

ANNEXURE A

WEBSITE EVALUATIONS

A-1.1 High Power Distance

A-1.2 Low Power Distance

A-2.1 High Uncertainty Avoidance

A-2.2 Low Uncertainty Avoidance

A-3.1 Masculinity

A-3.2 Femininity

A-4.1 Individualist

A-4.2 Collectivist

A-5.1 Long-Term Oriented

A-5.2 Short-Term Oriented

Annexure A-1.1

Website Evaluation: Power Distance - www.uum.edu.my

Evaluation taken from Marcus [2000]

High Power Distance		Low Power Distance	
Metaphors			
Institutions, buildings, objects with clear hierarchy: schools, government, monuments		Institutions, building, objects, with equality: play/games, public spaces	
Mental Models			
Reference data with no relevance ranking		Less structured data with relevance	
Navigation			
Restricted access and choices, authentication, passwords, prescribed routes		Open access, multiple options, sharable paths	
Interaction			
Severe error messages, wizards or guides lead usage		Supportive error messages, cue cards	
Appearance			
Images of leaders, nations, official music, anthems, formal speech		Images of people, daily activities, popular music, informal speech	

Evaluation : HIGH POWER DISTANT

Correlates to Hofstede's analysis for Malaysia's index (Score = 104 = Highest HPD)

Annexure A-1.2

Website Evaluation: Power Distance - <http://osprey.unisa.ac.za>

High Power Distance		Low Power Distance	
Metaphors			
Institutions, buildings, objects with clear hierarchy: schools, government, monuments		Institutions, building, objects, with equality: play/games, public spaces	X
Home page has picture of a computer on it – could refer to public spaces and play/games, or it could be perceived as a work tool [Marcus and Baumgartner, 2002]			
Mental Models			
Reference data with no relevance ranking		Less structured data with relevance	X
Search provides relevance ranking			
Navigation			
Restricted access and choices, authentication, passwords, prescribed routes		Open access, multiple options, sharable paths	X
Very open access: Although separate links for prospective and registered students, same information available for all. Multiple navigation options available – menu options on left hand side and hyperlinks at top and bottom of screen. Also lots of links within content			
Interaction			
Severe error messages, wizards or guides lead usage	X	Supportive error messages, cue cards	
No wizards or guides for finding information pertaining to courses. Some cues / guidance provided with the search function in terms of drop/downs and radio buttons. However, error message, although polite, does not provide additional help [Marcus and Baumgartner, 2002]			
Appearance			
Images of leaders, nations, official music, anthems, formal speech		Images of people, daily activities, popular music, informal speech	X
Images provided are those of staff members, but only on the Staff Info page, and also very informal (no academic dress, etc). Very informal tone to information content			

Evaluation : LOW POWER DISTANT

Correlates to Hofstede's analysis for South Africa's index (Score = 49 = medium LPD)

Annexure A-2.1

Website Evaluation: Uncertainty Avoidance - www.travelagent.gr

High Uncertainty Avoidance		Low Uncertainty Avoidance
Metaphors		
Familiar, clear references to daily life, representation	X	Novel, unusual references, abstraction
<p>Imagery on start page indicates very clearly what the website is all about – no abstractions, clear references [Marcus and Baumgartner, 2002] Timetable metaphor for display of cruise and tour schedules</p>		
Mental Models		
Simple, clear articulation, limited choices, binary logic	X	Tolerance for ambiguousness, complexity, fuzzy logic
<p>Multiple service options grouped into very simple, understandable and limited menu choices. Multiple service options narrated on home page, with very clear and specific instructions on how to access them using the menu choices provided. The “All Trip Insurance” link as a top level menu option could also be seen as very high uncertainty avoidant [Marcus and Baumgartner, 2002]</p>		
Navigation		
Limited options, simple and limited controls	X	Multiple options, varying and complex controls
<p>Limited menu options. Options accessible from menu bar on left of screen and also at bottom of screen. Bottom screen options only visible after scrolling. Mouse overs on menu bar provide a “you are here” message over appropriate menu option. (Noted that there is no breadcrumb trail or site map which would reduce uncertainty in terms of where user is. Also, links don’t change color, and no “top of page” links in the middle of the page)</p>		
Interaction		
Precise, complete, detailed input and feedback of status	X	General, limited or ambiguous input and feedback of status
<p>On screen that schedule is displayed is a prominent message that tells user to “click on tour to see details”. Very precise, and detailed information on services and products. Easy to understand language used.</p>		
Appearance		
Simple, clear consistent imagery, terminology and sounds, highly redundant coding	X	Varied, ambiguous, less consistent imagery, terminology and sounds
<p>No sound used. Terminology used consistent to everyday language and the language of the services provided. Little imagery used in entire site – photos relating to tourist attractions in the country and hotels.</p>		

Evaluation : HIGH UNCERTAINTY AVOIDANT

Correlates to Hofstede’s analysis for Greece’s index (Score = 112 = Highest HUA)

Annexure A-2.2

Website Evaluation: Uncertainty Avoidance - www.singaporeair.com.sg

High Uncertainty Avoidance	Low Uncertainty Avoidance
Metaphors	
Familiar, clear references to daily life, representation	Novel, unusual references, abstraction
	X
Content appears complex, for example, use of concepts such as “Raffles class”, and “Mobile Services”. The metaphor on the front page does not clearly refer to the subject of flying – abstraction used instead of clear references [Marcus and Baumgartner, 2002]	
Mental Models	
Simple, clear articulation, limited choices, binary logic	Tolerance for ambiguousness, complexity, fuzzy logic
	X
Fuzzy logic for booking flights – have to first search for flight, then view best fare, before you can actually login and book the flight.	
Navigation	
Limited options, simple and limited controls	Multiple options, varying and complex controls
	X
Different ways to access same information. Left hand menu options change with top level menu chosen. Multiple options under each main menu option which becomes visible only when moving mouse over menu option. Site map and link to Help available but links only at the bottom of the screen which is only viewable after scrolling.	
The website provides a horizontal list of the activities that need to be performed in order to complete the booking process. However, at first glance it is not obvious what this is, as the usual arrows (like in breadcrumb trails) are not used.	
Interaction	
Precise, complete, detailed input and feedback of status	General, limited or ambiguous input and feedback of status
X	X
Good feedback of status while processing flight search. However, if unable to process pricing, ambiguous feedback as to what the problem is.	
Appearance	
Simple, clear consistent imagery, terminology and sounds, highly redundant coding	Varied, ambiguous, less consistent imagery, terminology and sounds
	X
No sounds used. Inconsistent use of breadcrumb concept in flight booking process. Color usage inconsistent between different pages. Terminology used for flight booking is ambiguous – use of “search” button to actually continue the process, instead of a “continue” button is confusing.	

Evaluation : LOW UNCERTAINTY AVOIDANT

Correlates to Hofstede’s analysis for Singapore’s index (Score = 8 = Highest LUA)

Annexure A-3.1

Website Evaluation: Masculinity vs Femininity - www.sony.se

Masculinity		Femininity	
Metaphors			
Sports oriented, competition oriented, work oriented	X	Shopping carts, family oriented	
Very work / task oriented in terms of categorization of products. No shopping carts, no metaphors of family			
Mental Models			
Work/business structures, high level executive views, goal oriented	X	Social structures, detailed views, relationship oriented	[
Some detailed views in product information. However, initial information provided on products is sparse, high level. Products categorized vigorously in terms of work/business structures. No explicit distinction made between genders and age, which could indicate femininity. Use of words such as beautiful, elegant, etc in product write ups suggest some femininity, but rest of mental models masculine oriented			
Navigation			
Limited choices, synchronic	X	Multiple choices, multi-tasking, polychronic	
Top level menu on home page provides very limited choices for navigating site and products. Sub menu categorizes products rigorously. Do not seem to be able to switch between different categories in an informal manner - synchronic.			
Interaction			
Game oriented, mastery oriented, individual oriented	X	Practical, function oriented, cooperation oriented, team oriented	[
Very individual oriented in terms of product information (you, your, etc). None of the product write ups seem to incorporate the use of the product for team/cooperative work. Each product has a "Glossary" and "Support" link, both of which could be viewed as practical and function oriented [Marcus and Baumgartner, 2002], or as a quick way of obtaining sufficient information about the technology to be able to understand and therefore master it.			
Appearance			
Masculine colors, shapes, sounds	X	Feminine colors, shapes, sounds, acceptance of cuteness	[
Masculine music – rhythmic, funky rather than calming and melodic. Colour is predominantly a pale blue – pastels are feminine colours, but blue is often seen as a masculine colour. Although the graphic design seems quite soft [Marcus and Baumgartner, 2002], there is no hint of cuteness anywhere. Also in terms of the DVD and WEGA products featured, it is interesting to note that the sub-options images were all dark blues and blacks, except for one which portrayed a woman on her own. This particular image was light (mainly white), and portrayed the woman in a subtly sensual manner, suggesting that the website was trying to attract male users – possible implicit distinction of gender.			

Evaluation : MASCULINE

Does NOT correlate to Hofstede's analysis for Sweden's index (Score = 5 = FEM)

Annexure A-3.2

Website Evaluation: Masculinity vs Femininity - www.ibm.com

Masculinity		Femininity	
Metaphors			
Sports oriented, competition oriented, work oriented		Shopping carts, family oriented	X
Shopping cart metaphor used extensively. Also holiday gift ideas which could indicate family orientation.			
Mental Models			
Work/business structures, high level executive views, goal oriented	X	Social structures, detailed views, relationship oriented	X
Some of the products had only high level executive views, whilst others had very detailed views, some even had slide shows. The holiday gifts section indicates relationship orientation. No distinctions between gender or age			
Navigation			
Limited choices, synchronic		Multiple choices, multi-tasking, polychronic	X
Multiple choices in navigation – multiple menu options and links and ability to access information in many different ways. Polychronic in terms of the amount of information and options displayed – distracting and tempting user to explore many things at once.			
Interaction			
Game oriented, mastery oriented, individual oriented		Practical, function oriented, cooperation oriented, team oriented	X
Use of phrases such as “your education community” and “we’re ready to team up with you” suggests teams and cooperation. The shopping function is broken down into specific sub-tasks, indicating a practical, functional orientation.			
Appearance			
Masculine colors, shapes, sounds	X	Feminine colors, shapes, sounds, acceptance of cuteness	X
Main theme colour is predominantly blue which is often seen as a masculine colour. It is interesting to note that the colour blue is also the company’s colour [Marcus and Baumgartner, 2002]. The graphic design theme seems harder than that of the Sony site, in that clear objects are used, with very little shading or shadows [Marcus and Baumgartner, 2002]. However, many of the images make use of muted colours, indicating femininity. No sound was used. .			

