIZATION

Localization has to be performed on different levels of increased comprehensiveness and cultural dependence (see fig. 1). Higher levels usually rely on lower-levels of localization.

**Technological Infrastructure Layer** : The basis for localization are technical and organizational provisions. They are mostly invisible to the user and provide the basis for making a product ready to be localized (Barbour and Yeo, 1996; Chroust, 2000b). They are concerned with the separation of text and code, reserving sufficient storage space for texts, proper coding of characters (including national ones), applying correct sort order, taking care of two-byte languages used in Asia (Adams, 1993), providing for correct writing and reading direction (left-to-right, right to left), see (He et al., 2002; Kim, 1999; Trager, 2006). This holds also for the so-called *locale* which defines the proper representation of date, currency, time, etc. , word order (He et al., 2002; Herden, 2006; Kubota, 2003; Trager, 2006).

**Grammatical Layer** : Textual translation for computer supported texts needs some additional considerations. Many of the sentences are computer generated. As a technical languages has to conform to rules slightly different from literary languages. Typically in literary texts variations of expressions are good style, in system oriented domains uniform, standardized texts are to be preferred in order to avoid ambiguity and confusion.

**Semantic Layer** : This is concerned with the use of technical versus common language, expressiveness of languages, abbreviations. It is to a large degree the domain of (human) language translators.

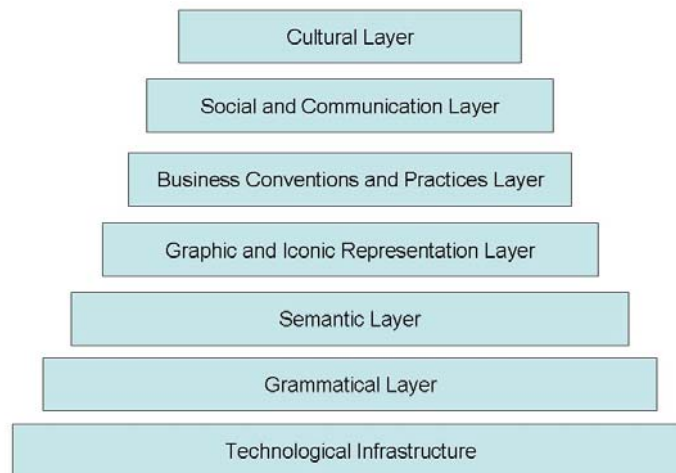
**Graphic and Iconic Representation Layer** : Increasingly software products rely on graphical representations in panels, demos, and animations. Here a considerable amount of correct symbolic meanings, colour codes, taboos, body language when showing people in their national, private setting..

**Business Conventions and Practices Layer** : This will be discussed in section 4.1

**Social and Communication Layer** : This will be discussed in section 4.2

**Cultural Layer** : This will be discussed in section 4.3

The last three layers are very intimately associated with cultural aspects. In order to understand their implications and background one has to understand basic dimensions of cultural preferences in different nations (see section 3).



**Fig. 1: Layers of Localization**

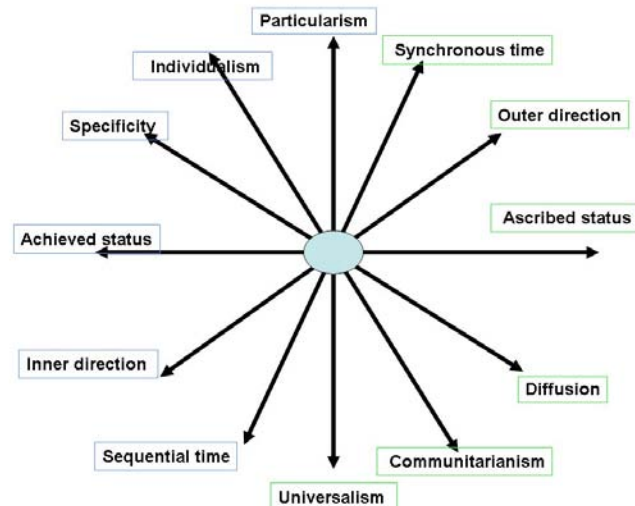
## **CULTURAL DIFFERENCES**

In (Hampden-Turner and Trompenaars, 2000) the following definition of culture is given: *the shared complex system of language, value system, norms, religion, myths, beliefs, manners, behaviour, and structure which is characteristic of a society or part of it*. The broadness of this definition thus encompasses both superficial habits and views which can easily be changed down to long-time deeply ingrained basic values of somebody's *Weltanschauung* (world view).

