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A process model for developing usable cross-cultural websites

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Abstract

In this paper we present a process model for developing usable cross-cultural websites. Compatible with ISO 13407, the process model documents an abstraction of the design process focusing on cultural issues in development. It provides a framework in which a variety of user-based and expert-based techniques for analysis and design are placed within the life-cycle of website development. In developing the model, we relate practical approaches to design with theories and models of culture and discuss the relevance of such theories to the practical design process. In particular we focus on four key concerns: how an audit of local website attractors can inform the design process; the concept of a cultural fingerprint to contrast websites with the cultural needs of local users; the problems associated with user evaluation; and cross-cultural team development. We then show their relation to our process model. We conclude by summarising our contribution to date within the field.

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1. Executive summary

This paper provides a process model for the development of usable cross-cultural websites based on the authors' academic and professional research in this field of development. For international websites to be successful many organisations are now beginning to realise that they need first to understand, and then address the needs of

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a culturally diverse user base. The problem is that people differ across regional, linguistic and country boundaries and user requirements are strongly influenced by their local cultural perspective. Cross-cultural usability is about making websites an effective means of communication between a global website owner and a local user.

The process model set out in this paper documents an abstraction of the design process focusing on cultural issues in development. It provides a framework in which a variety of user-based and expert-based techniques for analysis and design are placed within the life-cycle of development. In the paper the authors propose a number of approaches for different stages of development from requirements to design, from user involvement to multi-cultural development teams and to user evaluation. Three key issues underpinning usable website development in a global context are considered in detail—*requirements for design*, *tools for design (interpreting requirements)* and *strategies for evaluation*. The rationale for our process model is the belief, based on evidence from both theory and practice, that traditional methods of analysis and interface design are not fully adequate for identifying the requirements for cross-cultural websites.

Firstly we introduce the concept of *cultural attractors* to define the interface design elements of the website that reflect the signs and their meanings to match the expectations of the local culture. The cultural attractors typically comprise of: colours, colour combinations, banner adverts, trust signs, use of metaphor, language cues, navigation controls and similar visual elements that together create a ‘look and feel’ to match the cultural expectations of the users for that particular domain. The paper describes some studies in India and Taiwan applying these concepts. A long-term aim is to develop a set of comprehensive cultural attractors and their meanings derived from cultural site audit(s) for each particular culture or sub-culture and the domain of the e-market. Such an approach holds considerable potential for localisation companies and others to create reusable libraries of such sets of cultural attractors and their meanings that would provide a set of useful building blocks for future commercial web-site localisation projects.

The paper then discusses a number of cultural models that can assist cross-cultural developers. An issue that concerns cross-cultural developers is the validity of cultural models derived from other disciplines. The paper describes two studies of Chinese websites aimed at verifying cultural dimensions. The websites chosen possessed different levels of the dimensions of *power distance (PD)*, *individualism/collectivism (IC)*, *masculinity/femininity (MF)* and *uncertainty avoidance (UA)* as rated by using Marcus and Gould’s guidelines for international website design. The studies provide only limited evidence to support these cultural models. The question we are beginning to answer here is the extent to which generic cultural issues really affect website usability and acceptability, and how this information can be easily communicated to developers and site owners. In the case of China the four dimensions have greatly differing significance. PD is very important, and masculinity/femininity less so, but international website designers would be ill-advised to ignore either of these two issues. Contrary to expectations, individualism/collectivism is not important to Chinese users and global expectations of the web would seem to predominate.

A key issue that has emerged from international usability projects in which the authors have been involved is the need to provide an accessible means through which the cultural characteristics of a particular website can be discussed with clients who would be

unfamiliar with theoretical cultural models. In response to this need we are developing the concept of a ‘cultural fingerprint’ which can diagrammatically compare the cultural profile of a website (Site Fingerprint) with that of its target cultures (Country or Culture Fingerprint). From a study of Chinese websites the authors present the country fingerprint for China.

A further section of the paper concerns the important issue of user evaluation. It recognises that ‘traditional’ methods of user testing are difficult and costly to operate across cultures and remote geographical locations. There is the problem of successfully engaging with users from different cultures within the user testing process itself, whereas at a higher level the whole concept of user-centred design (UCD) and participation may be difficult for multi-national development teams. However, overall we believe that it should be possible to develop guidelines for specific cultures and contexts.

Culture and user participation are also discussed. The authors suggest that the motivation for user involvement may be the result of Western culture’s view that users as individuals have a democratic right to be involved in the development of software they are expected to use, and that these assumptions cannot be automatically transferred to other cultural environments and can cause misunderstandings in cross-cultural development teams. The results of a study of developers’ attitudes highlights that cross-cultural difficulties are to be expected and that the choice and deployment of development methods need to recognize this issue.

In the context of user evaluation the paper reviews the existing guidelines and distinguishes between internal and external cultures. In ‘external’ cultures user evaluation should be based wherever possible on teams of users and evaluators from the same culture, while in dealing with ‘internal’ cultures this is less important. Further work is continuing to discover which tools and techniques were particularly sensitive to cultural factors.

Finally these approaches are drawn together within the framework of a process model. As with ISO 13407 our process model (Fig. 10) comprises of five stages, four of which are implicitly joined in a loop. Although the process is iterative it could be converted to a waterfall life-cycle model by simply going through once only. However, the true benefit of this model emerges when it is used to guide an iterative development process. In cross-cultural development there needs to be a strong relationship between cultural theory and commercial practice so that by an iterative process of design, evaluation and reflection on theory an improved product can be obtained.

2. Cross-cultural web development

The website is now an established channel of communication between a whole variety of organisations and their diverse groups of stakeholders. In the e-commerce environment, for example, the web makes a global market accessible to even the smallest company. However, for international websites to be successful many organisations are now beginning to realise that they need to understand, and then address the needs of a culturally diverse user base. A survey by [World Trade \(2000\)](#) in the e-commerce arena echoed the view of researchers in cross-cultural usability that the more organisations adapt websites to local markets, the more successful they should be. As World Trade summarise, putting

the ‘think globally, act locally’ principle into action, is not simple but the rewards can be large.

The problem is that people differ across regional, linguistic and country boundaries and user requirements are strongly influenced by their local cultural perspective. Cross-cultural usability is about making websites an effective means of communication between a global website owner and a local user. Using the Internet to facilitate communication may be a relatively new phenomenon but in order to fully understand it we need to start by investigating the much wider research area of intercultural communication. Although the roots of intercultural communication can be traced even further back, the anthropologist Edward T. Hall established the original paradigm for intercultural communication. Hall has described culture as a selective screen through which we see the world, and believed that basic differences in the way that members of different cultures perceived reality were responsible for miscommunications of the most fundamental kind (Hall, 1959).

Addressing cultural differences means designing and building websites specifically for a global cross-cultural audience. In fact producing good international software products has always been difficult and there are many examples in the past of systems that have failed or caused their users great problems (Del Galdo, 1990). Cultural differences have significance not only for the design itself but also for the process of design. Firstly there is the choice of overall strategy, to develop an international culturally free interface or to provide localised versions. Day (1996) describes three levels of specialisation:

- globalisation, applying an allegedly culture-less standard to be used across different cultures,
- internationalisation, designing base structures for later local customisation,
- localisation, developing specific interfaces to meet particular local markets.

Cultural diversity makes it unrealistic for designers to rely on intuition or personal experience of interface design. However, designing multiple interfaces for different user groups adds significantly to the cost of development. It is important to focus on design characteristics that are sensitive to demographic differences, but it is often not clear what these are. We identify two broad types of usability issue inherent in international website design. Firstly there are easily identifiable ‘objective’ issues, such as language and format conventions, that are straightforward to address. Although important, such issues are not the concern of this paper. Here we are interested in ‘subjective’ issues, those that focus on the ways in which people in different cultures interact with computers and websites. The underpinning cultural and cognitive dimensions of website usability have major implications for the process of international website design.