Evaluation : FEMININE

Does NOT correlate to Hofstede’s analysis for USA’s index (Score = 62 = Med MAS)

Annexure A-4.1

Website Evaluation: Individualism vs Collectivism - www.nps.gov/glba

Evaluation taken from Marcus [2000]

Individualism	Collectivism
Metaphors	
Action oriented	Relationship oriented
Mental Models	
Product or task oriented	Role oriented
Navigation	
Individual paths, popular choices, celebrity choices, stable across roles, customizable	Group oriented, official choices, changes per role
Interaction	
Keyword searches, active oriented, multiple devices, customizable	Limited, office devices, role driven; discourages personal opinion
Appearance	
Images of products, people, low context, hyperbolic, dynamic speech, market driven topics, imagery and language, customizable, direct and active verbs	Images of groups, organizations; images of roles; high context; official, static terminology; institution driven topics, imagery, language; passive verbs

Evaluation : INDIVIDUALIST

Correlates to Hofstede's analysis for index (Score = 91 = Highest IND)

Annexure A-4.2

Website Evaluation: Individualism vs Collectivism – www.tourism-costarica.com

Evaluation taken from Marcus [2000]

Individualism	Collectivism
Metaphors	
Action oriented	Relationship oriented
Mental Models	
Product or task oriented	Role oriented
Navigation	
Individual paths, popular choices, celebrity choices, stable across roles, customizable	Group oriented, official choices, changes per role
Interaction	
Keyword searches, active oriented, multiple devices, customizable	Limited, office devices, role driven; discourages personal opinion
Appearance	
Images of products, people, low context, hyperbolic, dynamic speech, market driven topics, imagery and language, customizable, direct and active verbs	Images of groups, organizations; images of roles; high context; official, static terminology; institution driven topics, imagery, language; passive verbs

Evaluation : COLLECTIVIST

Correlates to Hofstede's analysis for Costa Rica's index (Score = 15 = COL)

Annexure A-5.1

Website Evaluation: Time Orientation - www.cybrary.com.sg

Long Term Orientation		Short Term Orientation	
Metaphors			
Stable family, paternalistic: Father, Mafia, Chinese state businesses, IBM in 1950s	X	Interchangeable roles, jobs, objects	
<p>Very officious looking site. Rule driven in terms of who can be members – membership rules is a high level menu option. Also, it is interesting to note that information on entertainment (the fun stuff) is provided as a link to another website, rather than being part of the content of this website.</p>			
Mental Models			
Love/devotion; social coherence, responsibility, support	X	Liberty: social incoherence, social irresponsibility, efficiency	
<p>Appears to be very socially responsible in that much attention is given to research. Seems to give the impression of kind but firm welcome. Implies rules that need to be conformed to in order to be welcomed into the country.</p>			
Navigation			
Tolerance for long paths, ambiguity; contemplation-oriented	X	Bread-crumbs trails, taxonomies; quick-results; action-oriented	
<p>Mouse overs on home page do not differentiate options. No breadcrumb trails, no home page link. Have to burrow to find information, in particular the slide library site. Ambiguous menu options that don't provide clues as to what information is available.</p>			
Interaction			
Preference for face-to-face communication, harmony; personalized messages; more links to people; live chats; interaction as “asking”	X	Distance communication accepted as more efficient; anonymous messages tolerated; conflict tolerated, even encouraged; performance-critical communication	
<p>Distance communication seems an accepted mode of interaction, obviously because of the nature of the site. However, the site offers users the option to request additional information, providing space for the user to enter contact details that include telephone and fax details. The feedback page requires the user to enter his name and email address. Links are provided to other websites that provide information on entertainment and social activities.</p>			
Appearance			
Cultural markers: flags, colors, national images; soft focus; warm, fuzzy images; pictures of groups inviting participation, suggestions of intimacy and close social distance	X	Minimal and focused images; short borders, lines, edges; concentration on showing task or product	
<p>Limited images on main site that comprise of national images and buildings.</p>			

Evaluation : LONG TERM ORIENTATION

Does NOT correlate to Hofstede’s analysis for Singapore’s index (Score = 48 = STO)

Annexure A-5.2

Website Evaluation: Time Orientation - www.bn.com

Long Term Orientation	Short Term Orientation
Metaphors	
Stable family, paternalistic: Father, Mafia, Chinese state businesses, IBM in 1950s	Interchangeable roles, jobs, objects X
Use of shopping cart and bookstore metaphor consistent to familiarity, therefore short-term oriented as user can quickly become familiar with concepts, which will help to complete tasks quickly. Use of snowflakes as background imagery as opposed to official buildings or authority figures more supportive of short-term orientation [Marcus and Baumgartner, 2002].	
Mental Models	
Love/devotion; social coherence, responsibility, support	Liberty: social incoherence, social irresponsibility, efficiency X
Gift ideas could reflect social responsibility, in that it is expected to exchange gifts over the festive season. (Good marketing ploy in that it could be seen as a way to force people to buy gifts out of a sense of social duty) Gift ideas specifically for children indicates love/devotion Help available on main screen indicates support	
Navigation	
Tolerance for long paths, ambiguity; contemplation-oriented	Bread-crumbs trails, taxonomies; quick-results; action-oriented X
Prominent search facility on main screen provides for quick results and action-oriented navigation. Search results provide a list with limited information for quick scanning and choice. Also provides Bestseller list and Top 5 for easy choice. No breadcrumb trail, but products categorized well for quick access	
Interaction	
Preference for face-to-face communication, harmony; personalized messages; more links to people; live chats; interaction as “asking”	Distance communication accepted as more efficient; anonymous messages tolerated; conflict tolerated, even encouraged; performance-critical communication X
Conflict tolerated and encouraged by provision of customer review facility. These reviews can also be posted anonymously, in that the reviewer’s name is not required; also the reviewer can choose not to have his email address displayed with his review. There is also no direct link to a contact possibility [Marcus and Baumgartner, 2002]	
Appearance	
Cultural markers: flags, colors, national images; soft focus; warm, fuzzy images; pictures of groups inviting participation, suggestions of intimacy and close social distance	Minimal and focused images; short borders, lines, edges; concentration on showing task or product X X
Images are predominantly of the products. Suggestions of intimacy and close social distance through the “Meet the writers” option.	

Evaluation : SHORT TERM ORIENTATION

Correlates to Hofstede’s analysis for USA’s index (Score = 28 = STO)

ANNEXURE B

USER PROFILE QUESTIONNAIRE

USER PROFILE QUESTIONNAIRE

We are conducting a research project on the effects of cultural diversity on the design of human computer interaction.

This questionnaire will be used to identify your cultural profile, which will be matched at a later stage to your interaction design preferences. As a result, it is important that you fill in your student number on the MCQ answer sheet.

This questionnaire will be used purely for research purposes, and will not be part of any student's academic evaluation. Your personal identity will be kept confidential and any answers gained from this questionnaire will not be used against you in any way. The research results will be published in summary form so that there is no way in which you can be personally identified. All individual answers obtained from this questionnaire will be kept confidential.

There are no right or wrong answers. Please answer each question honestly and to the best of your ability.

Your input and time spent on answering this questionnaire is considered very valuable and is highly appreciated.

INSTRUCTIONS TO PARTICIPANTS

- (1) Fill in your student number on the MCQ answer sheet
- (2) Answer all questions on the MCQ answer sheet
- (3) Please answer ALL the questions (Part A and Part B)

PART A

1. What degree are you registered for?
 - [a] B Com / B Bus Sci - Accounting
 - [b] B Com / B Bus Sci - Business Information Systems
 - [c] B Com / B Bus Sci - Other
 - [d] B Sc - Computer Science
 - [e] Other

2. What is your highest academic qualification?
 - [a] matric / Grade 12
 - [b] Trade / technikon (after matric)
 - [c] Undergraduate degree (eg B. Com)
 - [d] Postgraduate degree (eg Hons B Com)

3. What language do you speak at home?
 - [a] English
 - [b] Afrikaans
 - [c] Zulu
 - [d] Another African Language
 - [e] Any other language, eg Chinese, Portuguese, French

4. What language do you most often use to speak to your friends?
 - [a] English
 - [b] Afrikaans
 - [c] Zulu
 - [d] Another African Language
 - [e] Any other language, eg Chinese, Portuguese, French

5. What racial group do you belong to?
 - [a] African
 - [b] Asian
 - [c] Coloured
 - [d] White

6. If English is not your first language, how well do you **speak** English?
NB: Do not answer this question if English is your first language
 - [a] Poorly - I have trouble communicating with English speaking people
 - [b] Adequately - I speak well enough to get around
 - [c] Fluently - I speak almost as well as a person whose first language is English

7. If English is not your first language, how well do you **read** English?
NB: Do not answer this question if English is your first language
 - [a] Poorly - I have trouble reading documents written in English
 - [b] Adequately - I read well enough to get around
 - [c] Fluently - I read almost as well as a person whose first language is English

8. How would you describe your general level of computer experience?
 - [a] None - I have never used any computer programs
 - [b] Low - I have used one or two computer programs
 - [c] Moderately low - I have learned and used between three and six computer programs
 - [d] Moderately high - I have learned and used more than six different computer programs, but I have no programming skills
 - [e] High - I have used many different computer programs and have some programming skills

9. What is your level of typing skill?
 [a] "Hunt and Peck" - less than 15 words per minute
 [b] Moderately skilled - between 15 and 50 words per minute
 [c] Highly skilled / touch typist - more than 50 words per minute
10. Have you ever bought anything online (using the Internet)?
 [a] Yes
 [b] No
11. If you have ever bought anything online, where was it from?
 [a] Amazon
 [b] Kalahari
 [c] Barnes&Noble
 [d] Any other online bookstore
 [e] Any other online company, other than a bookstore
Note: you may select more than one answer for this question, if relevant.
12. How long have you been using computers for?
 [a] less than a year
 [b] 1 - 2 years
 [c] 2 - 4 years
 [d] more than four years
13. How often do you use a computer?
 [a] less than once a month
 [b] once a month
 [c] once a week
 [d] once a day
 [e] more than once a day
14. What do you use computers mainly for?
 [a] send and receive e-mails / type out assignments
 [b] find information from the internet
 [c] play games
 [d] IT industry related work (eg creating websites / programming)
 [e] other
Note: you may select more than one answer for this question, if relevant
15. How many computer courses have you attended at training schools, technikons or colleges?
 [a] none
 [b] 1
 [c] 2-4
 [d] more than 4
16. How have computers affected your life?
 [a] Computers have made my life easier
 [b] Computers have not affected my life in any particular way
 [c] Computers have made my life more difficult
17. Do you enjoy learning how to use a new computer program?
 [a] Yes, it's usually challenging and interesting
 [b] Sometimes, depending on the program
 [c] No, it's usually tedious and frustrating

18. When learning how to use a new computer program, which do you prefer?
[a] read the user manual first, then try to use the program
[b] try to use the program first, and refer to the manual when you need help
[c] find someone who knows how to use the program to teach you
[d] learn the program by using the program, without referring to the user manual
19. On average, in a course (eg BIS 2B), how often do you ask the lecturers questions about the lecture material?
[a] Never
[b] 1 - 3 times per course
[c] 4 - 7 times per course
[d] 8 - 10 times per course
[e] more than 10 times
20. If your answer to the previous question was NOT [d] or [e], which of the following statements best explains the reason?
[a] The lecturer is not approachable
[b] I don't like asking questions in class
[c] I don't have any questions relating to the lecture material
Note: If you answered [d], or [e] to question 19, ignore this question
21. Are you colour blind?
[a] Yes, I cannot see red writing on a green background, or vice versa
[b] Yes, I have difficulty in seeing some colors
[c] No
22. Do you wear glasses or contact lenses?
[a] No, my vision is fine without them
[b] No, but I should
[c] Yes, and with the glasses / contact lenses my vision is fine
[d] Yes, but I still struggle to see and/or read, even with the glasses / contact lenses
23. Do you have any physical handicaps, other than vision deficiencies, that affect the way in which you work with a computer?
[a] No
[b] Yes, I have difficulty hearing
[c] Yes, I have difficulty moving my fingers, wrists, elbows or shoulders
[d] Yes, I am wheelchair-bound
[e] Yes, but the handicap is not listed above.
24. Are you?
[a] Male
[b] Female
25. How old are you?
[a] 18 - 19
[b] 20 - 21
[c] 22 - 23
[d] 24 or older

PART B

For each of the following statements, please indicate how you feel about each one by choosing the appropriate letter as your answer. For example

- if you **strongly agree** with the statement, then choose **[a]** as your answer
- if you **agree** with the statement, but have no strong feelings about it, then choose **[b]** as your answer
- if you are **not sure** if you agree or disagree with the statement, then choose **[c]** as your answer
- if you **disagree** with the statement, but have no strong feelings about it, then choose **[d]** as your answer
- if you **strongly disagree** with the statement, then choose **[e]** as your answer

*Please make sure you indicate your answer on the MCQ sheet,
and NOT on this questionnaire*

26. If a lecturer says something that I disagree with, I will challenge the lecturer **during** the lecture

Strongly Agree [a]	Agree [b]	Not Sure [c]	Disagree [d]	Strongly Disagree [e]
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27. Social acceptance is more important to me than self-respect

Strongly Agree [a]	Agree [b]	Not Sure [c]	Disagree [d]	Strongly Disagree [e]
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28. I am more comfortable in a learning environment with structured timetable slots and precise learning objectives, than in an open-ended learning environment.