The following two subsection will describe essential cultural differences between nations in the terminology of key research: (Hampden-Turner and Trompenaars, 2000) and (Hofstede and Hofstede, 2005). Both authors use as their basis similar sets of representative and large scale statistical material and come also to similar results. In (Hofstede and Hofstede, 2005) the similarities and dissimilarities of the findings in the two books are discussed.

### **Cultural Dimensions (Hampden-Turner and Trompenaars)**

In (Hampden-Turner and Trompenaars, 2000) and (Changing Minds (ed.), 2006) one finds six culture-defining dimensions (axes). On each axis of the six dimensions different nations occupy different positions. Considering the 'extreme' positions the authors talk about advantages and disadvantages of each position when (as they formulate it) these positions are taken 'at their best' and 'at their worst'. The 6 dimensions are shown in fig. 2 and described in fig. 3.



**Fig. 2: Cultural Dimensions according to (Hampden-Turner and Trompenaars, 2000)**

**universalism-particularism** Universalism is about finding broad and general rules. When no rules fit, it finds the best rule. Particularism is about finding exceptions. When no rules fit, it judges the case on its own merits, rather than trying to force-fit an existing rule.

**individualism-communitarianism** Individualism is about the rights of the individual. It seeks to let each person grow or fail on their own, and sees group-focus as denuding the individuals of their inalienable rights. Communitarianism is about the rights of the group or society. It seeks to put the family, group, company and country before the individual. It sees individualism as selfish and short-sighted.

**specificity-diffusion** Focussing on the specific role of a person or situation or thing versus looking at them holistically; e.g., in negotiating a deal with your supplier, should you consider what kind of a 'parent' your counterpart is to his/her children? Diffusionists would! High-context cultures with their reliance on the context and the nonverbal aspects are to be distinguished from low-context cultures which depend more on explicit, verbally expressed forms of communication (Hall, 1976; Schneider, 2001).

**achieved status - ascribed status** Achieved status is about gaining status through performance. It assumes individuals and organisations earn and lose their status every day, and that other approaches are recipes for failure. Ascribed status is about gaining status through other means, such as seniority or birth. It assumes status is acquired by right rather than by daily performance, which may be as much luck as judgement. It finds order and security in knowing where status is and stays.

**inner direction-outer direction** Inner-directed is about thinking and personal judgement 'in our heads'. It assumes that thinking is the most powerful tool and that considering ideas and intuitive approaches are the best way. Outer-directed is seeking data and information in the outer world. It assumes that we live in the 'real world' and that is where we should look for our information, directives and decisions.

**sequential time-synchronous time** Time as sequence sees events as separate items in time, sequenced one after another. It finds order in a serialized array of actions

that happen one after the other. Time as synchronisation sees events in parallel, synchronised together. It finds order in the coordination of multiple efforts.

**Fig. 3: Cultural Differences (Hampden-Turner and Trompenaars, 2000)**

**General Cultural Dispositions (Hofstede and Hofstede)**

Similarly (Hofstede and Hofstede, 2005; Hofstede, 2005) have established five dimensions of cultural differences described in fig. 4 and shown in fig. 5. Their findings are to a large extent based on the same statistical material as used in (Hampden-Turner and Trompenaars, 2000).

**Power Difference Index (PDI)** : This is the extent to which the less powerful members of organizations and institutions (like the family) accept and expect that power is distributed unequally. The inequality is endorsed by the followers as much as by the leaders.