A key issue in the design of international websites is effective usability evaluation. There are, however, huge difficulties in user evaluation for both localisation and internationalisation for multi-cultural systems development. In relation to *expert/heuristic evaluation* problems involve the degree to which existing web design guidelines are culturally biased and how to develop multi-cultural heuristics. In relation to *user testing*, it is necessary to test with representative, local users but this involves logistical problems and can be both difficult and costly.

In response to these many challenges, this paper provides a review of the authors' academic and professional research in the field of cross-cultural website development. We relate practical approaches to design with theories and models of culture and discuss the relevance of such theories to the practical design process. By pulling together a number of strands from our work we establish a process model for usable cross-cultural website development. The process model documents an abstraction of the design process focusing on cultural issues in development. It provides a framework in which a variety of user-based and expert-based techniques for analysis and design are placed within the life-cycle of development. We start with a review of some key theories of culture which have been related to our field.

3. Theoretical underpinning for cross-cultural usability

There is no lack of theoretical underpinning for cross-cultural usability. However, before summarising some of the key underpinning theories of cultural differences, it is worth emphasising at the outset that there is a lack in explicit demonstration that such theories of culture are actually applicable to, and significant within, website usability. However, we will go on to present our work to date in verifying such theories.

A number of researchers have attempted to define the various dimensions that underpin culture through empirical research. Hall (1976) distinguished cultures on the basis of a way of communicating along a dimension from 'high-context' to 'low-context'. A high-context communication is one in which little has to be said or written because most of the information is either in the physical environment or within the person, while very little is in the coded, explicit part of the message. Trompenaars (1993) researched value dimensions and his work was spread over a 10 year period with 15,000 managers from 20 countries representing 47 national cultures. In relation to learning styles, field-dependency is a further factor that varies across cultures (Engelbrecht and Natzel, 1997) and this may effect cross-cultural usability. Field-independent individuals tend to be more analytical, impose their own structuring more on a situation, and be relatively less passive and global in their behaviour (Ford et al., 1994).

In spite of a wide range of research, it is Hofstede's (1991) dimensions of culture that are the most often quoted theories in relation to cross-cultural usability. He conceptualised culture as 'programming of the mind', in the sense that certain reactions were more likely in certain cultures than in other ones, based on differences between basic values of the members of different cultures. Hofstede carried out a study of 116,000 IBM employees distributed through 72 countries using 20 languages in 1968 and 1972. The study was based on a rigorous research design and systematic data collection. He proposed that all cultures could be defined through three dimensions:

- power distance (PD), the degree of emotional dependence between boss and subordinate,
- collectivism/individualism (IC), integration into cohesive groups versus being expected to look after him/her self,
- femininity/masculinity (MF), which could be interpreted as toughness versus tenderness.

In later research he recognised that, for Western cultures there was another important dimension:

- uncertainty avoidance (UA), the extent to which members feel threatened by uncertain or unknown situations;
and for Eastern cultures
- long-term Confucian orientation, which represented a philosophy of life that was prepared to sacrifice short-term results for long-term gain. This dimension does not discriminate across all cultures in the same way as the dimensions given above. It has been suggested that it discriminates between environment-centric cultures and human-centric cultures (i.e. the ‘West’).

Cultural differences such as those described above are potentially relevant to both the design and the process of design. In relation to the design (artefact) itself the cultural dimensions can lead to design guidelines. [Marcus and Gould \(2000\)](#), for example, address Hofstede and present guidance for each of Hofstede’s dimensions based on a theoretical analysis of websites. Hofstede’s work has been influential in research in information systems development (e.g. [Merrit and Hemlreich, 1996](#)). [Rathod and Miranda \(1999\)](#) found evidence that high PD produced high emotional dependence but low task dependence for tele-working.

A closely related concept to Hofstede’s individualism-collectivism dimension is [Rotter’s \(1966\)](#) locus of control (LC) which refers to whether individuals tend to feel that events are the result of their own actions (internal locus) or the effect of the external environment and powerful others (external locus). It has been suggested that LC influences information-seeking behaviour so that ‘internals’ seek more information in problem solving, although the strength of this behaviour depends very much on the situation. In contrast when individuals adopt an ‘external’ approach they might not generalise or learn effectively. They learn less because they believe they do not control the relationship between their behaviour and reinforcement. It has been hypothesised that externals would suffer depression and anxiety as a result of poor achievement outcomes whereas internals would exhibit more ‘planful’ behaviour. For example in Western cultures the making of plans and having them work is frequently endorsed, while in collectivist societies the focus is less on having plans work well, but more upon personal relationships and the causal reasons for not doing well in them. This can have many effects including the belief a person has in his or her ability to accomplish computer tasks ([Langford and Reeves, 1998](#)).

4. Practical approaches to international website development

Collectively we have been working in the area of cross-cultural usability for over five years both as academic researchers (in three UK universities) and as usability practitioners (for a usability consultancy based in central London). From both our academic and commercial experience we identify three key issues underpinning usable website

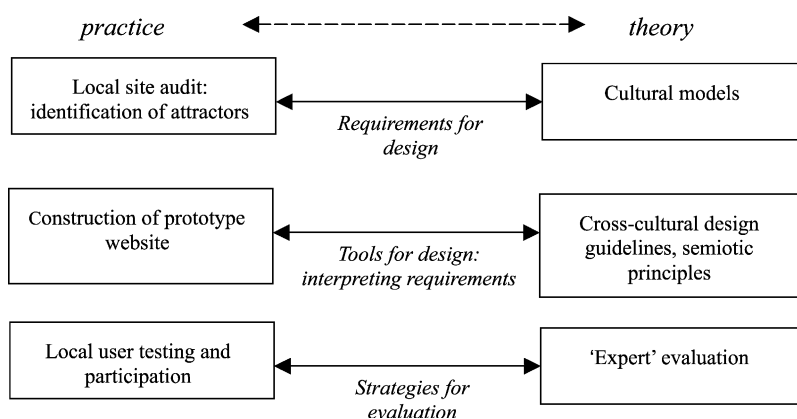


Fig. 1. Issues underpinning international website usability.

development in a global context—*requirements for design*, *tools for design (interpreting requirements)* and *strategies for evaluation*. Furthermore, as shown in Fig. 1, we believe that approaches to analysing these three issues lie on scales representing the extremes of theory and practice.

We will use the framework given in Fig. 1 to structure our discussion in detail over the following sections. However, in summary, in relation to the *requirements for design*, one approach is to undertake local website audits to identify the elements that are indigenous to sites in the target culture. The alternative is to predictively apply theoretical models such as Hofstede when proposing designs. In respect of *tools for design* that successfully translate requirements in to usable solutions, a theoretical approach is to apply the limited but developing cross-cultural guidelines, whereas a practical approach would require effective prototyping. The same issues are mirrored in evaluation strategies: either test prototypes with real users in the target culture, or evaluate against cross-cultural heuristics. For significant international projects it is likely that tools and techniques selected from across all three underpinning issues will be necessary for effective design. We will now address some of the key elements of Fig. 1 in more detail.

5. Requirements for design: local site audit and identification of attractors

5.1. Semiotic 'attractors'

Design decisions taken during the development of a site will directly determine the meanings, both intended and unintended, that it may ultimately communicate to the end user. In order to design the user interface of the website that is culturally optimised, that is an interface that matches the cultural expectations of a particular cultural group, it is necessary to first understand how existing sites in a country/culture are built within, and for, that particular target culture or sub-culture.

We believe that traditional methods of analysis and interface design are not fully adequate for identifying the requirements for cross-cultural websites. Semiotics,

the ‘science of signs’, has previously been explored by one of us in the context of enabling a diverse and geographically distributed set of stakeholder groups to ‘share meanings’ during the requirements elicitation process and beyond. It is claimed that by adopting a semiotic perspective we are able to more carefully examine the computer based signs and their cultural and semantic bindings as instantiated in a cross-cultural website artefact. The central notion of semiotics is that users give meanings to a set of computer based signs, that this process of meaning making (called semiosis) is infinite, but strongly influenced by a user’s cultural and social context of use.