Strongly Agree [a]	Agree [b]	Not Sure [c]	Disagree [d]	Strongly Disagree [e]
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29. Competing with my fellow students academically or otherwise is NOT important to me

Strongly Agree [a]	Agree [b]	Not Sure [c]	Disagree [d]	Strongly Disagree [e]
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30. If I do a favour for someone, I expect that person to return the favour when I need it (eg if I give a lift to a friend, I expect that friend to give me a lift when I need one)

Strongly Agree [a]	Agree [b]	Not Sure [c]	Disagree [d]	Strongly Disagree [e]
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31. If a lecturer says something that I disagree with, I will challenge the lecturer **after** the lecture

Strongly Agree [a]	Agree [b]	Not Sure [c]	Disagree [d]	Strongly Disagree [e]
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32. When doing a project as a group, (eg the Major Project), each group member should get the same mark for that project, rather than each member getting assessed individually

Strongly Agree [a]	Agree [b]	Not Sure [c]	Disagree [d]	Strongly Disagree [e]
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33. I have no problem with proceeding with a task even if the objectives are initially not clearly defined (eg proceeding with an assignment but I don't know how it will be marked)

Strongly Agree [a]	Agree [b]	Not Sure [c]	Disagree [d]	Strongly Disagree [e]
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34. A lecturer who is friendly and sociable is a better lecturer than one who has a strong academic reputation

Strongly Agree [a]	Agree [b]	Not Sure [c]	Disagree [d]	Strongly Disagree [e]
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35. I believe in living my life for the moment rather than planning for the future

Strongly Agree [a]	Agree [b]	Not Sure [c]	Disagree [d]	Strongly Disagree [e]
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36. If a lecturer disagrees with the work that I have submitted, and I feel that I am in the right, I will take it up with the lecturer and stand up for my point of view

Strongly Agree [a]	Agree [b]	Not Sure [c]	Disagree [d]	Strongly Disagree [e]
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37. I would prefer to work on the Major Project on my own, rather than as a group, if there would be the same amount of work for me if I worked on the project in a group or on my own.

Strongly Agree [a]	Agree [b]	Not Sure [c]	Disagree [d]	Strongly Disagree [e]
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38. Unfamiliar situations make me feel uncomfortable

Strongly Agree [a]	Agree [b]	Not Sure [c]	Disagree [d]	Strongly Disagree [e]
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39. I prefer to discuss lecture material with tutors rather than with lecturers

Strongly Agree [a]	Agree [b]	Not Sure [c]	Disagree [d]	Strongly Disagree [e]
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40. When I am learning something new and difficult, such as a new computer program, I persevere until I understand it

Strongly Agree [a]	Agree [b]	Not Sure [c]	Disagree [d]	Strongly Disagree [e]
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41. I often discuss lecture material with my lecturers outside of lecture times

Strongly Agree [a]	Agree [b]	Not Sure [c]	Disagree [d]	Strongly Disagree [e]
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42. Salary and promotions are more important to me than caring and social roles in my job

Strongly Agree [a]	Agree [b]	Not Sure [c]	Disagree [d]	Strongly Disagree [e]
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43. It is more important for me to get the recognition that I deserve for the work that I do, rather than to work with people who cooperate well with one another

Strongly Agree [a]	Agree [b]	Not Sure [c]	Disagree [d]	Strongly Disagree [e]
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44. I think that the correct answer is more important than an original / creative answer

Strongly Agree [a]	Agree [b]	Not Sure [c]	Disagree [d]	Strongly Disagree [e]
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45. It is more important to me to have a challenging job rather than a job that provides me with good working conditions.

Strongly Agree [a]	Agree [b]	Not Sure [c]	Disagree [d]	Strongly Disagree [e]
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*PLEASE MAKE SURE THAT YOU HAVE FILLED IN
YOUR STUDENT NUMBER ON THE MCQ SHEET*

THANK YOU FOR YOUR PARTICIPATION

ANNEXURE C

TEST TASKS

Exercise 1	http://www.uum.edu.my	High Power Distance
Exercise 2	http://www.sony.se	Masculinity
Exercise 3	http://www.travelagent.gr/	High Uncertainty Avoidance
Exercise 4	http://www.nps.gov/glba/	Individualism
Exercise 5	http://www.cybrary.com.sg	Long-Term Orientation
Exercise 6	http://osprey.unisa.ac.za	Low Power Distance
Exercise 7	http://www.ibm.com/	Femininity
Exercise 8	http://www.singaporeair.com.sg	Low Uncertainty Avoidance
Exercise 9	http://www.tourism-costarica.com/	Collectivism
Exercise 10	http://www.bn.com	Short-Term Orientation

EXERCISE 1

1.1 Type in the following URL

<http://www.uum.edu.my>

Select the HTML version

1.2 Answer the following questions in the space provided

	QUESTION	YOUR ANSWER
1.2.1	How many computers are linked to the university's campus-wide network?	
1.2.2	What is the Minimum Cumulative Grade Point (CGPA) that a student needs to achieve in order to qualify for a degree at this university?	

<p>THERE IS A SLIDE ON THE OVERHEAD PROJECTOR INDICATING THE NUMBER OF MINUTES THAT YOU TOOK TO COMPLETE THIS EXERCISE.</p> <p>WHEN YOU HAVE FOUND THE ANSWERS TO BOTH OF THE ABOVE QUESTIONS, ENTER THE NUMBER THAT YOU SEE ON THE SLIDE HERE</p>	
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DO NOT TURN OVER THE PAGE UNTIL YOU ARE TOLD TO DO
SO

EXERCISE 2

2.1 Type in the following URL

<http://www.sony.se>

2.2 Answer the following questions in the space provided

	QUESTION	YOUR ANSWER
2.2.1	What was Sony's recorded consolidated annual sales for the fiscal year ending 31 March 2001?	
2.2.2	What is the product code of the First Sony Car stereo with MP3 on CD-R and CD-RW?	

<p>THERE IS A SLIDE ON THE OVERHEAD PROJECTOR INDICATING THE NUMBER OF MINUTES THAT YOU TOOK TO COMPLETE THIS EXERCISE.</p> <p>WHEN YOU HAVE FOUND THE ANSWERS TO BOTH OF THE ABOVE QUESTIONS, ENTER THE NUMBER THAT YOU SEE ON THE SLIDE HERE</p>	
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DO NOT TURN OVER THE PAGE UNTIL YOU ARE TOLD TO DO SO

EXERCISE 3

3.1 Type in the following URL

<http://www.travelagent.gr/>

3.2 Answer the following questions in the space provided

	QUESTION	YOUR ANSWER
3.2.1	From what port does the 7-Day Cruise 1 leave?	
3.2.2	The Coral Hotel has a view of which Gulf?	

<p>THERE IS A SLIDE ON THE OVERHEAD PROJECTOR INDICATING THE NUMBER OF MINUTES THAT YOU TOOK TO COMPLETE THIS EXERCISE.</p> <p>WHEN YOU HAVE FOUND THE ANSWERS TO BOTH OF THE ABOVE QUESTIONS, ENTER THE NUMBER THAT YOU SEE ON THE SLIDE HERE</p>	
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DO NOT TURN OVER THE PAGE UNTIL YOU ARE TOLD TO DO SO

EXERCISE 4

4.1 Type in the following URL

<http://www.nps.gov/glba/>

4.2 Answer the following questions in the space provided

	QUESTION	YOUR ANSWER
4.2.1	What mode of transport is required to get to the Northern Lights Haven Lodge?	
4.2.2	Where do Kayak trips originate from?	

<p>THERE IS A SLIDE ON THE OVERHEAD PROJECTOR INDICATING THE NUMBER OF MINUTES THAT YOU TOOK TO COMPLETE THIS EXERCISE.</p> <p>WHEN YOU HAVE FOUND THE ANSWERS TO BOTH OF THE ABOVE QUESTIONS, ENTER THE NUMBER THAT YOU SEE ON THE SLIDE HERE</p>	
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DO NOT TURN OVER THE PAGE UNTIL YOU ARE TOLD TO DO
SO

EXERCISE 5

5.1 Type in the following URL

<http://www.cybrary.com.sg>

5.2 Answer the following questions in the space provided

	QUESTION	YOUR ANSWER
5.2.1	What was the total number of visitors to Singapore in December 2001?	
5.2.2	How much would you pay for the "Glimpses of Singapore" (CD-ROM) from the Tourism Cyberstore, if you are NOT a TRC member?	

<p>THERE IS A SLIDE ON THE OVERHEAD PROJECTOR INDICATING THE NUMBER OF MINUTES THAT YOU TOOK TO COMPLETE THIS EXERCISE.</p> <p>WHEN YOU HAVE FOUND THE ANSWERS TO BOTH OF THE ABOVE QUESTIONS, ENTER THE NUMBER THAT YOU SEE ON THE SLIDE HERE</p>	
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DO NOT TURN OVER THE PAGE UNTIL YOU ARE TOLD TO DO
SO

EXERCISE 6

6.1 Type in the following URL

<http://osprey.unisa.ac.za>

6.2 Answer the following questions in the space provided

	QUESTION	YOUR ANSWER
6.2.1	The Human Computer Interaction Focus Group is a research group that is active in the Computer Science and Information Systems Department of this University. What is the name of the Group Leader of this research Group?	
6.2.2	What is the name of the prescribed textbook for the INF 420-H module?	

<p>THERE IS A SLIDE ON THE OVERHEAD PROJECTOR INDICATING THE NUMBER OF MINUTES THAT YOU TOOK TO COMPLETE THIS EXERCISE.</p> <p>WHEN YOU HAVE FOUND THE ANSWERS TO BOTH OF THE ABOVE QUESTIONS, ENTER THE NUMBER THAT YOU SEE ON THE SLIDE HERE</p>	
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DO NOT TURN OVER THE PAGE UNTIL YOU ARE TOLD TO DO
SO

EXERCISE 7

7.1 Type in the following URL

<http://www.ibm.com/>

7.2 Answer the following questions in the space provided

	QUESTION	YOUR ANSWER
7.2.1	What is IBM's web price for the ThinkPad X series notebook?	
7.2.2	Which of the four ViaVoice Release 9 (for Windows) editions of speech recognition software has robust dictation, internet and command and control features?	