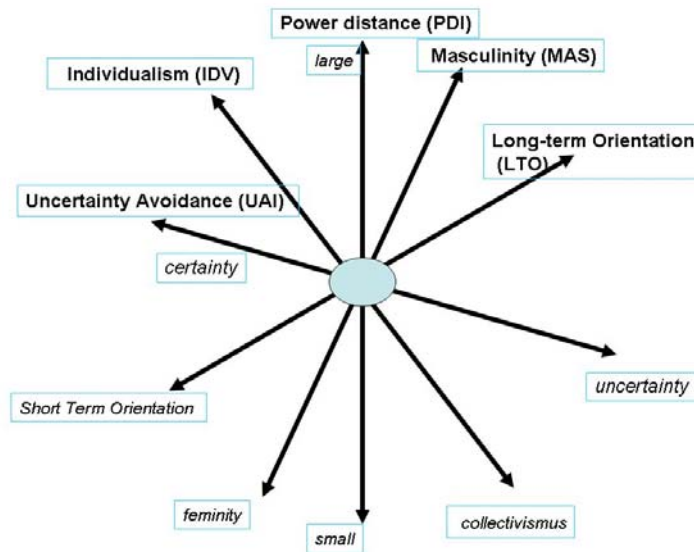
**Individualism Index (IDV)** : This is an indication of how loose the ties between individuals are as compared to (collectivistic) societies where individuals from birth onwards are integrated into strong, cohesive in-groups, often extended families which continue protecting them in exchange for unquestioning loyalty.

**Masculinity (MAS)** : This characterises how big the gap between men's values and women's values is. It states to what degree mens' values are assertiveness and competitiveness, while womens' values are modesty, care, consolation, etc.).

**Uncertainty Avoidance Index (UAI)** : This deals with a society's tolerance for uncertainty and ambiguity, how uncomfortable one feels in unstructured situations which are novel, unknown, surprising, or different from usual. Uncertainty avoiding cultures try to minimize the possibility of such situations by strict laws and rules, safety and security measures, and on the philosophical and religious level by a belief in absolute Truth.

**Long-Time Orientation Index (LTO)** : Values associated with LTO are thrift and perseverance; values associated with Short Term Orientation are respect for tradition, fulfilling social obligations, and protecting one's 'face'.

**Fig. 4: Cultural Dispositions (Hofstede and Hofstede, 2005; Hofstede, 2005)**



**Fig. 5: Cultural Dispositions (Hofstede and Hofstede, 2005; Hofstede, 2005)**

### THE SOCIO-CULTURAL LAYERS

The topmost three layer of fig. 1 are closely related the ingrained, deep-seated aspects of culture.

#### **Business Conventions and Practices Layer**

Business practices show dramatic cultural differences, as described by (Hampden-Turner and Trompenaars, 2000) and (Hofstede and Hofstede, 2005) causing misunderstanding, friction, and alienation (Krishna et al., 2004). Especially animations, but even texts, could contain cultural blunders.

**leadership approach** : Leadership approach varies in different countries and within organizations (democratic, authoritarian, participative). Management support tools have to conform in their users' expectations in their interfaces and procedures.

=> *In Spain it is customary to first inform management before disseminating any information to the employees. BOOTSTRAP (a European software processes assessment method (Haase et al., 1994)) had to be modified in order to cater for this effect in Spain.*

**organizational structure** : Depending on whether the society is rather egalitarian or hierarchical, both the structure of interfaces, web-sites - and obviously pictorial representations must conform to cultural expectations (Hofstede and Hofstede, 2005).

=> *The rather large Power Distance Index of India (PDI) reflects itself in strict and well-distinguished management levels (Winkler et al., 2007).*

=> *In egalitarian cultures when showing a 'team-photo' the boss usually stands in the middle of the group, not separated at all, a leader on equal level with the led. Such an picture would not be understood in India, were the boss would be singled out and given a predominant position in the photographed group.*

**navigation in web-sites** : Many of the national preferences (e.g. low- versus high context cultures (Hall, 1976), specificity versus diffusion) have to reflect themselves in the design of web pages.

=> *Users in highly hierarchical cultures (large PDI) may view a site positively if it provides a 'member only' access, whereas an egalitarian culture may find it disagreeable.*

**dates and deadlines** : Commitment to dates and deadlines vary considerably in different cultures, as expressed in (Hampden-Turner and Trompenaars, 2000) by the sequential versus synchronous time dimension. Vague deadlines have to be catered for in project management tools to make the tools culturally acceptable.