Semiotics is the discipline that connects meaning, meaning making, communication and culture through an understanding of acts of signification. Computer-based *signs* in this context include textual cues, images, icons, and sounds. There are a variety of semiotic discourses and traditions, most noticeably that of Peirce (1953) and Saussure (1974) and there have been similarly various recent attempts to apply semiotic principles to the design of user interfaces (French, 2002). Semiotics does not recognise that any particular sign (e.g. on-line brand sign) is truly ‘universal’. It all rather depends on the context: both local and global. Previous studies have tried to define and quantify the difference between a sign and its meaning (Blankenberger and Hahn, 1991) without much success. This ‘failure’ is not, however, surprising, since it is due to a fundamental semiotic principle: that both the *context of the sign* and the *interpretant of the sign* alter the *meaning* of the sign itself. This field of semiotics, therefore, implies that signs and their meanings would vary in different cultures.

Towards gaining a deeper understanding of how to develop websites, that are optimally matched to both its target audience and to its domain (e.g. e-finance, e-commerce), it is necessary to investigate the different signs in a local culture, their context of use, and the meanings that the locals attribute to them. This can be achieved by conducting an audit of local indigenous sites. Typically, an audit would be carried out by a usability expert who belongs to that target culture, or has a good understanding of that culture via first-hand personal experiences, or through extended family or friends. The audit would involve evaluating prominent and successful local websites that are considered to be typical exemplars in the domain of interest or in related domains, with a view to identifying the use of specific *cultural attractors*.

We define cultural attractors as the interface design elements of the website that reflect the signs and their meanings to match the expectations of the local culture. The cultural attractors typically comprise of: colours, colour combinations, banner adverts, trust signs, use of metaphor, language cues, currency formats, navigation controls and similar visual elements that together create a ‘look and feel’ to match the cultural expectations of the users for that particular domain. Previous studies have clearly established that these surface level features are indeed differentially perceived across linguistic and cultural boundaries (Fink and Lapause 1999). For example, trust aspects have previously been shown to be differentially perceived across cultural boundaries (Jarvenpaa and Trackinsky, 2000).

Although it is proposed here that the identification and analysis of cultural attractors holds promise for better cultural optimization, little has thus far been published concerning the relationship between specific cultural attractors and cultural phenomena operating in specific emerging e-markets. In order to give an example of the kind of

approach we envisage, we have audited some prominent e-finance sites in two emerging e-markets, namely India and Taiwan. We attempt to relate some specific cultural attractors embedded into these sites, to wider cultural phenomena. We discuss our findings in Section 5.2.

5.2. Indian and Taiwanese e-finance audit

The Indian and Taiwanese e-finance site audits were undertaken by auditors who had first-hand personal experiences of the respective culture. Details of the full audit are available elsewhere (French et al., 2002), and here we present an abridged analysis focussing on just a few key points.

5.2.1. India

Banking in India is witnessing dynamic change as the sector launches new applications and introduces new technology. The benefits of these changes, which includes the availability of banking services to the masses is challenging the previous dominance of foreign banks, who offered on-line services to an elite customer base. With recent deregulation and liberalisation, private banks have grown in number and urban populations have ready access to on-line services. However, there remains a cultural divide between urban access (only 5 million out of India’s population of over a billion, use the Internet regularly) and the vast countryside. ICICI Bank (Fig. 2), HDFC Bank and Citibank have so far pioneered Internet banking in India. In the full audit therefore we chose to highlight these sites in so far as they reflect Indian cultures, values and customs. We also included the State Bank of India (India’s largest commercial bank). Fig. 3 presents a summary of our Indian e-finance attractor audit.

5.2.2. Taiwan

The banking industry in Taiwan is being de-regulated on a continual basis since martial law ended in 1987. The most recent accession of the ‘separate customs territory’ of Taiwan and its islands of Penghu, Kinmen and Matsu as the 144th member of the World Trade Organisation is likely to lead to widespread consolidation of the 40 + prominent private



Fig. 2. Example Indian and Taiwanese websites.

Indian e-finance website attractors		
Website	Attractors	Rationale
ICICI Bank (last accessed 13 th February 2002) <i>Second largest commercial bank in India, can be described as the first universal Indian bank</i>	Colour red Colour saffron In combination Use of language Term 'Munshi' Term 'Pardes' Link Munshi-Pardes Religious iconography Charity Puja Service - enabling donations for good causes in India	Associated with vitality, energy, prosperity, health, ambition and initiative Considered auspicious by Hindus, Sikhs, Jains and Buddhists (Kingsland, 1999). Signifies prosperity for current and future customers In Hindi means 'family accountant' In Hindi means 'abroad' Combination signifies customer friendly To seek blessings from God. Hindu communicating with his or her personal Hindu God or Goddess (Knott, 1998)
State Bank of India www.statebankofindia.com (last accessed 21 st July 2003) <i>Largest commercial bank in the country</i>	Gandhi's image Map of India	Conjures up patriotic feelings. Signifies that the bank serves all Indians whether at home or abroad. Bank serves all Indians, rural and urban

Fig. 3. Indian e-finance website attractors.

and publicly owned banks on the island. There is every opportunity since WTO membership for Taiwan to open up financial services to outside competition, hence opportunities for localisation activities. However, the market as it exists today shows little influence of globalisation, displaying instead a rich and often surprising mix of culturally specific influences and attractors as summarised in Fig. 4.

5.3. Towards a taxonomy of attractors

Both of the attractor audits revealed a range of cultural attractors which would perhaps not be expected by Western website developers. Furthermore, these attractors can be conveniently assembled into the following loose meta-level taxonomy:

- Use of colour and colour combinations;
- Use of culturally specific symbols;
- Linguistic cues (mixed, dual language and assimilation of one language into another);
- Culturally specific iconography (religious and charity giving, cartoon, geographical);
- Trust aspects as instantiated in site branding and signification.

A long-term aim is to develop a set of comprehensive cultural attractors and their meanings derived from cultural site audit(s) for each particular culture or sub-culture and the domain of the e-market. Such an approach holds considerable potential for

Taiwanese e-finance website attractors		
Website	Attractors	Rationale
Grand Commercial Bank (last accessed 20 th December 2001, site since updated)	Cartoon characters and comic-culture (Surprising and visually striking signification and images appear alien to Western viewer's expectations of bank site content)	Forms part of a wider Asia-Pacific shopping cultural phenomena, in which the traditional Asian cultural aversion to borrowing and use of credit cards, is being ameliorated through the use of youth-oriented branding using cartoon characters (Hui, 2001, Miranda, 1999). Strong Japanese influences and can be related to the success of a particular Taiwanese "Hello Kitty" credit card – directed mainly towards young women.
SinoPac Bank www.banksinopac.com.tw (last accessed 20 th Dec. 2001) <i>Whilst the Bank is using e-mediated forms of commerce and addressing global e-Markets, it is, nevertheless, cherishing traditional Chinese values</i>	Double-fish sign (which decorates the exterior of their head-office building in downtown Taipei) "Welcome to SinoPac Bank: we grow your assets"	Local iconography which serves as a visual reminder to local residents who are familiar with the physical decoration of the building and also signifies prosperity – something will be left over after Chinese New Year feast Balanced neutral message for Foreign investors
Yu Shan Bank www.esunbank.com.tw (last accessed 20 th December 2001) <i>Clearly a niche player, representing local cultural continuity, rather than change</i>	Jade Mountain symbol No English version. All images of people represent only a single ethnic group	Bank's is derived from Yu Shan ('Jade' Mountain) symbolism - highest mountain peak in Taiwan – to invoke the spirit of the mountain to emphasise banks support for single and exclusive local ethnic group and cultural continuity. Entirely local significance

Fig. 4. Taiwanese e-finance website attractors.

localisation companies and others to create reusable libraries of such sets of cultural attractors and their meanings that would provide a set of useful building blocks for future commercial web-site localisation projects. One aim of this approach is to raise awareness amongst researchers as to the potential value of addressing quite specific cultural phenomena directly, rather than attempting to build upon generic cultural differences and models. In a sense therefore, our attractor taxonomies offers a pragmatic 'bottom up' approach to localisation which complements 'top-down' approaches such as cultural models and cultural 'goodness of fit' such as those we address in Section 6.