<p>THERE IS A SLIDE ON THE OVERHEAD PROJECTOR INDICATING THE NUMBER OF MINUTES THAT YOU TOOK TO COMPLETE THIS EXERCISE.</p> <p>WHEN YOU HAVE FOUND THE ANSWERS TO BOTH OF THE ABOVE QUESTIONS, ENTER THE NUMBER THAT YOU SEE ON THE SLIDE HERE</p>	
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DO NOT TURN OVER THE PAGE UNTIL YOU ARE TOLD TO DO SO

EXERCISE 8

8.1 Type in the following URL

<http://www.singaporeair.com.sg/>

8.2 Answer the following questions in the space provided

	QUESTION	YOUR ANSWER
8.2.1	What is the name of the lounge at Singapore Airport that is reserved for First Class and Raffles Class passengers?	
8.2.2	How much would you pay for a return Economy Class ticket to Manchester if you took advantage of Singapore Airlines special student fares?	

<p>THERE IS A SLIDE ON THE OVERHEAD PROJECTOR INDICATING THE NUMBER OF MINUTES THAT YOU TOOK TO COMPLETE THIS EXERCISE.</p> <p>WHEN YOU HAVE FOUND THE ANSWERS TO BOTH OF THE ABOVE QUESTIONS, ENTER THE NUMBER THAT YOU SEE ON THE SLIDE HERE</p>	
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DO NOT TURN OVER THE PAGE UNTIL YOU ARE TOLD TO DO SO

EXERCISE 9

9.1 Type in the following URL

<http://www.tourism-costarica.com/>

9.2 Answer the following questions in the space provided

	QUESTION	YOUR ANSWER
9.2.1	How many feet long are the ropes used for bungee jumps?	
9.2.2	What is the name of the public holiday that falls on January 25 th of each year in Costa Rica?	

<p>THERE IS A SLIDE ON THE OVERHEAD PROJECTOR INDICATING THE NUMBER OF MINUTES THAT YOU TOOK TO COMPLETE THIS EXERCISE.</p> <p>WHEN YOU HAVE FOUND THE ANSWERS TO BOTH OF THE ABOVE QUESTIONS, ENTER THE NUMBER THAT YOU SEE ON THE SLIDE HERE</p>	
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DO NOT TURN OVER THE PAGE UNTIL YOU ARE TOLD TO DO SO

EXERCISE 10

10.1 Type in the following URL

<http://www.bn.com>

10.2 Answer the following questions in the space provided

	QUESTION	YOUR ANSWER
10.2.1	What is Amazon.com's price for Enya's CD entitled "A Day without Rain"	
10.2.2	How much (in percentage) would you save if you bought the RCA RT2500 700 Watt Dolby Digital /DTS Home Theatre system from Amazon.com?	

<p>THERE IS A SLIDE ON THE OVERHEAD PROJECTOR INDICATING THE NUMBER OF MINUTES THAT YOU TOOK TO COMPLETE THIS EXERCISE.</p> <p>WHEN YOU HAVE FOUND THE ANSWERS TO BOTH OF THE ABOVE QUESTIONS, ENTER THE NUMBER THAT YOU SEE ON THE SLIDE HERE</p>	
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DO NOT TURN OVER THE PAGE UNTIL YOU ARE TOLD TO DO SO

ANNEXURE D

SATISFACTION QUESTIONNAIRE

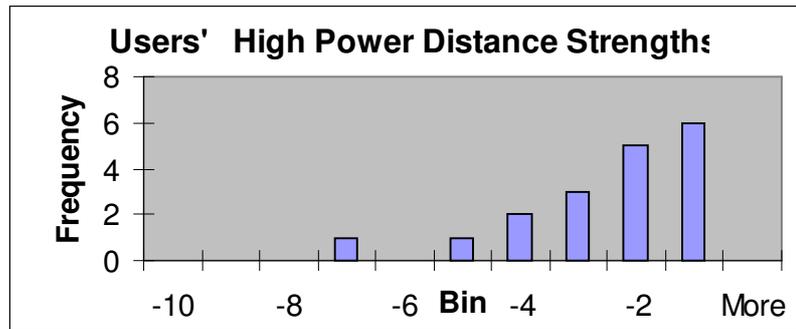
Complete the following questionnaire based on your interaction with this website

1	Mentally, how did you feel while working on this website?						
	Completely confused	a	b	c	d	e	Everything made sense
2	While completing this task, did you						
	feel completely frustrated	a	b	c	d	e	always know what to do next
3	Compared to what you expected, did this task go						
	much slower	a	b	c	d	e	much faster
4	How confident are you that your answers are correct?						
	Not at all confident	a	b	c	d	e	very confident
5	How easy was it to find the information that you were looking for?						
	Very easy	a	b	c	d	e	Very difficult
6	Did you find the response time of this website						
	too slow	a	b	c	d	e	fast enough
7	Learning to navigate around this website was						
	very difficult	a	b	c	d	e	very easy
8	Overall, did you find this website						
	very easy to use	a	b	c	d	e	very hard to use
9	Did you want to continue working with this website?						
	Definitely	a	b	c	d	e	Definitely Not

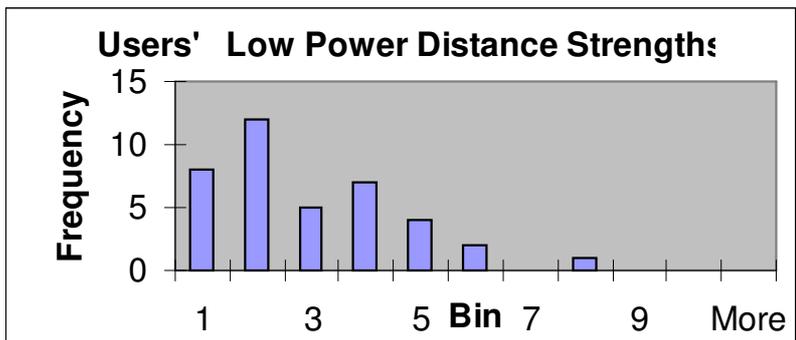
ANNEXURE E

HISTOGRAMS OF USERS' CULTURAL DIMENSION STRENGTHS

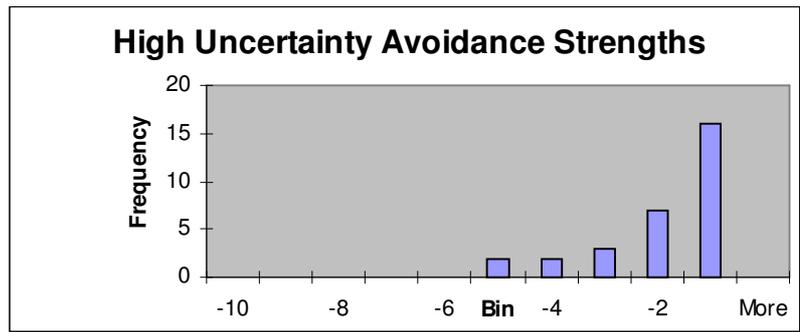
<i>Bin</i>	<i>Frequency</i>
-10	0
-9	0
-8	0
-7	1
-6	0
-5	1
-4	2
-3	3
-2	5
-1	6
More	0



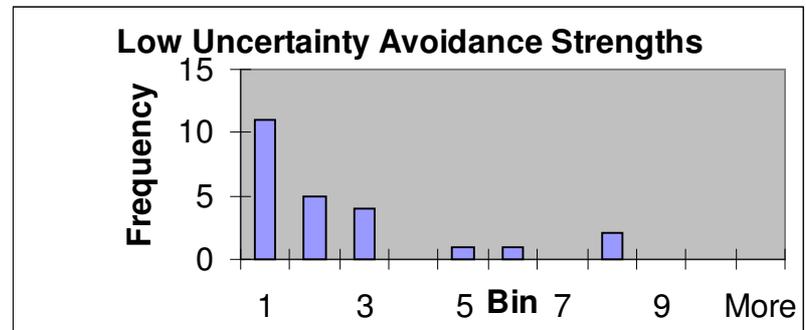
<i>Bin</i>	<i>Frequency</i>
1	8
2	12
3	5
4	7
5	4
6	2
7	0
8	1
9	0
10	0
More	0



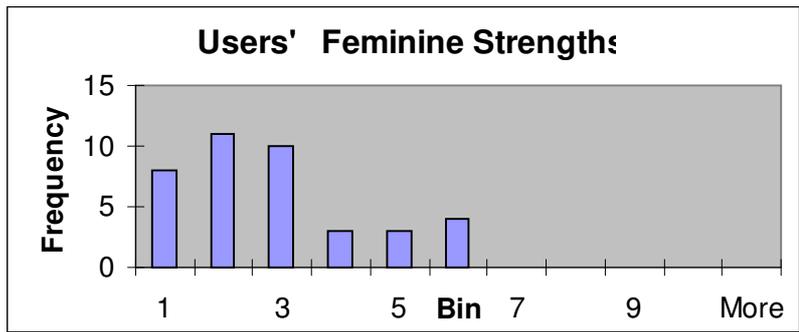
<i>Bin</i>	<i>Frequency</i>
-10	0
-9	0
-8	0
-7	0
-6	0
-5	2
-4	2
-3	3
-2	7
-1	16
More	0



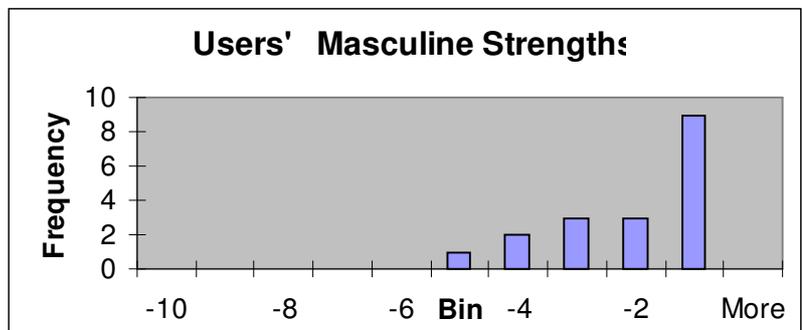
<i>Bin</i>	<i>Frequency</i>
1	11
2	5
3	4
4	0
5	1
6	1
7	0
8	2
9	0
10	0
More	0



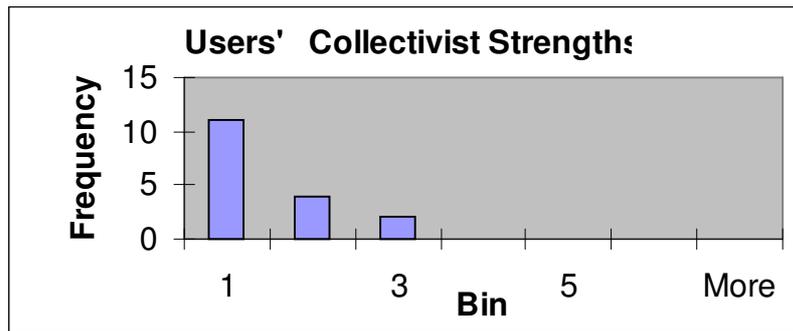
<i>Bin</i>	<i>Frequency</i>
1	8
2	11
3	10
4	3
5	3
6	4
7	0
8	0
9	0
10	0
More	0