=> *In Sri Lanka the author was assured that a deadline is just a non-committal promise for delivery.*

**performance measures** : Performance measures vary according to cultural divergence, especially with respect to individualism-communitarianism/collectivism and inner direction-outer direction (Hampden-Turner and Trompenaars, 2000) (Hofstede and Hofstede, 2005).

=> *Even neighbouring countries like Austria and Switzerland have different ways of evaluating salespersons. In Switzerland a pharmaceutical salesperson has to pay in order to be given an appointment with a practicing doctor.*

=> *Typically in the USA scientific and business awards go usually to an individual, in Japan usually to the team in total.*

## **Transaction Layer**

Humans have the tendency to ascribe human qualities to complex sophisticated computer interfaces. As a result they "expect good behaviour, observation of etiquette and politeness, subservience, helpfulness, and the sensitivity of an intuitive, courteous butler" (Miller, 2004). The more realistic the human/computer interface becomes (from simple text-based to animated interactive displays with software agents (avatars), (Payr and Trappl, 2004)) the more the computer interface has to obey social conventions.

=> *The misinterpretation of a socially well-designed computer interface was dramatically shown back in 1966 by Joseph Weizenbaum's famous 'Eliza-Experiment' (Weizenbaum, 1966). (Fiadeiro, 2007) even speaks of 'social complexity' when considering federations of individual (software) modules or components.*

**addressing and greeting the user** : Rules for addressing and greetings persons vary greatly both with respect to the chosen phrases (use of family name, title ...) and the accompanying gestures (Herden, 2006). Especially expressing the various degrees of familiarity is very subtle. Pictures and animation must conform to these conventions.

=> *In Japan the suffix '-san' is attached to the family name, to express one's appreciation, in Austria the academic or business title ('Dr.', 'Director' etc.) must be used. In Cambodia the (positional) title is preferred, not the name.*

=> *American manuals address readers directly (e.g. 'In order to switch panels you press key F10') which is considered highly impolite and improper in Germany. Here a neutral, non-personal wording is expected: '...to switch panels, key F10 is pressed'. Personal address is usually reserved for immediate emergency actions 'If ....., switch off immediately!'*



**answering a user** : A 'polite' system is expected to conform to the ways of saying 'no' in a culturally compatible manner. In many Asian countries a 'no' is avoided in favour of no answer at all or a 'yes', which is to be interpreted as a 'no' (Herden, 2006).

**communication styles** : Communication styles permeate to interactive web sites. High-context cultures with their reliance on the context and the nonverbal aspects are to be distinguished from low-context cultures which depend more on explicit, verbally expressed forms of communication (Hall, 1976; Schneider, 2001).

=> *The United States of America are a low-context culture that generally relies heavily on information communicated explicitly by words. Asian and Hispanic cultures, by contrast, resemble high-context audiences that generally accept communications that are deeper and more complex than spoken or written messages (Lang, 2006).*

=> *With respect to advertising Japanese audiences prefer indirect verbal communication and symbolism over the direct "in your face" communication approaches used by Americans. American advertising traditionally relies on words to explain the product and its features and how the product differs from the competition. In contrast, advertising communications used in high-context countries such as Japan rely on nuances and overall differences in the tone, music, scenery, and other nonverbal cues to differentiate the product (Lang, 2006).*

**social classes** : Social class affiliation may play a dominant role in communication (Davidson, 2002) (Hampden-Turner and Trompenaars, 2000), (Hofstede and Hofstede, 2005), (Soh et al., 2000). Differentiation must be made depending on the users and their individual subculture (class), including difference with respect to age, education, etc. (Payne, 2006; Marsh and Morris, 1989).

=> *In English we have to distinguish between 'posh' vs. 'street' English.*

=> *In the Khmer-language even such simple words like 'eat' or 'yes' have different linguistic stems depending on social status (from the king to one's younger brother) (Herden, 2006).*

**social position - age** : The importance and respect for age and the resulting social or economic position varies in different countries (Hampden-Turner and Trompenaars, 2000).