Clearly, much future work needs to be done before we can develop outputs of wider significance to industry. This (as yet largely unexplored research domain) is likely to involve at least the following activities:

- wide-ranging local cultural observations;
- site-audits, development of taxonomies and sign-object reusable libraries;
- consumer interviews conducted within target local markets;
- wider (ethnographic) analysis of ‘e-culture’ as a significant cultural phenomena;
- integration of ‘top-down’ cultural theories with ‘bottom-up’ site audit.

To some extent this research agenda also seeks to challenge traditional ‘USA-centric’ models of website design. Indeed, one of our sub-aims is to highlight the potential that exists in emerging e-markets to encourage wider uptake of amongst developing nations. This divide can only be effectively bridged if one tries to gain a deep understanding of the endemic social-semiotic e-culture that exists in such countries, rather than simply adopting a simplistic ‘one-size-fits-all’ approach as often seen hitherto. Our earlier examples have illustrated that successful sites in India and Taiwan do not in fact follow such stereotypes but rather, effectively define their own e-culture (often a subtle and variable mix of ‘eastern’ and ‘western’ visual influences). It is proposed that by seeking to deconstruct such sites into their individual visual components and associated cultural bindings, we may gain a better understanding and hence construct local sites that are culturally optimised to their local consumers, whether they be from developed or from developing e-markets.

6. Requirements for design: cultural models and ‘cultural fingerprints’

6.1. *Cultural theories and website usability*

The local site audit approach described in Section 5 lies at one end of the scale representing the *requirements for design* issue shown in Section 4, Fig. 1. This practical approach can be balanced by more formal techniques based upon theoretical models of culture such as Hofstede. Marcus and Gould (2000), for example, address Hofstede and present guidance for each of Hofstede’s dimensions based on a theoretical analysis of websites. In relation to high and low PD cultures they address issues such as structure in access to information, hierarchies in mental models, emphasis on social and moral order, focus on expertise, prominence given to leaders, importance given to security and social roles used to organise information.

A key issue that has emerged from international usability projects in which we have been involved is the need to provide an accessible means through which the cultural characteristics of a particular website can be discussed with clients. In response to this need we are developing the concept of a ‘cultural fingerprint’ which can diagrammatically compare the cultural profile of a website (Site Fingerprint) with that of its target cultures (Country or Culture Fingerprint). Initially we developed the concept of a ‘first-shot’ cultural fingerprint that addresses four of Hofstede’s dimensions (see Section 4) and presents Hofstede’s data on a scale from 0 to 10.

Taking PD, for example, Hofstede lists PD scores for 53 countries from a score of 11 for Austria (low PD), to 104 for Malaysia (high PD), with the UK scoring 35. On our 10 point scale the UK scores $10 \times (35 - 11)/(104 - 11) = 2.58$. The score for PD along with

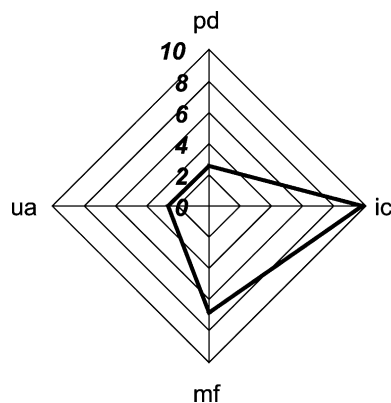


Fig. 5. UK 'first-shot' country fingerprint.

equivalent scores for the other Hofstede dimensions described in Section 4—IC, MF and UA—lead to the specification of the 'first-shot' country/cultural fingerprint, adopting a 'radar diagram' approach, shown in Fig. 5. We refer to this as a 'first-shot' fingerprint as the diagram suggests that each of the four dimensions are equally important, and indeed that they are actually significant at all. In the latter parts of this section we will show how we are developing the concept to take account of the actual significance of Hofstede's cultural dimensions within specific countries/cultures.

Site fingerprints are developed from expert evaluation. In this case up to five independent consultants (Landauer, 1995) rate each of the four dimensions on a scale of 0–10, and the average value is used to determine the site fingerprint. They assess sites against criteria based upon Marcus and Gould's (2000) guidelines. By comparing country and site fingerprint the usability/acceptability of websites can be diagrammatically matched to the target culture. The approach has been applied to a number of high profile international clients in the e-finance and e-commerce sectors. It is also possible to develop a weighted average fingerprint for all the target cultures, based upon known or desired usage profile in order to determine whether a 'cultureless' standard (Day, 1996) has been achieved.

6.2. Case study: corporate websites

In the UK, the Financial Times Shareholder Communications survey (16/11/01) ranked the websites of all 300 constituent members of the FTSE Eurotop 300 Index under two categories of technology/functionality and content. The result was claimed to be the most thorough assessment yet of company websites from the point of view of the international investor. However, one issue that was not addressed was the usability of each site to a global audience of potential investors. In order to explore the suitability of these sites to a global audience a sub-set of sites were selected roughly equally spread out over the FT's listing. Through expert evaluation the site fingerprint of each site was generated. Four cultures in which UK companies seek significant shareholder investment are the USA, Germany, Japan and Arab countries. Therefore, in order to investigate the suitability of

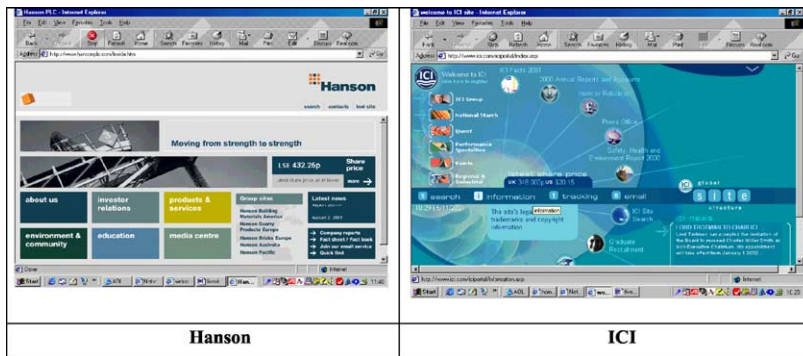


Fig. 6. Example UK Corporate homepages.

the sites to the target global audience, the cultural fingerprints of these countries was then also generated. In Fig. 6 we provide the home page of these two sites and in Fig. 7 present the site fingerprint of two of these sites together with those of two key investor countries: USA and Japan.