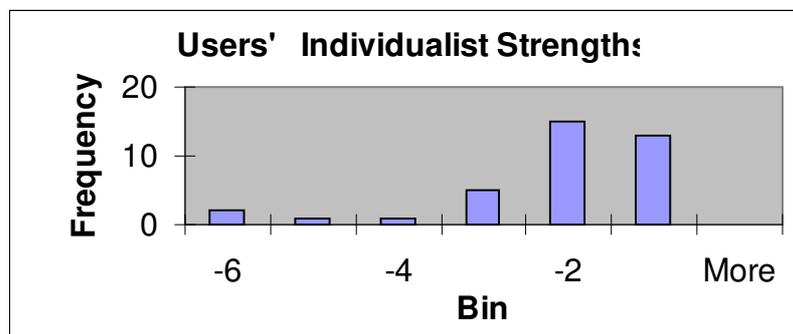
<i>Bin</i>	<i>Frequency</i>
-10	0
-9	0
-8	0
-7	0
-6	0
-5	1
-4	2
-3	3
-2	3
-1	9
More	0



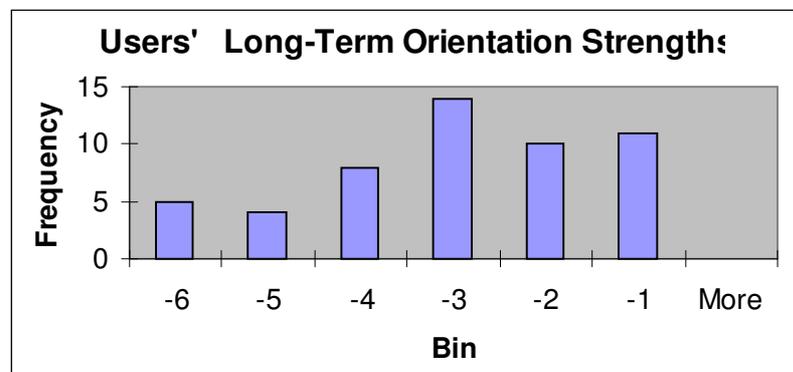
<i>Bin</i>	<i>Frequency</i>
1	11
2	4
3	2
4	0
5	0
6	0
More	0



<i>Bin</i>	<i>Frequency</i>
-6	2
-5	1
-4	1
-3	5
-2	15
-1	13
More	0



<i>Bin</i>	<i>Frequency</i>
-6	5
-5	4
-4	8
-3	14
-2	10
-1	11
More	0



ANNEXURE F

PUBLISHED PAPERS

One paper based on the work done in this dissertation, was published. A second paper has been accepted for presentation and inclusion into the proceedings of the HCII 2005 conference to be held in July 2005 in Las Vegas. These are attached as follows:

- F-1 Ford, G. and Gelderblom, J.H. 2003. The Effects of Culture on Performance Achieved through the use of Human-Computer Interaction. In J Eloff, P Kotzé. A Engelbrecht and M Eloff (Eds), *IT Research in Developing Countries - Proceedings of the SAICSIT 2003* (pp 218-230). ACM International Conference Proceeding Series.

- F-2 Ford, G. and Kotze, P. Cultural Dimensions: Who is Stereotyping Who? Abstract accepted for presentation and inclusion in the proceedings of the HCII 2005 conference to be held in July 2005 in Las Vegas.

The Effects of Culture on Performance Achieved through the use of Human Computer Interaction

GABRIELLE FORD
University of Natal, Durban
and
HELENE GELDERBLUM
University of South Africa

The user interface development process focuses on understanding users and their individual differences. These differences result from, inter alia, differences in culture. The primary goal of this research project was to determine whether Hofstede's [1991] cultural dimensions affect the performance achieved through the use of human-computer interaction. In order to achieve this goal, it was necessary to (1) identify the characteristics of the cultural dimensions; (2) identify test subjects and test interfaces displaying appropriate cultural dimensions and (3) assess the impact of these cultural dimensions on the speed, accuracy and satisfaction levels achieved by test subjects using the test interfaces to perform data collection tasks. Test subjects and website interfaces were identified in terms of the cultural dimension characteristics. The test subjects were selected based not only on their cultural dimensions, but also by controlling for user profile variables. The data resulting from the experiment was then analyzed to establish whether these dimensions had any impact on the performance achieved when using these websites. The results of the experiment did not provide sufficient evidence to conclude that any of the tested cultural dimensions affected human performance. However, the performance levels attained suggest that the usability of the interfaces was increased for all users, as a result of accommodating high uncertainty avoidance, masculinity, collectivism and high power distance characteristics into the design of the interfaces. In addition, two main categories of further research have arisen as a result of this research. The first category comprises new research questions. The second focuses on the changes that should be made to the research design used for this research effort.

Category of Submission: Full Paper

Categories and Subject Descriptors: H5.2 [Information Interfaces and Presentation]: User Interfaces -

Evaluation/methodology, Graphical user interfaces, Interaction styles, User-centered design, Screen design, Theory and methods, Web-based interaction; H.1.2 [Models and Principles]: User/Machine System - Human factors

General Terms: Design, Human Factors, Experimentation, Measurement, Performance, Theory

Additional Key Words and Phrases: Human-computer interaction, culture, cultural dimensions, usability, user interfaces, design guidelines, user performance

1. INTRODUCTION

This paper¹ evaluates the impact of a selected subset of cultural dimensions on human performance achieved through the use of web-based interfaces. Specifically, this paper compares the performance achieved by users using web sites that display cultural dimension characteristics that correspond to those identified in the user, to the performance achieved by users using web sites with opposing cultural dimensions.

This research arose as a result of considering the impact of the global market on user interface design, in conjunction with the usability concept of consistency.

The ultimate purpose of a computer-based information system is to improve human performance [Mayhew 1992]. Numerous user interface principles and guidelines have been identified in an attempt to enhance usability so that human performance is improved. Many of these principles and guidelines are encapsulated into the fundamental usability design technique of User Centered Design (UCD), which focuses on designing software interfaces that are consistent to the users' skills, knowledge, habits and tasks.

Over the past two decades, information technology has evolved in a way that it can now support a global market. In particular, the World Wide Web enables global distribution of products and services through websites. These products and services include software applications as well as the websites that are used to market them.

Designing the software to be consistent to the target user market now requires designers to take into consideration the cultural diversity of these users [Marcus 2000]. This is being attempted through the globalization [Bourges-Waldegg & Scrivener 1998] of the software applications and websites. This globalization process has concentrated primarily on translating the objective cultural aspects [Dunckley & Smith 2000], such as language and date and time formats [Bourges-Waldegg & Scrivener 1998]. However, it has been suggested that it is also necessary for the interfaces to reflect the values, ethics and morals of the target users [Carey 1998, Russo & Boor 1993], in order to make the users more comfortable and accepting of the interfaces. These aspects relate to the subjective culture [Dunckley & Smith 2000].

Objective and subjective cultural aspects are often described through cultural dimensions [Hoft 1996]. Numerous cultural models have been proposed [Hall 1959, Hofstede 1991, Trompenaars 1993, Victor 1992], each comprising a different set of cultural dimensions. To accommodate them all would be prohibitive both in terms of cost and time. In order to ascertain which of these cultural dimensions should be accommodated into the design of interfaces, it is necessary to first identify which of these dimensions affect human performance, in terms of speed, accuracy and satisfaction [Bailey 1996].

¹ This paper has been substantially condensed for submission purposes. The full paper is available from the authors.

Consequently, research needs to be conducted to determine which cultural dimensions affect human performance, so that these dimensions can be accommodated into the design of user interfaces in the future. It is believed that this will help to achieve the ultimate purpose of computer-based information systems of improving human performance.

The focus of this paper is to begin this process by assessing the impact of Hofstede's [1991] five cultural dimensions on human performance

2. LITERATURE SURVEY

A computer based information system is a tool that is used by humans to perform a set of tasks or actions in order to satisfy an objective. The human computer interface is the means of communication between the user and the computer. Thus, the objective of human computer interface design is to increase the usability of the system, in order to help users attain acceptable or improved performance levels. Numerous usability principles and guidelines have been developed for this purpose. Yet, many software products continue to degrade, rather than enhance, performance [Bailey 1996]. As a result of the need to internationalize products, attention has recently been turned to the cultural diversity of users. The question that now arises is whether the accommodation of culture into the design of user interfaces will alleviate the degradation of performance. In addition, the extent of any improvement in performance needs to be established, as marginal increases may not be considered justifiable in terms of cost and time.

2.1 Performance

Human performance is commonly measured in terms of speed, accuracy, training time and satisfaction [Bailey 1996]. When dealing with work-oriented software and interfaces, however, it is important that the interface is successful in providing people with information so that they can make decisions [Spool, et al 1999]. This success is measured in terms of how quickly and accurately the user obtains the information, and how much the users enjoyed using the interface to complete their tasks.

Bailey [1996] suggests that it is the designers who should be held responsible for reduced human performance, particularly if 'poor design decisions resulted from ignorance of human performance technology'. Therefore, to improve performance, designers must know what factors affect it [Mayhew 1992].

2.1.1 Consistency

It has been stated that consistency is one of the basic principles of usability [Dix, et al 1998] that can be used to improve human performance. In its narrowest sense, consistency is defined as similarities within a product [Mayhew 1992], for example, the same information should be located in the same place and displayed in the same way on all screens [Nielsen 1993]. However, it has been argued that consistency can be regarded as a usability category in its own

right, with many of the other usability principles appearing in support of consistency [Dix, et al 1998]. Consistency can therefore be more broadly defined as similarities within and across products, as well as compatibility with user characteristics.

The implication of consistency on user interface design is that designers need to know the user in order to design an interface that is consistent to that user's profile. The User Centred Design (UCD) technique is based on this premise, and encapsulates the principle of consistency and its related principles and guidelines.

2.1.2 User Characteristics

For human performance to take place, the human must be able to process information, solve problems, make decisions and react to that decision. These tasks are known collectively as the cognitive process [Ahituv & Neumann 1982] and are accomplished by the human information processing system [Mayhew 1992].

The human information processing system consists of components such as sensors, responders and memory that have inherent capabilities and limitations, which will influence the levels of performance achieved. These capabilities and limitations, in turn, are influenced by a number of user characteristics, such as the user's psychological characteristics, knowledge and experience, job and tasks, physical characteristics, physical environment, and tools [Mayhew 1992].

Mayhew [1992] suggests that using these characteristics would provide the designer with sufficient knowledge about the intended users to design an interface consistent to those users, thus increasing human performance. However, with the advent of the global market, and the ability to distribute products and services through web interfaces, it is equally important to design interfaces that are consistent to the target users' cultures [Marcus 2000].

2.2 Culture

There are many different definitions, approaches and models of culture in the literature, but there is no agreement on a specific definition of culture [Hoft 1996]. Consequently, instead of trying to produce a general definition, it is more important to find a definition of culture that serves this specific area of research [Honold 2000]. Thus, for the purposes of this paper, culture is defined in terms of the cultural aspects that influence human performance achieved through the use of human-computer interaction.

Culture has been described in terms of cultural dimensions, which are used to organise cultural data [Evers 2001]. Different cultural dimensions have been identified by David Victor [1992], Edward Hall [1959], Fons Trompenaars [1993] and Geerd Hofstede [1991].

Cultural dimensions can focus on objective aspects such as political and economic contexts, and differences in the format of the time of day, dates and numbers [Hoft 1996]. These

dimensions can also focus on subjective aspects such as values, beliefs, patterns of thinking and behavior. For example, Hofstede's model comprises the following five cultural dimensions²:

1. Power Distance – refers to the extent to which less powerful members expect and accept unequal power distribution within a culture [Marcus 2000]
2. Uncertainty Avoidance – relates to the way in which people cope with uncertainty and risk [Hoft 1996]
3. Masculinity vs Femininity – refers to gender roles, as opposed to physical characteristics, and is commonly characterized by the levels of assertiveness or tenderness in the user [Hofstede 1991]
4. Individualism vs Collectivism – refers to the role of the individual and the group, and is characterized by the level of ties between an individual in a society [Hoft 1996]
5. Time Orientation – refers to people's concerns with the past, present and future [Evers 2001].