=> *In China seniority is expected to go hand in hand with higher positions in management (ascribed status), in contrast to Western management in which hierarchies rely on achieved status.*

=> *In electronic groupware systems the question whether persons with lower status (Hofstede's PDI (Hofstede and Hofstede, 2005)) are allowed to respond to persons with higher standing has to be taken into account.*

**social position - gender** : The social position of women varies in different cultures. In western societies it is politically correct to show women in leadership positions. This is not expected in some Arabic countries. In Western societies gender-independent language is preferred, especially if otherwise gender-specific role behaviour is implied. The distribution of gender-dependent and gender-independent words differs in the national languages and should be considered. This can be well mapped on the masculinity index of (Hofstede and Hofstede, 2005).

=> *Consider a demo showing a Ms. Jones and her two male subordinates. Due to pregnancy she will use a work flow system to distribute her work to her subordinates. This demo cannot be*

*salvaged for an Arabic country by simply renaming and redrawing Ms Jones to a Mr Jones, because usually a women cannot be a superior to men there.*

*=> In English student means both male and female students while in German one has to revert to Student and Studentin or in a rather awkward new form StudentIn (with an upper-case 'I' in the middle!)*

**acceptable overtime** : The acceptable amount of unpaid overtime work varies and has to be reflected in attendance recording and payroll programs.

*=> While in Japan many companies expect their employees to do work overtime. Austrians rather strict labour laws require employers not only to pay for over time work they are also required by law to ensure that employees under normal conditions do work more than the legal limits (10 hours a day, etc.)*

## **Cultural Layer**

Cultural divergence has to be reflected in system design due to its high impact on acceptability of a software product. The six cultural dimensions identified in (Hampden-Turner and Trompenaars, 2000) or the cultural dispositions in (Hofstede and Hofstede, 2005) have to be observed especially when localizing software.

**taboos** : Taboos are ancient 'good practices' which have changed into religious or social interdiction, often devoid of meaning today. They are highly culturally dependent, highly sensitive and often not explicitly talked about.

*=> In spring 2006 Danish caricatures of the prophet Mohammed caused severe riots in Islamic countries due to a much stricter interpretation of the limits of insult.*

**metaphors, puns, jargon** : Metaphors, puns and jargon are especially prone to cultural divergence. Their use easily causes misunderstandings and ineffective communications. They are best avoided in favour of simple, short and direct messages (Lang, 2006). Typically sport metaphors may not come across if the specific discipline is not played in certain countries.

*=> Asking for a "ballpark figure" as an effort estimate shows a typical American cultural influence as this relates to American baseball.*

**humour** : Humour very rarely carries over to another culture, being the result of the interplay of representation, meaning and context (Bourges-Waldegg and Scrivener, 1998). Especially the context-information will often be lost during localization.

*=> Typically the Mohammed caricatures which were considered as good humour by a Danish newspaper turned out to be seen as a serious insult by Muslims.*

## **CULTURAL PROFICIENCY**

When making decisions in designing socio-technical systems a designer should be aware of potential clashes and should either avoid them (which is only possible in few cases) or take provisions to allow later localization of this feature/function/representation etc. Like quality also localization cannot be later 'added-on'. It must be considered and prepared for from the beginning of a design project. We should not forget, as we said in the introductory statement,

that users expect the interface of a software-intensive system to behave like an "intuitive, courteous butler".

The level of cultural proficiency is an important measure of one's ability to appropriately handle interfaces and reactions of software-intensive systems with respect to users from different cultural background.

According to (Lindsey et al., 2003) there are six levels in the cultural proficiency continuum that indicate how a person (or a system in our case) sees and responds to difference (see table 1).

**Table 1: Cultural Proficiency and Software-intensive Systems, following (Lindsey et al., 2003)**

type	human behaviour	software-intensive-system design
Cultural de-structiveness	see the difference, stomp it out, s eliminate other people's cultures.	force the user to follow the prescribed communication and concepts even if it is contrary to the user's cultural expectation or <u>pre-condition</u>
Cultural incapacity	see the difference, make it wrong, belief in the superiority of one's own culture and behaviour that <u>dis-empowers another's culture.</u>	'correct' or 'improve' on culturally relevant interactions
Cultural blindness	see the difference, act like you don't, act as if the cultural differences you see do not matter, or not recognizing that there are	believe that you 'know' how to include cultural variation, but just use traditional cliches and ignore any discrepancy
Cultural pre-competence	see the difference, respond inadequately. Awareness of the limitations of one's skills or an organization's practices when interacting with other cultural <u>groups</u>	provide certain cultural parameters which the user is encouraged to change, but the support it inadequately
Cultural competence	see the difference, understand the difference that difference makes.	all relevant parameters of cultural difference are adjustable and flexible, the responses are adequate
Cultural proficiency	see the differences and respond positively and affirmingly. esteem culture, learn about individual and organizational culture, and interact effectively.	It is doubtful whether a system would/could reach this level. It would mean interactively recognizing cultural aspects to adapt and learn.