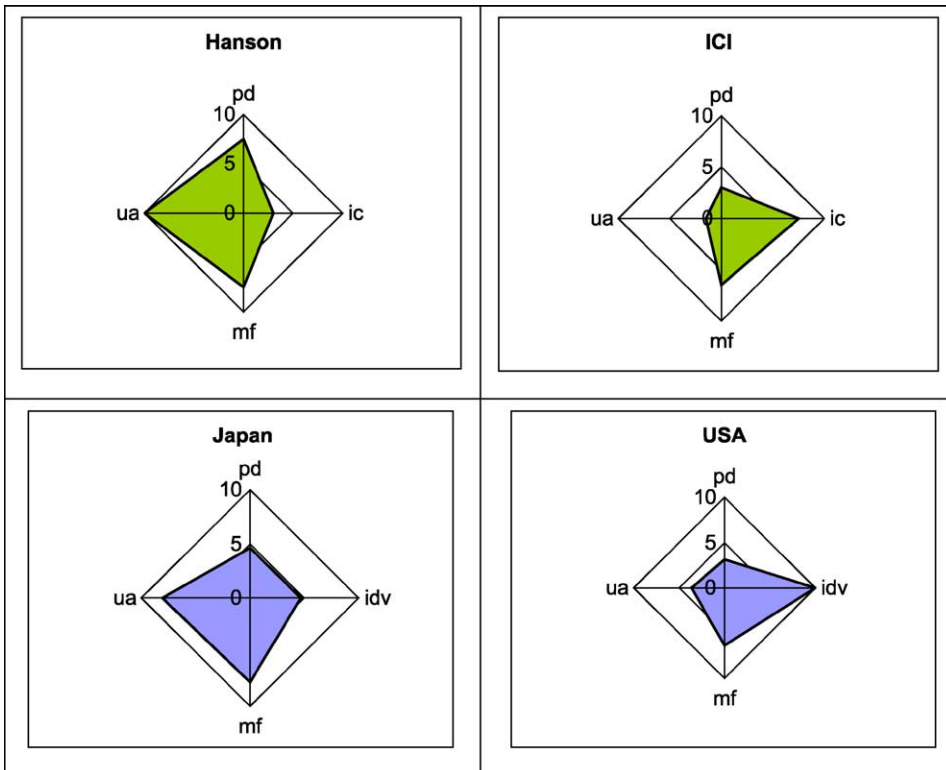


Fig. 7. Corporate investor websites 'first-shot' fingerprints.

We note some very interesting differences. Although the Hanson site (www.hansonplc.com) was rated the best of our selection of sites from the FT survey, its site fingerprint would not seem to match many of the target cultures. However, its profile suggests it could be an effective mode of communication with people in Japan. Culturally the ICI site would appear to be almost a mirror image of that of Hanson and is more suitable for a US audience. The question here is: are these two companies really aiming their communications to totally different client and cultural groups or have these differences arisen by chance, perhaps through the cultural slant of their developers?

6.3. Verifying cultural dimensions

As we have stated, although there is no lack of theoretical underpinning for cross-cultural usability, there *is* a lack in explicit demonstration that such theories are actually transferable. Theories such as Hofstede were formed some time ago, and were not related to usability but to organizational change. Furthermore although culture is generally agreed not to change very fast, there are views that, being a global phenomenon, issues related to the Internet may apply globally, thereby transcending local concerns. We are interested, therefore in conducting studies with end users to determine the extent to which cultural factors do actually affect international website usability and acceptability.

Our approach to undertaking user studies in cultural usability is influenced by Taguchi's work in Total Quality Management (Taguchi, 1986). This bases the quality improvement of products and processes on concepts of optimisation through the design of experiments where key factors are investigated by a set of experiments using orthogonal arrays. The technique is based on the factorial design method first introduced by Fisher in the 1920s and extensively applied in agrarian and social sciences. Fractional factorial experiments can be used to simplify the investigation by looking at only a fraction of all the possible experiments, or in our case user tests. Taguchi methods have been adopted within the LUCID (Logical User Centered Interface Design) method (Smith and Dunckley, 1996) and offer considerable potential for researchers in cultural diversity as they minimise the amount of costly user testing required (Smith and Dunckley, 1998).

Taguchi standardised the procedure by providing a framework based on orthogonal arrays. He also provided a simplified analysis of results, which makes the fractional factorial design accessible to non-statisticians. Experiments (in our case user tests) are conducted to determine values of the quality characteristic (in our case usability/acceptability). Orthogonal arrays are a set of tables devised by Taguchi and are used to specify the minimum number and types of experiments (user tests) needed. Table 1 illustrates the first orthogonal array, the L_4 array that would deal with up to three factors (such as Hofstede dimensions). After completing the tests and collating the data analysis of variance is then used to identify the optimum condition (in our case ideal website type) and the strength of each of the factors.

In order to verify the applicability of cultural dimensions a range of research studies are being undertaken. On the basis that China is an important developing market, the work reported here addresses Hofstede dimensions in the Chinese context. Our aim is to determine how strong each of the Hofstede's dimensions might be to Chinese users.

Table 1
Taguchi L_4 array

$L_4(2^3)$	Factors		
	1	2	3
Experiments	1	1	1
	2	2	2
	3	1	2
	4	2	1

A number of studies in China (Beijing, Dalian and Kunming) were completed during 2003 in which Chinese users were asked to undertake a series of tasks on at most two Chinese websites. The sites chosen possessed different levels of the factors of *PD*, *individualism/collectivism*, *masculinity/femininity* and *UA* as rated by experts using Marcus and Gould's conjectures. These factors were mapped to the $L_4(2^3)$ orthogonal array.

One study (Study A) investigated the relative significance of three dimensions *PD*, *IC* and *UA* using an L_4 array. The use of the L_4 array structured the study, so that each dimension was viewed as having two possible settings. For example, in the case of *PD* and *UA* these settings would be 'high' and 'low' while for *IC* they would be individualist or collectivist. This design fitted well into the array set out in Table 2. The L_4 array will allow the investigation of up to three factors, so that three of Hofstede's dimensions were selected. To investigate more than three would require the use of a larger array and would therefore require more website experiments. Four websites were selected by experts using Marcus' conjectures, with settings for the three dimensions to fit the orthogonal array as shown in Table 2.

After accessing the sites users were asked to complete a relatively simple quantitative survey instrument designed to elicit their overall 'acceptance' of the site. A number of issues were considered within the overall acceptance such as: appropriateness of layout and navigation, ease of information access, level of trust engendered and likeliness of return and recommendation to others. The acceptance scores from the survey instrument formed the basis of the following statistical analysis.

In Tables 3a and b we present the analysis of the results using Taguchi's methods. In Table 3(a) the 'Preferred' section shows the preferred type of website together with the contribution which each of the Hofstede dimensions made to the expected result. In

Table 2
Orthogonal Array: websites selected

Orthogonal array						Site
PD	IC	UA	PD	IC	UA	
1	1	1	High	Individual	High	http://www.yanjing.com.cn
1	2	2	High	Collectivist	Low	http://www.lolo.com.cn
2	1	2	Low	Individual	Low	http://www.wahaha.com.cn
2	2	1	Low	Collectivist	High	http://www.loulan.com.cn

Table 3a
Preferred cultural orientation

Dimension	Preferred level for dimension		Contribution
PD	High PD	1	3.32
IC	Individualistic	1	0.92
UA	High UA	1	0.57
Total contribution from all factors			4.72

Table 3(b) the analysis of variance ‘ANOVA’ provides the detailed results for each of the cultural factors, together with the variance ratios (F). This analysis provides a means of distinguishing the contributions made by the separate cultural factors and their significance which can be assessed by a comparison between the actual F values and the F critical values obtained theoretically. Taguchi uses a form of ANOVA for saturated designs. Readers who are new to this type of statistical analysis may wish to focus on the final column of Table 3(b). The three percentages shown here represent the relative importance/significance of these three cultural issues to acceptability in the Chinese context.

Before discussing the results for the individual factors/dimensions it is worth looking at the significance of the error term in ANOVA. At 63.2% this might initially seem high, but this value accounts for all other variability within the study—other website factors, and individual user variability. From the authors’ experience this is quite a normal value. In fact, it is quite significant that the three cultural factors under study account for 36.8% of variability, providing evidence that these issues are indeed important. A number of findings emerge from this study. Firstly by far the most significant/important dimension is that of PD, with 35.4% of the variability in the experiment being a result of differences in PD. The preferred level for Chinese users was, as predicted by generic cultural models, that of High PD. In relation to IC, Chinese users were found to marginally prefer individualistic sites, in contrast to possible expectations. Hofstede later suggested UA to be only relevant to Western cultures and this is vindicated in the fact that this factor was not found to be significant at all for Chinese users.