One approach to cultural diversity concludes that, when dealing with human-computer interaction, meaning is the central issue in culture [Bourges-Waldegg & Scrivener 1998]. Supporters of this approach suggest that designers need only cater for cultural diversity by ensuring that the intended meaning of user interface representations, such as symbols, icons and language, are translated to suit the target cultures, so that they are understood correctly. Thus, this approach is based on the premise that it is the objective, rather than the subjective, cultural aspects that are important.

This has formed the basis for the current method of globalizing products for the international market. This method comprises (1) internationalizing the product, which involves identifying the culturally specific elements of the product, and (2) localizing the product, which involves substituting those culturally specific elements with a local content [Russo & Boor 1993]. The translation of text into an appropriate language is an example of the current globalization method.

However, Carey [1998] points out that there is a difference between comprehension and acceptance. She suggests that it is not enough just to translate the representations, but that it is equally important that other cultural conventions feel comfortable and recognizable to the user, thereby increasing user acceptance of the interface. Russo and Boor [1993] expand on this suggestion, pointing out that in addition to language, interfaces need to reflect the values, ethics and morals of the target users. Del Galdo & Nielsen [1996] clearly support this by pointing out that there are three levels of internationalization, namely

1. Displaying the native language, character set and notations,
2. Translating the user interface and documentation so that it is understandable and usable,

² The characteristics of each dimension is described in detail in Evers [2001], Hofstede [1991], Hofstede [1996], and Marcus [2000]

3. Matching the user's cultural characteristics, which goes beyond avoiding offensive icons and must accommodate the way business is conducted and the way people communicate .

Essentially, this approach is based on the premise that culture is about how individuals behave and respond, their beliefs and values, and therefore it is also necessary to reflect subjective culture in interfaces [Dunckley & Smith 2000].

2.3 The Influence of Culture on Human Performance

For human performance to take place, the cognitive process must be initiated and successfully completed. This process consists of four sequential stages [Ahituv & Neumann 1982]. The first stage - attention - is where a stimulus (signal) attracts the user's attention. Using computer based information systems, this stimulus is usually aimed at the visual or auditory sensors [Dix, et al 1998].

Whenever the user's attention is attracted, the signal is then transferred to the second stage of the cognitive process, known as the identification or recognition phase. During this stage the user tries to identify the signal in terms of his knowledge base and general context.

Should identification of the stimulus occur, the stimulus is then transferred to the user's long-term memory for further processing. This third stage of the cognitive process is known as the analysis stage. Here the stimulus is classified, stored and analyzed. It is mainly during this stage that decision making, problem solving and reasoning occurs.

The fourth stage of the cognitive process is called response. This is where the analysis triggers a decision to react to the stimulus. Using a computer based information system the user's reaction is usually made through movement, for example, using fingers to enter data or select a menu option via a keyboard or mouse.

Users interpret new information on the basis of their existing mental models [Honold 2000]. This model is focused on determining the patterns of thinking, feeling and acting that form a culture's mental model [Hoft 1996]. Therefore, it is suggested that these cultural dimensions can influence human performance during the cognitive process. Some examples follow.

2.3.1 Attention and Identification

Attracting the attention of the user and helping the user to identify the stimulus appear to be influenced primarily by objective cultural issues. For example, using a language, date format or metaphor that the user does not understand may either fail to attract the user's attention, or cause the user to be unable to identify the stimulus, thus resulting in the cognitive process aborting. In a study performed on a children's game, for example, it was found that European children did not recognize a football as a ball, because they had never seen a ball that was not round [del Galdo & Nielsen, 1996].

However, it is suggested that the metaphors used should be pertinent to the cultural dimension of the user. For example, High Power Distant users would be more attracted to metaphors that focus on expertise, authority, official stamps and logos, whereas Low Power Distant users would prefer metaphors that focus on images of equality, such as playgrounds and public places. Similarly, Feminine users would identify better with family oriented metaphors and imagery [Marcus 2002a]. This could also facilitate identification of the metaphor, particularly if used as a way of representing a particular function of the interface.

2.3.2 Analysis

The complexity of the problem to be solved often affects the problem solving process. Concreteness of data may alleviate complexity. Concrete data is data that does not have to be manipulated [Ahituv & Neumann 1982]. However, the user's perception of concrete data can be influenced by the user's cultural dimension. For example, a High Uncertainty Avoidant user prefers detailed explanations and information, whereas a Low Uncertainty Avoidant user prefers summarised data [Marcus 2002a].

Reasoning and problem solving require concentration. Any distractions could cause a loss in concentration, resulting in a need to start again, thus reducing speed, and sometimes accuracy, of performance. Slow response times also cause the user to become distracted from their task through boredom or irritation, causing loss of concentration. This is exacerbated in users that are naturally impatient or wanting to complete tasks quickly, such as Masculine and Short-Term Oriented users [Marcus 2002a].

Anxiety reduces the size of memory, as the user is partially absorbed by concerns that are beyond the problem solving task [Shneiderman 1987]. For example, a High Uncertainty Avoidant user is generally more emotional and stressed than a Low Uncertainty Avoidant user, and may be so anxious about having to learn how to navigate through the interface, that he is not concentrating on the problem itself. As another example, High Power Distant users may be worried about disappointing their superiors, thus putting themselves under more pressure and causing additional anxiety [Marcus 2002a].

The cultural dimensions of Power Distance, Time Orientation and Masculinity vs Femininity may result in loss of speed and accuracy and reduced user satisfaction during the analysis phase. As a result, human performance levels could be reduced during this phase of the cognitive process if these cultural dimensions are not accommodated for in the design of the interfaces.

2.3.3 Response

Hofstede's cultural dimensions also appear to affect the way in which users will respond to messages. For example, Collectivist users would be most uncomfortable with having to express personal opinions, while High Power Distant users would not wish to express an opinion that is in direct contradiction to their superiors. Similarly, Individualist users would not be comfortable

with having to provide personal information, but would find that being unable to express a personal opinion unacceptable [Marcus 2002a].

This, in turn, will affect the functionality provided in the interface. For example, a study conducted on students' use of a hypertext product to analyze a poem found that students should be able to add their own viewpoints to the system in some cultures (Low Power Distant and Individualist), but in others (High Power Distant and Collectivist) this would be unacceptable [Russo & Boor 1993]. Because the product did not provide a function that allowed students to add their viewpoints, the system was considered unacceptable to some cultures. Therefore, the functionality provided in the interface should be consistent with the users' cultural dimensions, thus adhering to the related principle of task conformance, and providing users with an appropriate mechanism with which to respond. This will reduce the possibility of a loss of speed and accuracy, increased training time, and reduction in user satisfaction.

It is therefore theoretically possible that these five cultural dimensions would affect the understanding, comfort and acceptance levels of the users, and therefore the performance levels attained when using a human-computer interface.

2.3.4 Summary

It is suggested that in order to design an interface that is fully consistent to the user, the designer needs to accommodate cultural dimensions as well as the user profile variables into the design of the user interface. This is supported by many authors, including Marcus [2001], who states that 'companies that want to do international business should consider the impact of culture on the understanding and use of user interfaces'.

However, 'the theoretical foundation for cultural influences on interface design is confused and not yet at the level which would allow designers to predict where cultural differences will have an impact on interactions between cultures or on products, or how these differences can be addressed' [Dunckley & Smith 2000]. Whilst it has been argued that subjective culture is important [Bourges-Waldegg & Scrivener 1998], and could play a significant role in improving performance, a definitive list of the subjective cultural dimensions that should be taken into consideration appears to be lacking. For example, Marcus [2000, 2002] discusses the five cultural dimensions identified by Hofstede [1991] in terms of their influence on user interface and Web design, but does not discuss the influence of these dimensions on human performance.

In terms of the cognitive process [Ahituv & Neumann 1982], it would seem that the cultural dimensions identified in Hofstede's model could substantially influence human performance. This research project therefore limits its scope to Hofstede's five cultural dimensions, to allow for a more focused study to be conducted.

From the above, the research objectives and hypotheses can be drawn and tested

3 RESEARCH OBJECTIVES AND HYPOTHESES

The aim of this research project was to identify whether Hofstede's cultural dimensions influence human performance. In order to achieve this aim, the following hypotheses were tested:

- H1 Power Distance will affect human performance achieved through the use of human-computer interaction.
- H2 Uncertainty Avoidance will affect human performance achieved through the use of human-computer interaction.
- H3 Masculinity vs Femininity will affect human performance achieved through the use of human-computer interaction.
- H4 Individualism vs Collectivism will affect human performance achieved through the use of human-computer interaction.
- H5 Time Orientation will affect human performance achieved through the use of human-computer interaction.

4 RESEARCH METHODOLOGY

A three-phased approach was followed, and is briefly discussed in this section.

4.1 Phase 1 Identification of Cultural Dimension characteristics

The objective of this phase was to identify the characteristics of the cultural dimensions selected for the research. The research method used for this phase was a literature survey. An analysis of the cultural dimensions was done to establish, for each cultural dimension, the character traits inherent in people belonging to different sides of the dimension, and the characteristics required by an interface that incorporates that dimension. The information obtained from this phase was used in Phase 2 to develop questionnaires in order to select test subjects and test interfaces

4.2 Phase 2 Assessment of Impact on Human Performance

The research methodology followed in this phase was based on the work of Spool et al [1999]. The primary research method used for this phase was an experiment, supported by the use of questionnaires.

4.2.1 The experiment

The impact of Hofstede's cultural dimensions on human performance was assessed by measuring and comparing the performance of users with different cultural profiles, while using different web site interfaces. Following Spool, et al's methodology [1999], in conjunction with Bailey's [1996] definition of human performance, performance was measured in terms of how

accurately and quickly the test subjects were able to find information, and the satisfaction levels experienced.

Five sets of test interfaces were identified and used. Each set consisted of two interfaces, each one displaying characteristics appropriate to one side of a cultural dimension. Web sites were used as test interfaces due to their abundance, availability and lack of cost implications.

Two questionnaires were developed for the experiment: The Cultural questionnaire was used to identify the cultural and user profiles of the test subjects prior to the subjects performing the test tasks. The Satisfaction questionnaire was used to measure the level of satisfaction experienced by the test subjects, after completing the test tasks for each web site.

The test subjects were selected from the group of 120 students enrolled for the third level course in the B Com (Information Systems & Technology) degree at the University of Natal, Durban. This group was selected with the expectation that they could share a similar user profile in terms of the same educational background and similar computer skills. Care was taken to ensure that the test subject group was representative of gender, and that the ages of the subjects were similar.

Accuracy and speed were measured by providing test subjects with a set of two questions relating to different web sites, the answers to which were to be found in the content of each web site. In keeping with Spool, et al's method [1999], the questions were designed so that the answer comprised a single fact, and there was only one correct answer.

The experiment data was analyzed to determine whether a correlation existed between the users' performance, the users' cultural dimensions and the test interfaces' cultural fit. For example, it was expected that High Power Distance (HPD) users using a High Power Distance site would achieve significantly different performance levels than when using a Low Power Distance (LPD) site.