### CONSEQUENCES OF POOR LOCALIZATION

Inadequate localization can have adverse business effects by reducing *effectiveness* and *productivity* due to misunderstood communication, misinterpretation of messages, sign and environment, due to anger and offences. It can be the source of *ridicule*, *embarrassment*, or *offence* and in the worst case result in broken personal and economic opportunities. Customers interpret inadequate localization as incompetence which will *diminish trust* and thus endanger

business contacts. Users will experience less *satisfaction* up to rejection of products. Even legal problems are not beyond imagination.

It can be expected that - due to globalization - issues of localization gain even more importance, to the extent that not only some (software) products are rejected and thus hurting business, but that some of their attributes are considered so offensive to some part of the population that even violence results, as the reactions to the Mohammed caricatures have shown.

## FUTURE TRENDS

The importance and pervasiveness of software products is growing globally. Inadequate localization will be increasingly detrimental to the perceived 'quality in use' (cf. (ISO/IEC, 2001)) and user acceptance. The classifications by (Hampden-Turner and Trompenaars, 2000) and by (Hofstede and Hofstede, 2005) are still rather coarse-grained, only considering whole nations. Actually we have a multi-dimensional distribution. Typically 'wealth' is a weak characteristic of nations but plays a distinctive role within nations in modifying the general tendency (this is well discussed in (Hofstede and Hofstede, 2005)).

The competition in marketing various products (many of them are software-intensive products without the customers noticing it) will force the suppliers of such goods to identify specific submarkets and the peculiarities of their members. First of all we expect a finer distinction between national differences. In both analyses people from 'South Asia' were lumped into one category despite some essential differences between them. And one knows that small differences with ones 'brothers' often weight more than larger differences with 'foreigners'.

Other splits will not necessarily follow the lines of the national differences as identified in the previous chapters. Some of the new subdivisions will be orthogonal to national boundaries: Chinese youngster and American youngsters - despite all their cultural differences - might have more in common than these youngsters have with members of quite different age class of their own nation.

Some of these orthogonal subdivisions are:

**religious differences** : The growing globalization of commerce together with the growing self-consciousness of the Second and Third World countries will have to be considered. This will involve in a stronger commitment to honour and consider religious preferences and sensibilities.

**sociological strata** : 'Horizontal strata' within a society will also receive more attention, e.g. young people, elderly people, different economic power, etc.

**technological communication means** : Access to internet and other sources of knowledge is both a matter of income but also to some extent still a matter of geographic location.

## CONCLUSIONS

This paper provides a discussion of some of the cultural issues related to the design and adaptation of interfaces of software-intensive systems. Some more details (and examples) can be found in (Chroust, 2007).

This area becomes obviously more important and lack of proficiency (cf. section 5) can have many unpleasant and detrimental effect. A first step to improving this situation is obviously awareness. Furthermore the power and the efficiency of software-intensive systems - which also

brought about the issue of localization and cultural disparities -could to some extent also be used to alleviate this problem. Some of the approaches could be:

**awareness and training programmes** : Providing informational material and courses would help to overcome at least the most basic mistakes. E-learning and on-line interactive scenarios could provide useful support in this respect.

**best practices and check-lists** : Putting together efficient, fast to use check-lists and examples would be a further help (e.g. (Lindsey et al., 2003; Collins, 2002; Decker, 2006; Esselink, 2000; Garnet, 2000). Again some checking could be done automatically.

**testing and certification** : Adequate testing methods (beyond simple check lists and some good advice (Vine, 2006)) and hopefully automatic methods are needed to reduce the risk of inadequate localization. Certification of the localization of software is also under discussion (similar to ISO/IEC 9000).