Another study (Study B) investigated the dimensions of PD, IC and MF. Again four (different) websites were selected with high and low characteristics for the three dimensions to fit the orthogonal array. We will not reproduce the detailed analysis here, but the summary results of both studies are presented in Table 4. There were

Table 3b
ANOVA

Dim.	DF	Sum of squares (S)	Variance (V)	F ratio	Pure sum (S')	Percent (%)
PD	1	416.0	416.0	22.70	397.7	35.4
IC	1	34.2	34.2	1.87	15.9	1.4
UA	1	13.2	13.2	0.72	0.1	0.01
Other	36	659.9	18.33	–	–	63.19
Total	39	1123.4	–	–	–	100

$$F_{\text{crit } 1,36} (0.05) = 4.11, F_{\text{crit } 1,36} (0.10) = 2.85.$$

Table 4
Summary data and sector angles for fingerprints

	Study A	Study B	Study A (scaled)	Average: Study B and Study A (scaled)	Sector angle	Chinese Hofstede score
PD	35.4	20.6	23.3	21.95	237.9	80
IC	1.4	3.6	0.92	2.26	24.5	15
UA	0.01	–	0.01	0.01	0.1	35
MF	–	9.0	–	9.00	97.5	50
Total	36.8	33.2	–	33.22	360	–

encouraging similarities between the percentage contributions for the four Hofstede factors over the two studies. In column 4 of Table 4 the contributions from Study A are scaled to equate to those from Study B. The values for PD (23.3 and 20.6%) and for IC (0.92 and 3.6%) presented are indeed encouragingly close. Column 5 presents the combined average for each of the factors over the two studies.

6.4. Enhancing the fingerprint

In order to take account of actual significance of cultural dimensions, we propose an enhanced fingerprint that uses ‘circle sectors’, as opposed to radar diagrams as the mode of representation. By so doing we are able to introduce a second dimension to the diagrammatic representation. The one-dimensional ‘first shot’ fingerprint (Fig. 5) only addressed the magnitude of each issue (e.g. 2.58 for UK PD), whereas the two-dimensional ‘enhanced’ fingerprint can address both magnitude and importance. In our enhanced fingerprint the sector angle (θ) represents the importance of the factor within the culture/country. The sector angle will be the same for both site and culture fingerprints. The radius of the sector (R) is determined by the magnitude the factor in the culture, based upon Hofstede scores for the country fingerprint or by expert evaluation for the site fingerprint.

From data such as that collected in our China studies it is now possible to construct enhanced site and country fingerprints.

- The Sector angle column of Table 4 is derived from the combined significance (percentage contribution) of each factor in both Study A and B. For example, in the case of PD, the sector angle is calculated from $21.95/33.22 \times 360 = 237.9^\circ$. The sector angles will be the same for both site and country fingerprints.
- The radius of the sectors for the country fingerprint is obtained from the best available score for that factor/dimension in the target culture/country. In relation to the latter it should be noted that Hofstede’s initial work, being based on IBM employees did not include China. Our results here include a mix of more recent scores for China and a weighted average of scores for Hong Kong, Taiwan and Singapore. The equivalent Hofstede scores adopted were therefore PD = 80 (7.4 on scale 1–10), IC = 15 (1.1), UA = 35 (2.6), MF = 50 (5.0).

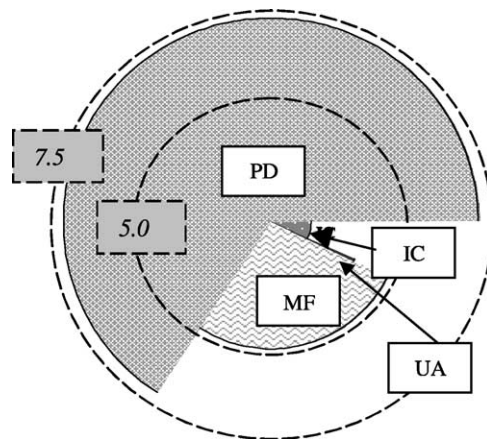


Fig. 8. China enhanced cultural fingerprint.

Fig. 8 presents our latest version of the enhanced country/cultural fingerprint for China, based upon the data reported in this paper.

The question we are beginning to answer here is the extent to which generic cultural issues really affect website usability and acceptability, and how this information can be easily communicated to developers and site owners. Already we have evidence that considerable caution needs to be adopted when applying generic models of culture to the world of the web. In the case of China the four Hofstede dimensions have greatly differing significance. PD is very important, and MF less so, but international website designers would be ill-advised to ignore either of these two issues. Contrary to expectations, IC is not important to Chinese users and global expectations of the web would seem to predominate. UA is also not important, but perhaps we should expect this from Hofstede who suggests that long-term orientation is more significant.

The next stages in our work in this area are as follows. Firstly to undertake further empirical studies in other countries/cultures and to investigate factors proposed by researchers other than Hofstede. We would welcome suggestions for collaborative projects. Secondly, based upon the cultural fingerprints (and underlying quantitative data) to develop specific localized design guidelines. In effect our work informs which of the generic guidelines (Marcus and Gould, 2000) actually need to be addressed in order to optimise international website acceptability.

7. Tools for design and strategies for evaluation: prototyping and local user testing

7.1. International user testing

Landauer (1995) has described user testing as the ‘gold standard’ because only by studying real workers doing real jobs in real environments can we be sure that we will find out what is truly relevant. User based testing comprises a well-documented set of methods, some of which are governed by international standards. These methods have been

developed over the last thirty years and traditionally involve directly testing prototype software systems with typical users in a usability laboratory or in their real-world locations. Whichever method is adopted, the aim is always to clarify the communication between the computer, the developers and the users. The process may involve actual metrics to assess the efficiency, effectiveness and satisfaction of the user interface investigated.

User based testing/evaluation techniques are often based upon the concepts of cooperative evaluation (Carroll and Mack, 1984) or contextual inquiry (Beyer and Holtzblatt, 1998) and are embodied in a variety of methods such as thinking-aloud protocols and DUCE (Smith and Dunckley, 2002). The methods aim to gain meaningful information about the user's work by empowering the users in direct conversation with the designer on equal terms. These 'traditional' methods of testing are difficult and costly to operate across cultures and remote geographical locations (Dray, 2001). As an illustration Murphy (2001) describes the problems that can arise in international usability testing. Usability professionals trying to undertake such techniques in Far Eastern cultures often find that users have particular difficulty (Yeo, 2000, 2001). Users vary in their ability and willingness to articulate their thoughts to the evaluator depending on both their individual personality and cultural background.

Using local testers in combination with foreign developers affects the ability of the local tester to comprehend the rationale, selection of usability method, context and overall purpose of the test. To overcome these problems it is not unusual for the foreign designer to travel to the location and observe the conduct of the local usability tests, to provide advice and to observe and take notes. This procedure, however, significantly increases the cost of testing but results in improved quality of usability evaluation.

7.2. *Relating cultural theories to international testing*

Research into contact between different cultural groups has long recognised the scope for conflict and misunderstandings. Small differences between groups are often exaggerated and distorted to provide a mutually negative image or stereotype based on 'us' and 'them' differentiation. Bochner (1988) showed harmonious relations arise when both parties share a super-ordinate goal—a goal that both groups want to attain and neither can attain if they compete. Stress and embarrassment are caused when normal rules of social engagement are broken. Thus 'in-group/out-group' conflict can be increased or decreased by factors in the working environment which influence perceived status, purpose and inter-group competition. For example, the cultural component of a setting will have great influence on the individual's attitude. Changes in working practices involving cross-cultural changes may, for example, require a reordering of the individual's cognitive structures making them, in a real sense, different persons. According to Bochner it should be assumed that individuals will react and try to modify surroundings which cause cross-cultural conflicts.

Several large studies of cultural differences have been made that are relevant to user-centred evaluation and design because they relate to different perceptions of control. One study (Smith et al., 1997) found evidence of primary and secondary control. Primary control, characterised by US society, seeks to control events around one-self directly, whereas secondary control seeks to control oneself and adapt to events that are seen

as uncontrollable, as typified by Japanese society. Users in Japanese society accept the need to learn how to use software, and to adapt themselves.