4.2.2 Implementation of the Experiment

The experiment was conducted in three steps, as described below.

Step 1: Identification of test interfaces

Marcus [2000] identified five sets of websites that display characteristics relevant to Hofstede's cultural dimensions. It was originally intended to make use of these web sites for the experiment, however, it was determined that five of the web sites were not appropriate for the test tasks, as the content was not English, and one of the web sites had been discontinued as a result of the company declaring insolvency. Furthermore, one of the websites became unavailable during the conduction of the experiment, and as the subjects had already seen the questions, could not be used during a later session. As a result, replacement web sites needed to be identified for seven of the test interfaces. These were identified through the following process:

- 1 Countries with high and low indices for the various cultural dimensions were identified from Hofstede's [1991] survey.
- 2 Potential websites were then identified from those specific countries and evaluated in terms of the characteristics identified in Phase 1.
- 3 Fourth level students (registered for the Hons B Com (IST) degree) were given five of the websites to evaluate independently as part of their coursework.
- 4 The evaluations done by the researcher and the fourth level students were compared as a final check to ensure that the websites displayed the relevant cultural dimensions required for this research. This comparison was successful for all five websites.
- 5 After the experiments had been conducted, a new literature source became available that mapped user interface dimensions to web site components [Marcus 2002a]. The websites were then retro-evaluated in terms of this article, and submitted to Marcus for confirmation [2002a, 2002b]. The results of this evaluation process are discussed in Section 6

Step 2: Identification of users' cultural profile

The Cultural questionnaire was used to identify the cultural profile of the test subjects. All students enrolled for the third level BIS course were required to complete the Cultural Questionnaire, so that an appropriate group of test subjects could be identified. The questionnaire was developed based on the cultural dimension characteristics identified in Phase 1. Some use was made of Hofstede's survey questions, but many of these questions had to be adapted to suit students with little or no working experience.

Questions relating to user profile characteristics were incorporated into the questionnaire to identify any variables other than the cultural dimensions that may have affected the outcome of the test [Olivier 1999], for example, computer literacy levels and home language. These questions were based on prior research done by Mayhew [1992], Shneiderman [1987], and Rubin [1994]. The results of the users' cultural profile evaluation are discussed in section 7.

Step 3: Measurement of human performance using the interfaces

Subjects were required to access each web site, find the correct answer to both questions, and then complete the satisfaction questionnaire. This was done in five sessions, one dimension being tested per session. The reason for this was that the total amount of time required to complete the tasks for the ten websites was one-and-a-half hours. It was believed that the test subjects would become tired, impatient and bored, possibly leading to incorrect results.

Subjects were given a time limit within which to complete the tasks for each web site, based on a pilot study that was done prior to the experiment. Subjects were required to record the amount of time that they took to complete the task for each web site.

Measurements were recorded of each user's speed, accuracy and satisfaction when using an interface that corresponded to the user's cultural dimension side. The same measurements were recorded of the user when using an interface with the opposing cultural dimension side.

The score for accuracy was determined by calculating the percentage of correct answers. For example, if the user answered both questions, and both answers given were correct, his score for accuracy was 100%. If the user answered only one question, and the answer given was correct, his score for accuracy was 100%. This calculation was used to avoid accuracy measures being influenced by speed. Speed was recorded as amount of time that each user spent using each website, regardless of the number of answers found, or the number of accurate answers given. User satisfaction was measured using a Lickert 5-point scale. The scoring method used was dependent on whether the question was positively or negatively phrased.

4.3 Phase 3 Analysis and Interpretation

The way in which the hypotheses stated in section 3 were analyzed is best described by way of example. The Power Distance dimension is used for this purpose. The primary hypothesis (H11) states that 'Power Distance will affect human performance achieved through the use of human computer interaction'. The null hypothesis (H10) is therefore that Power Distance does not affect human performance.

The primary hypothesis (H11)) can be accepted if the accuracy, speed or satisfaction levels of HPD users, when using a HPD interface, are significantly different to the levels attained when using a LPD interface. Similarly, the hypothesis can be accepted if the accuracy, speed or³ satisfaction levels of LPD users, when using a LPD interface, are significantly different to the levels attained when using a HPD interface. The null hypothesis (H10) should be retained if the levels obtained when using the two different interfaces, by the same users, are the same. The same logic holds true for the primary hypotheses about the other cultural dimensions.

However, it was also noted during the analysis that it was possible that variables other than cultural dimensions in both the sites and the user groups could have affected performance levels. For example, one of the two sites in a set could have been superior in some way, or one of the two sets of users could have, by chance, been performing better generally. These additional variables were controlled for by accepting the above primary hypotheses only if, in addition to significant differences being found as explained above, no differences were found between the sites or between the user groups.

Four different types of statistical tests [Heiman 1996] were performed for each cultural dimension's set of measures:

- 1 Paired samples t-Test - used to determine whether a user, using an interface with the corresponding side of the cultural dimension, performs better than when using an interface with the opposing side of the dimension. If any significant differences were found ($\mu_D < 0$), then independent samples t-Tests were performed on the sites and user groups. Table 1 illustrates the comparisons done for each set of measurements for each cultural dimension.

³ It has not been established which of these performance measures are the most important

- 2 Independent Samples t-Test (Site) - used to determine whether one of the sites was generally a 'better' site than the other. This was done by comparing the average score achieved by all users using the first site, to the average score achieved by all users using the second site. If a significance difference was found ($\mu_S \neq 0$), then it was concluded that one of the sites was generally a better site.
- 3 Independent Samples t-Test (User) - was used to determine whether one set of users was generally a 'better' set of users than the other. This was done by comparing the average score of users of one side of the dimension using both sites, to the average score of users of the other side of the dimension. If a significant difference was found ($\mu_U \neq 0$) then it was concluded that one of the test subject groups was generally performing better than the other.
- 4 Paired samples t- test (Usability) – was used to confirm the findings of the previous two tests. This was done by comparing the average scores of users using a site with the same dimension to the average scores of users using a site with the opposing dimension.

Based on the above four tests, the hypotheses stated in Section 3 above can be decomposed into the following set of secondary hypotheses for each performance category for each side of each cultural dimension:

$$H_0 : \mu_D = 0 \text{ AND } \mu_S \neq 0 \text{ AND } \mu_U \neq 0$$

$$H_1 : \mu_D \neq 0 \text{ AND } \mu_S = 0 \text{ AND } \mu_U = 0$$

(where μ_D denotes the variance of the scores between the measures M1 – M2;

μ_S denotes the variance of the mean scores between either of the sites in a set of sites ;

and

μ_U denotes the variance of the mean scores between the test subject groups)

Cultural Dimension	Accuracy		Speed		Satisfaction	
	M1	M2	M1	M2	M1	M2
	User/Interface	User/Interface	User/Interface	User/Interface	User/Interface	User/Interface
Power Distance	HPD/HPD	HPD/LPD	HPD/HPD	HPD/LPD	HPD/HPD	HPD/LPD
	LPD/LPD	LPD/HPD	LPD/LPD	LPD/HPD	LPD/LPD	LPD/HPD
Uncertainty Avoidance	HUA/HUA	HUA/LUA	HUA/HUA	HUA/LUA	HUA/HUA	HUA/LUA
	LUA/LUA	LUA/HUA	LUA/LUA	LUA/HUA	LUA/LUA	LUA/HUA
Masculinity vs Femininity	MAS/MAS	MAS/FEM	MAS/MAS	MAS/FEM	MAS/MAS	MAS/FEM
	FEM/FEM	FEM/MAS	FEM/MAS	FEM/MAS	FEM/MAS	FEM/MAS
Individualism vs Collectivism	IND/IND	IND/COL	IND/IND	IND/COL	IND/IND	IND/COL
	COL/COL	COL/IND	COL/COL	COL/IND	COL/COL	COL/IND
Time Orientation	LTO/LTO	LTO/STO	LTO/LTO	LTO/STO	LTO/LTO	LTO/STO
	STO/STO	STO/LTO	STO/STO	STO/LTO	STO/STO	STO/LTO

Table 1: Measure Comparisons

6 CULTURAL DIMENSION CHARACTERISTICS

The objective of the first phase of the research was to identify the characteristics of the five cultural dimensions, in order to establish the character traits inherent in people belonging to different sides of each dimension, and the characteristics required by an interface that accommodates each dimension side. The character traits are defined by numerous authors [Evers 2001, Hofstede 1991, Hoft 1996, Marcus 2000], and are therefore not replicated here. Similarly, the general characteristics required by the interface are defined in Marcus [2002a].

Additional analysis has revealed that there are many conflicts and correlations between these dimensions. For example, a Masculine and Short-Term Oriented user would appreciate a navigation structure that supports user control and exploration. However, if that same user is also High Uncertainty Avoidant, then such a navigation structure could lead to anxiety and lower performance levels. It is possible that one cultural dimension may override others that are in conflict, particularly if the user displays a substantially high level of the overriding dimension, or relatively low levels of the other dimensions. In the above example, it is possible that the user's interaction will be dominated by his High Uncertainty Avoidant nature, thus reducing or even eliminating the impact of the other dimensions on the interaction.

7 IDENTIFICATION OF TEST INTERFACES

Using the interface characteristics identified in phase 1, one website for each side of each cultural dimension was identified. The retrospective evaluation of the web site evaluated the interfaces' cultural profile in terms of the five components that comprise an interface, namely metaphors, mental models, navigation, interaction and appearance [Marcus 2002a].

Marcus & Baumgartner [2002] agreed with the overall⁴ findings of the retrospective evaluations of all the sites except for the two used for the Masculinity vs Femininity dimension. They point out that in comparison to the IBM (Sweden) site, the IBM (USA) site is not strongly Feminine in its characteristics. Also, the Sony (Sweden) site is more Feminine than its USA counterpart. This argument is accepted. However, in comparing the IBM (USA) site to the Sony (Sweden) site, the IBM (USA) site does exhibit more Feminine characteristics than the Sony (Sweden) site. Consequently, for the purposes of this research, user performance on the IBM (USA) site will be analyzed in terms of the Feminine side of the cultural dimension, and the Sony (Sweden) site performance will be analyzed in terms of the Masculine side.

Marcus [2002b] suggested that it is possible that only some of the screens, or some of the components of the websites, displayed the properties relevant to the identified cultural dimension side. He also pointed out that the chosen sites had varying degrees of design expertise, which could lead to misleading results. These suggestions confirmed the need to perform the independent samples t-tests for site and user differences and the paired samples t-tests for usability equality.

⁴ Additional points were made and incorporated into the evaluations.

8 IDENTIFICATION OF TEST SUBJECTS

Users were selected from the 120 third level students enrolled for the B Comm (Information Systems and Technology) degree at the University of Natal, Durban Campus. All candidates completed the Cultural questionnaire so that test subjects with similar user characteristics and opposing cultural dimensions could be identified. To control for variables other than cultural dimensions, test subjects were selected by filtering the candidate population by ensuring homogeneity in terms of education levels, home language, racial group, and computer experience and skills. The majority of selected users scored in the low levels of each dimension.

9 MEASUREMENT OF PERFORMANCE

The performance of more than 50 test subjects for four of the five cultural dimensions were measured and compared. Due to the very small sample size of Short-Term Oriented users found, it was not possible to analyze the results for the time orientation dimension.

9.1 Detailed Findings

This section reports on the results of the four statistical tests performed on the data obtained on the measures for each cultural dimension.