**automation** : Higher levels of localization are becoming more difficult and resource consuming, especially with the growing difference between cultures. The growing demand on human involvement will limit the ambitions with respect to localization. Despite sophisticated programs helping with localization, fully automatic localization will be beyond reach.

**learning systems** : A different approach would be to build learning systems based on Artificial Intelligence programs which gradually learn and adopt adequate localization by a mixture of tutoring and error recognition during actual work.

It must be accepted that localization is an absolute necessity in the global economy. It is not cheap, but the extra expenses are usually compensated by increased usability of the product and thus by larger marketing revenue.

## REFERENCES

- Adams, G. (1993). Internationalization and character set standards. *StandardView*, 1(1):31–39.
- Barbour, R. H. and Yeo, A. (1996). Bilingual/multi-lingual business software: the spreadsheet. In *Proc. 1996 Information Systems Conf. of New Zealand (ISCNZ'96)*, pages 63–71.
- Bourges-Waldegg, P. and Scrivener, S. (1998). Meaning, the central issue in cross-cultural HCI design. *Interaction with Computers vol. 9 (1998)*, pages 287–309.
- Changing Minds (ed.) (2006). Trompenaars' and Hampden-Turner's cultural factors. [http://changingminds.org/explanations/culture/trompenaars\\_culture.htm](http://changingminds.org/explanations/culture/trompenaars_culture.htm) [2005-10-27].
- Chroust, G. (2000a). Electronic performance support systems - challenges and problems. In P. Kopacek (ed.): *Computer Aided Systems Theory - EUROCAST'99, Vienna, Sept., Springer 1999*, pages 281–284. Springer.
- Chroust, G. (2000b). Internationalization is more than language translation! In Hofer, S., Beder, M. (eds.): *IDIMT-2000, 8th Interdisciplinary Information Management Talks, Trauner, Linz*, pages 431–440.
- Chroust, G. (2007). Localization, culture and global communication. In Goran D. Putnik and Maria Manuela Cunha: *Encyclopedia of Networked and Virtual Organizations - To be published (Paper 0105)*, page 8. Idea Group Reference, Hershey, London, Melbourne, Singapore, 2007.
- Collins, R. W. (2002). Software localization for internet software: Issues and methods. *IEEE Software March/April 2002 (Vol. 19, No. 2)*, pages 74–80.
- Davidson, R. (2002). Cultural complications of ERP. *Comm. ACM vol. 45 (2002) no. 7*, pages 109–111.