7.3. Suitability of methods

Advances in technology such as remote evaluation are making user testing for websites both feasible and lower in cost (Hilbert and Redmiles, 1998; Hartson et al, 1996; Dunckley et al, 2000). However, a number of complications arise when traditional evaluation methods are used. Firstly there are the practical difficulties of communicating effectively between groups of developers, users and evaluators who are geographically widely distributed. Secondly there are the social and cultural distances between the groups that can add to misunderstandings and misinterpretations of data. Thirdly there is the possibility of methodological errors—we cannot assume that methods developed principally in Western societies will be universally applicable. At the detailed level there is the problem of successfully engaging with users from different cultures within the user testing process itself, whereas at a higher level the whole concept of UCD and participation may be difficult for multi-national development teams.

Most Western software developers would support the principles of UCD but underlying concepts and assumptions are derived from USA/Northern European cultures. It is inevitable that those tools and techniques which involve users the most would be those very techniques which were most sensitive to cultural issues and the most susceptible to misinterpretations which could have serious impact on the quality of communication between designers and users. For example the design of task scenarios must be much richer for effective use of verbal protocols with Indian users.

8. Tools for design and strategies for evaluation: guidelines and expert evaluation

Although a wide range of design guidelines for usability are available for both generic systems (Shneiderman, 1998) and for websites (e.g. Nielsen, 2000) guidance for international and cultural issues is less easy to find, although a number of key sources exist (e.g. Del Galdo, 1990, 1996; Fernandes, 1995). We believe that the process of internationalisation and localisation of web-based systems involves an analysis of both objective and subjective cultural issues. In this context an objective issue is one that can be relatively easily addressed through an understanding of routine practice in the target country or culture. A clear example is the use of formats for numeric information such as dates (1/31/02 and 31/1/02 for 31st January). Subjective issues involve a deep understanding of the target culture. Generic dimensions of culture can be applied to develop guidelines for international web design (Marcus and Gould, 2000). However, as demonstrated in Section 6 the link between Hofstede theories and web usability is at best unproven and that guidelines such as Marcus and Gould's need rigorous testing and much further validation.

Overall we believe that it should be possible to develop guidelines for specific cultures and contexts. However, much more user-based research will be needed in order for a comprehensive bank of guidelines to be developed. Our taxonomy of

attractors is just a start in one direction. Through extensive auditing in key cultures and domains it should be possible both to refine the taxonomy itself and develop culture and domain specific guidance to developers. Another of our contributions in this area is in the validations of cultural models. Through much more extensive research, such as our work based upon Taguchi Methods, it should be possible to quantify the significance of cultural factors (such as Hofstede). By knowing which of these factors is actually significant in each culture, generic guidelines such as those proposed by Marcus and Gould can then be refined into specific ones for particular cultures.

9. Culture and user participation

Of course a basic tenet of usable design is the principle of user centred design and the aim of enabling users to actively participate in the design process. Although HCI specialists have stressed the importance of UCD for a long time, it has recently become an essential component of main-stream software development methods such as Extreme programming (Beck, 2000) and DSDM (Stapleton, 2003). Indeed, the latest version of DSDM addresses the need for these methods to be usable by cross-national teams including users. However, as we began to explore in Section 7, cultural differences are being seen to have implications for the success of the user-centred paradigm in the international context. As a contribution to study in this area we now describe a study that investigated the implications of cultural influences on software development teams and user involvement.

A large group of students in computing/information systems, who were engaged in software development modules, were asked to complete a questionnaire which included eight of the original statements used by Rotter. The questionnaire included questions on beliefs about teamwork and UCD as well as locus of control (LC). The dichotomous LC scale was replaced with a semantic differential five-point scale for the purposes of statistical analysis. In addition there were five questions related to UCD and six questions about team working. The group consisted of 97 subjects, the largest cultural group was English but also included European, Caribbean, African, Asian and Chinese groups. The Chinese group was too small to include in the statistical analysis. The overall average results for the largest groups are presented in Table 5. High values indicate

Table 5
Results of cultural groups for Team Work, UCD and locus of control

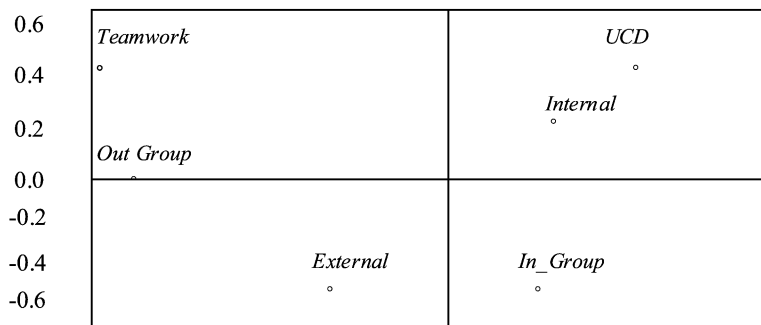
Group	External	Internal	UCD	Team work	In-group	Out-group
English	18.5	10.8	6.7	25.3	18.9	28.4
European	16.4	11.8	6.4	27.6	16.6	30.9
Caribbean	24.7	9.8	3.3	28.4	16.0	30.7
African	18.1	11.5	6.1	32.7	13.1	33.5
Asian	18.7	10.9	5.9	27.5	13.1	29.2

support for the concept, e.g. higher values for team-work and UCD represent attitudes supportive of team-work and user involvement.

Subsets of the team-work responses were also considered in terms of Bochner’s theories, i.e. preference for teams consisting people perceived as like themselves (in-group) versus those who would welcome diverse teams (out-group) even though these students had experienced team-work related to a super-ordinate goal of software development. In terms of attitudes to teamwork the African group was the most positive while the English were the most negative. This was consistent with our previous results which found high collectivism for African groups. A high value for external indicates ‘external LC’ tendency while a high value for Internal indicates an ‘internal LC’ tendency. The most internal group overall was European, (lowest value for External and highest for Internal) while the most external group was Caribbean. The results for LC are consistent with those reported by Smith et al. (1995). In terms of LC there is little difference between the English, Asian and African groups. However, the difference between the African and Caribbean groups is very interesting and may reflect the very different cultural experiences of these two groups. The higher average score on external LC could reflect the deprivations and lack of freedom experienced by the Caribbean culture in the past. The Caribbean group also had the lowest rating on UCD even though the training of all groups had been the same. These results were further analysed by multi-dimensional scaling, a technique designed to construct a ‘map’ showing the relationships between a number of similarity judgments (Fig. 9).

The interpretation of the two dimensions is complex but shows the scores for internal and external LC lying along one diagonal close to UCD, while the scores for team-work cross the other diagonal. UCD and internal LC are positively related to Dimension 1 while team-work is negatively related. This supports a cultural link between UCD and internal LC. It suggests that the motivation for user involvement may be the result of Western culture’s view that users as individuals have a democratic right to be involved in the development of software they are expected to use, rather than any enthusiasm for team working itself. User involvement is also important for building belief in the software

Dimension 2



Dimension 1

Fig. 9. Multi-dimensional scaling.

product in individualistic users (Tudhope et al., 2000). This suggests positive attitudes to team-work are not closely associated with either UCD or internal LC and that negative attitudes are more likely when the teams in question are ‘out-group’ teams. These results are consistent with our previous findings which linked UCD with individualist societies and team-work with collectivist societies and is further evidence that UCD a culturally determined concept that cannot be assumed to translate from Western to Eastern societies without modification or reinterpretation. The result also highlights that cross-cultural difficulties are to be expected as illustrated by Murphy and that development methods need to recognize this issue.

Positive attitudes to ‘in-group’ teams were more closely associated with external rather than internal LC. This could be interpreted that developers who view control as being external to themselves would accept working within in-group teams but those developers with strong internal LC will have difficulty yielding control over software development to others such as users whether the users are perceived as from their in-group or an out-group. This suggests that in external cultures, user evaluation should be based wherever possible on teams of users and evaluators from the same culture, while in dealing with Internal cultures this is less important. Further work is continuing to discover which tools and techniques were particularly sensitive to cultural factors.