- Decker, J. (2006). Symbolism of color: using color for meaning.  
<http://www.princetonol.com/groups/iad/lessons/middle/color2.htm> [Oct. 2006].
- Esselink, B. (2000). *A Practical Guide to Localization*. John Benjamins Publishing Comp., Amsterdam / Philadelphia 2000.
- Fiadeiro, J. L. (2007). Designing for software's social complexity. *IEEE Computer* vol. 40 (2007), no. 1, pages 34–39.
- Garnet, X. (2000). Colours. <http://garnet.acns.fsu.edu/~ekarahan/ch7/tsld008.htm> [removed from internet!].
- GSSI (2000). Software localization. GSSI - WWW, <http://www.g11n.com/apps.htm>, [April 2000].
- Haase, V. et al. (1994). Bootstrap: Fine-tuning process assessment. *IEEE Software* vol. 11, no. 4, pages 25–35.
- Hall, E. (1976). *Beyond Culture*. Doubleday Anchor Books, Garden City, NY, 1976.
- Hampden-Turner, C. and Trompenaars, F. (2000). *Building Cross-Cultural Competence - How to Create Wealth from Conflicting Values*. Yale Univ. Press 2000.
- He, Z., Bustard, D. W., and Liu, X. (2002). Software internationalisation and localisation: practice and evolution. In *PPPJ '02: Proceedings of the inaugural conference on the Principles and Practice of programming, 2002*, pages 89–94, Maynooth, County Kildare, Ireland. National University of Ireland.
- Herden, J. (2006). Experiences from the KDE localization process in cambodia. KDE Cross Cultural 2006:  
[http://conference2006.kde.org/conference/slides/kde\\_cross\\_culture\\_akademy2006.pdf](http://conference2006.kde.org/conference/slides/kde_cross_culture_akademy2006.pdf).
- Hofstede, G. (2005). Cultural dispositions. <http://www.geert-hofstede.com> [may 2007].
- Hofstede, G. and Hofstede, G. J. (2005). *Cultures and Organizations - Software of the Mind*. McGraw-Hill, NY 2005.
- Ishida, R. and Miller, S. (2005). Localization vs. internationalization.  
<http://www.w3.org/International/questions/qa-i18n/>; [Jan 2005].
- ISO/IEC (2001). ISO/IEC 9126-1:2001 software engineering - product quality - part 1: Quality model. Technical report, Int. Org. for Standardization 2001.
- Kim, K. (1999). Standardizing romanization of Korean Hangeul and Hanmal. *Computer Standards and Interfaces*, vol. 21 (1999), no. 5, pages 441–459.
- Kossiakoff, A. and Seet, W. (2003). *Systems Engineering - Principles and Practice*. Wiley Series in Systems Engineering and Management, Wiley Interscience.
- Krishna, S., Sahay, S., and Walsham, G. (2004). Managing cross-cultural issues in global software outsourcing. *Comm. ACM*, 47(4):62–66.
- Kubota, T. (2003). Introduction to i18n. <http://www.debian.org/doc/manuals/intro-i18n/>, [Feb. 2003].
- Lang, Y. (2006). Marketing communications, culture, and localization.  
[http://www.translate.com/technology/multilingual\\_standard/marketing\\_communications\\_culture.html](http://www.translate.com/technology/multilingual_standard/marketing_communications_culture.html) [Oct. 2006].
- Lindsey, R. B., Robins, K. N., and Terrell, R. D. (2003). *Cultural Proficiency: A Manual for School Leaders*. Corwin Press 2003.
- Lohse, G. and Spiller, P. (1998). Quantifying the effect of user interface design features on cyberstore traffic and sales. In *Conf. on Human Factors in Computing, 1998, Los Angeles*, pages 211–218.
- Marsh, P. and Morris, D. (1989). *Die Horde Mensch - Individuum und Gruppenverhalten*. Kremayr and Scheriau Wien.
- Miller, C., editor (2004). *Human-Computer Etiquette: Managing Expectations with Intentional Agents*. *Comm. ACM* vol. 47, No. 4.

- Payne, N. (2006). Web site localization and culture.  
[http://www.sideroad.com/Cross\\_Cultural\\_Communication/website-localization.html](http://www.sideroad.com/Cross_Cultural_Communication/website-localization.html) [Oct. 2006].
- Payr, S. and Trappl, R., editors (2004). *Agent Culture - Human-Agent Interaction in a Multicultural World*. Lawrence Erlbaum Assoc, Mahwah, New Jersey, London 2004.
- Schneider, U. (2001). Innovation in der Wechselwirkung der Kulturen. *IT'S T.I.M.E.*, vol. 2001, no. 1, pages 69–72.
- Soh, C., Kien, S., and Tay-Yap, J. (2000). Cultural fits and misfits: Is ERP a universal solution? *Comm. ACM* vol. 43 (2000), no. 4, pages pp 47–51.
- Trager, E. (2006). International text layout and typography : The big and future picture. Gnome Live, Boston, October 2006 - Text Layout Summit,  
<http://www.unifont.org/textlayout/TheBigPicture.pdf> [Oct. 2006].
- Vine, A. (2006). Internationalized software testing.  
[http://developers.sun.com/dev/gadc/dev\\_dev/Intl\\_Testing.html](http://developers.sun.com/dev/gadc/dev_dev/Intl_Testing.html) Oct 21, 2006.
- Weizenbaum, J. (1966). Eliza—a computer program for the study of natural language communication between man and machine. *Communications of the ACM*, vol. 9 (1966), no. 1, pages 36–35.
- Winkler, J., Dibbern, J., and Heinzl, A. (2007). Der Einfluss kultureller Unterschiede beim IT-Offshoring. *Wirtschaftsinformatik*, vol. 49 (2007), no. 2, pages 95–103.