10. A process model for developing usable cross-cultural websites

Having explored some key issues within developing usable cross-cultural websites, we now seek to pull the strands together within a semi-formal approach to development. We seek to establish a process model for developing usable cross-cultural websites, which is an acknowledged problem for many companies (Livermore and Coronado, 2001). We use the term process model, as opposed to methodology, tool or technique, following the definition given by Smith (1997): as a concept ‘providing a framework in which methodologies are defined through their use and can be taken as representative of the sequence of stages through which a software product or information system evolves’. We believe the process model to be compatible with more well-established frameworks for UCD such as the Star Life Cycle (Hix and Hartson, 1993) and the V-Model which has been associated with DSDM. Our process model is in effect an abstraction of the framework for user centred development activities specified in ISO 13407—Humans Centred Design of Interactive Systems.

As with ISO 13407 our process model (Fig. 10) comprises of five stages, four of which are implicitly joined in a loop. Although the process is iterative it could be converted to a waterfall life-cycle model by simply going through once only. However, the true benefit of this model emerges when it is used to guide an iterative development process. The actual presentation of the iterative stages is shown in a linear flow. By so doing we are able to superimpose our scales of theory and practice first introduced in Section 4, and can place the various activities appropriately on a horizontal dimension.

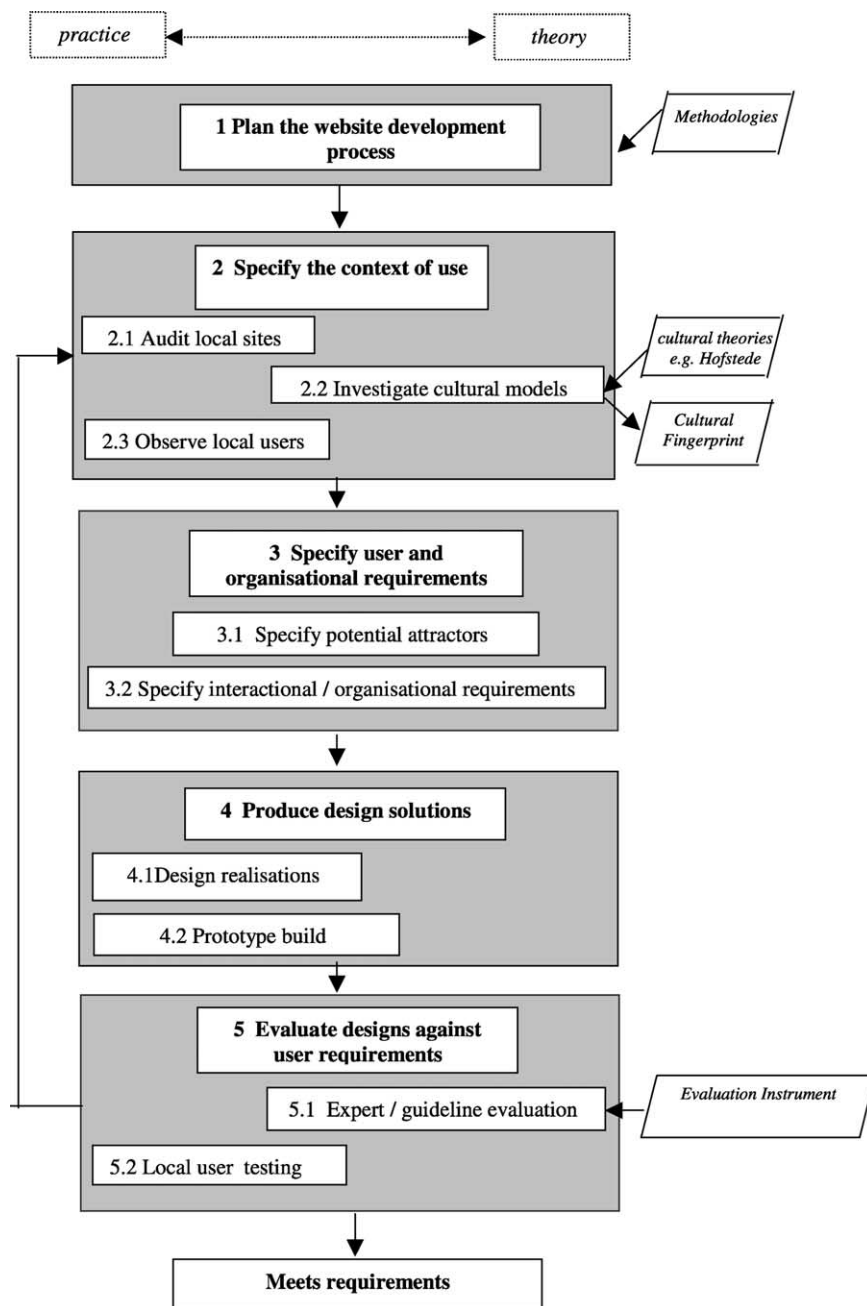


Fig. 10. Process model for developing usable cross-cultural websites.

Table 6
Details of activities within the process model

Activity 1	Plan the website development process	Select development framework (e.g. RAD, DSDM, XP). Identify technical architecture options. Consider implications for user centred design/participation
Activity 2	Specify the context of use	
	Activity 2.1 Audit local sites	Remote/local audit, expert based. Identify semiotic attractors operating in domain.
	Activity 2.2 Investigate cultural models	Identify Hofstede scores and cultural fingerprints
	Activity 2.3 Observe local users	Virtual ethnography. Local ethnography
Activity 3	Specify user and organisational requirements	
	Activity 3.1 Specify potential attractors	Select appropriate attractors suitable to the particular site.
	Activity 3.2 Specify interactional requirements	Select suitable metaphors, navigational styles (strong menus vs hypertext) etc.
Activity 4	Produce design solutions	
	Activity 4.1 Specify potential design realizations for attractors	Build low-fidelity prototypes
	Activity 4.2 Prototype build	Build high-fidelity prototypes
Activity 5	Evaluate designs against requirements	
	Activity 5.1 Expert/guideline evaluation	From a developing base of guidelines
	Activity 5.2 Local user testing	Remote or local testing. Use of culturally specific task scenarios. Verbal protocols.

In this research paper we do not have the scope here to provide a detailed manual for usable design, although we do see the need for such a tool. However, [Table 6](#) presents a brief overview of how the various elements fit together.

11. Conclusion

Within this paper we have drawn together a number of separate studies into a development framework. In this process we presented evidence to support the following important conclusions for international software development:

- (i) Semiotic attractors can be used both to audit sites for indigenous user requirements and to identify design solutions.
- (ii) Generic cultural factors (such as Hofstede) can make a significant and measurable contribution to website usability and acceptability. However, significant caution

needs to be exercised as we have evidence that there are large differences in the importance of the individual factors. Some are significant others are not.

- (iii) Cultural fingerprints can be used to support communication and discussions between designers, evaluators and users.
- (iv) International evaluation strategies must include an analysis of both the nature and suitability of the evaluation methodology and of the personnel who will be involved in it.
- (v) We cannot assume that Western methodologies, techniques for user centred design and participation can be used in other cultures, or within multicultural teams without adaptation.

As [Kersten et al. \(2000\)](#) observe,

‘There is no solid theory that links software to culture, or the way ideas and values are implemented in software. Such a theory requires and needs to go beyond the consideration of the surface manifestations of culture that have been widely accepted...’ (p. 509)

Although we do not claim to have developed a theory linking culture with software usability we hope that our work to date has contributed to a fuller understanding of the relationship between the two and that it may point the way towards a more reproducible methods of software development in the international context. However, we are only beginning to systematically read website content with any authority, and to relate specific kinds of Web content to specific cultural factors, phenomena and ideologies operating within particular countries of the world. For one thing, notions of culture still appear to us to be at a formative and immature stage despite years of research efforts. We also hope that others will support and extend our work presented here, particularly, since computer-mediated website texts are assuming an ever-greater role in our everyday lives and collective cultural consciousness.

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