9.1.1 Impact of Power Distance on Performance

There were no significant differences in the accuracy or satisfaction levels achieved. Significant differences in speed occurred within the LPD user group, but not within the HPD user group. It was noted that the difference within the LPD user group was positive, indicating that LPD users using the LPD site took longer to complete the tasks than when using the HPD site. The independent samples t-test (site) indicated that irrespective of the user's side of the cultural dimension, it took longer to complete the tasks overall using the LPD site than when using the HPD site. This was confirmed by the lack of significant results found in the paired samples t-test used to control for usability. No significant difference was found between the two user groups.

9.1.2 Impact of Uncertainty Avoidance on Performance

The only *insignificant* difference found at the 95% level in the comparisons was in the accuracy scores between LUA users using an LUA site compared to the same users using a HUA site. However, this difference fell just short of being significant in terms of the t-crit value, and could be accepted at the 94% level. It was noted that the differences found for the HUA user group were exactly opposite to the differences found for the LUA user group. This strongly suggested that the HUA site was substantially superior to the LUA site in terms of accuracy, speed and satisfaction levels. The independent samples t-tests (site) confirmed that, irrespective of the user's side of the cultural dimension, that (1) higher levels of accuracy were achieved, (2) less

time was taken to complete the tasks, and (3) greater satisfaction levels were reported, when using the HUA site than when using the LUA site. This was confirmed by the lack of significant results found in the paired samples t-test used to control for usability. No significant difference was found between the two user groups.

9.1.3 Impact of Masculinity vs Femininity on Performance

The only *insignificant* difference found at the 95% level in the comparisons was in the accuracy scores between MAS users using an MAS site compared to the same users using a FEM site. It was noted that the significant results found for the MAS user group were exactly opposite to the differences found for the FEM user group. This strongly suggested that the MAS site was substantially superior to the FEM site in terms of accuracy, speed and satisfaction levels. The independent samples t-test (site) confirmed that, irrespective of the user's side of the cultural dimension, that (1) higher levels of accuracy were achieved, (2) less time was taken to complete the tasks, and (3) greater satisfaction levels were reported, when using the MAS site than when using the FEM site. This was confirmed by the lack of significant results found in the paired samples t-test used to control for usability. No significant difference was found between the two user groups.

9.1.4 Impact of Individualism vs Collectivism on Performance

There were no significant differences in the accuracy or speed levels achieved. Significant differences in user satisfaction occurred within the IND user group, but not within the COL user group. It was noted that the difference within the IND user group was negative, indicating that IND users using the COL site reported higher satisfaction levels than when using the IND site. The independent samples t-test (site) indicated that irrespective of the user's side of the cultural dimension, greater satisfaction levels were achieved overall when using the COL site than when using the IND site. This was confirmed by the lack of significant results found in the paired samples t-test used to control for usability. No significant difference was found between the two user groups.

9.2 Summary of findings

For every significant result obtained from the paired samples t-tests, a significant result was obtained from the independent samples t-tests for site usability differences. This indicated that the increase in performance could be attributable to the cultural dimension on the site, or variables other than that cultural dimension. In addition, the paired samples t-tests used to test site usability equality produced insignificant results, thus confirming the independent samples t-tests results in each case. This is reflected in Table 2.

Tests	Accuracy	Speed	Satisfaction	Accuracy	Speed	Satisfaction
	Power Distance			Uncertainty Avoidance		
Paired samples	Insignificant	Significant	Insignificant	Significant	Significant	Significant
Site Differences		Significant		Significant	Significant	Significant
User Differences		Insignificant		Insignificant	Insignificant	Insignificant
Usability Equality		Insignificant		Insignificant	Insignificant	Insignificant
	Masculinity vs Femininity			Individualism vs Collectivism		
Paired samples	Significant	Significant	Significant	Insignificant	Insignificant	Significant
Site Differences	Significant	Significant	Significant			Significant
User Differences	Insignificant	Insignificant	Insignificant			Insignificant
Usability Equality	Insignificant	Insignificant	Insignificant			Insignificant

Table 2: Summary of Results

10 ANALYSIS AND INTERPRETATION

The results of the statistical tests strongly indicate that the differences in performance measures are attributable to one of the two sites in each set being a generally better site, rather than as a result of the user using an interface with a corresponding side of a cultural dimension. The sites that displayed the characteristics of HPD, HUA, MAS or COL were found to be the better sites.

10.1 Analysis of Findings

A number of reasons for the better sites are suggested below. However, it should be noted that there is currently insufficient empirical evidence to support these suggestions, and therefore further research and/or analysis of the current data is required before any of the suggestions should be accepted

10.1.1 Nature of the cultural dimension

It is possible that one of the two sites in each set was generally a 'better' site *because* it displayed the characteristics of a particular side of a cultural dimension. For example,

- the increase in speed and accuracy levels obtained on the HUA site could be attributable to the fact that HUA sites are designed to reduce uncertainty. The design provides clear and familiar metaphors, simple, clear articulation and limited menu options, simple and limited navigation controls, precise and detailed feedback of status, simple and clear imagery and highly redundant coding. All these characteristics would naturally cater for more accurate and speedier completion of tasks. As a result, satisfaction levels would also be increased, as users would feel that the task has been accomplished quickly and accurately.
- MAS site design incorporates similar characteristics to those of HUA sites. For example, MAS sites are designed to provide limited navigation choices, and high-level executive

views, and are goal and work oriented, thus providing for quick results of limited tasks. These characteristics would also naturally increase the speed and accuracy levels obtained, thereby also increasing satisfaction levels.

- HPD sites also provide limited navigation choices, and wizards or guides to assist with navigation, thereby increasing the speed, accuracy and satisfaction levels obtained. However, it is noted that a significant result was obtained only in speed levels when compared to the LPD site

In contrast to the HUA, MAS and HPD sites, the increase in satisfaction levels obtained on the COL site cannot be explained in terms of the characteristics of this side of the dimension.

10.1.2 Considerations other than cultural dimensions

- Heuristics: Nielsen [1993] identified a set of ten heuristics that should be used to evaluate the general usability of all interfaces, including websites. It is possible that the better sites were more generally usable if these heuristics were adhered to in the design of these websites.
- Common mistakes of web design: Nielsen [1996, 1999] also identified twenty common mistakes of web design. It is possible that the designers of the better web sites avoided these mistakes, thus enhancing the general usability of the interfaces, and consequently increasing performance
- Component impact: It is possible that performance is affected at different levels by the various interface components. This may also be dependent on the nature of the interface. For example, it is possible that the ease of navigation on a website interface could affect performance significantly more than the metaphors or appearance of the site. In contrast, when using a traditional graphical user interface (such as a word-processing or spreadsheet application), performance may be affected more by the appearance or mental models of the interface. It is therefore possible that the test tasks did not test the interface components equally.
- Partial representation: It is possible that not all of the screens on each website displayed the same side of the dimension [Marcus 2002b]. This could have resulted in the user responding to different sides of the same dimension, thus distorting the performance results.
- Order effect: It is interesting to note that of the four sets of sites tested for differences, the second site in three of the four sets appeared to have a higher usability than that of the first site. This could be indicative of an order effect.

10.2 Interpretation of Findings

It is possible that the better sites were better as a result of a mixture of the reasons given above. Therefore, it cannot be stated with certainty that the better sites are better because they displayed the characteristics of a particular side of a cultural dimension. Consequently, there is insufficient evidence to support the hypotheses that any of the four cultural dimensions tested

significantly affect human performance. To avoid a Type I error, all of the secondary null hypotheses were retained, resulting in all of the primary null hypotheses being retained as well.

11 CONCLUSION

This paper began the process of identifying the cultural dimensions that should be accommodated into the design of user interfaces by testing the effects of Hofstede's five cultural dimensions on human performance achieved through the use of a computer-based user interface. This was done by measuring the accuracy, speed and performance levels of users using interfaces that corresponded to their side of each cultural dimension and comparing them to the same measurements taken whilst using interfaces with opposing sides of each dimension. For each side of each cultural dimension, a paired samples t-test was performed to determine whether the differences in mean scores was significant.

11.1 Impact of Cultural Dimensions on Human Performance

It was noted during the analysis and interpretation phase that differences in scores could have been attributable to variables in the sites or users other than the cultural dimension being tested. These variables include the nature of the cultural dimension, heuristics, common mistakes of web design, component impact, partial representation and an order effect. These additional variables were controlled for by performing independent samples t-tests for every significant result obtained in the paired samples t-tests. In every case, significant differences were found between the two sites in each set of test sites. These findings were confirmed by performing an additional paired samples t-test which compared accuracy, speed and satisfaction levels between users using sites with cultural dimension sides corresponding to the users' cultural dimension sides, and users using sites with opposing cultural dimension sides. No significant differences were found between the user groups.

As a result, all secondary hypotheses were rejected at the 95% level, resulting in H1 – H4 being rejected. H5 could not be tested due to the limited number of test subjects that were identified as Short-Term Oriented.

11.2 Limitations of this Research

Some limitations of this research came to light during the analysis and interpretation of the results. These are discussed below

11.2.1 Cultural profile evaluation

Although care was taken to identify appropriate questions through the use of the literature as well as a pilot study, it is possible that the test subjects' cultural dimension sides were inaccurately evaluated. In particular, users with a high Power Distance index (HPD) could have caused errors by answering positively phrased questions positively, and vice versa, as they may not have wanted to be seen as disagreeing with the question. In hindsight, it is possible that the

users identified as LPD could in fact have been HPD, as the majority of the questions were phrased positively, where a positive answer indicated LPD.

11.2.2 Cultural dimension strengths

It is possible that performance levels are significantly affected only if the users display high levels of a particular side of a cultural dimension. For example, a user could be very High Uncertainty Avoidant or medium uncertainty avoidant. This aspect was not controlled for in the experiment, as it was noted that the majority of users scored in the low to medium levels of each dimension side (refer section 7). However, if the dimension sides themselves were inaccurately evaluated, it is equally possible that the strengths of the dimensions sides were also inaccurately evaluated.

11.2.3 Interplay between dimensions

As discussed in section 5, it is also possible that one cultural dimension could override the impact of the other cultural dimensions, particularly if the user displays a substantially high level of one dimension. For example, very high levels of uncertainty avoidance may dominate the user's interaction. Thus it is possible that there would be little effect on the user's performance in terms of the other dimensions, but a substantial effect when testing performance for uncertainty avoidance. This was not controlled for in the experiment.

11.2.4 Impact of interface components

As discussed in section 9, it is possible that performance is affected differently by the different components comprising an interface. This could also have an impact on the type of test tasks selected for the experiment. For example, if navigation is indeed found to have a significant impact on performance, then the test tasks should be selected to specifically test this component of the interface.

11.3 Further Research

Companies that choose not to internationalize their products stand to lose a significant market share [Bourges-Waldegg & Scrivener 1998]. Understanding the cultural aspects that affect the use and understanding of software is therefore very important to the success of these products. Thus, it is believed that it is important for further research to be done in this area.

Two main categories of further research have arisen as a result of this research. The first category comprises new research questions. The second focuses on the changes that should be made to the research design used for this research effort.

11.3.1 New research questions

Many of the limitations identified in the research design, as well as the issues found during the analysis and interpretation of the results, have led to the identification of potential further

research areas that may assist in the understanding of the relationship between culture and usability. These are listed below.

- Cultural dimension strengths – are performance levels only affected if users display high levels of a particular side of a cultural dimension?
- Interplay between dimensions – does one cultural dimension override the impact of other dimensions on performance?
- Interface components - is performance affected differently by different components, and if so, which ones?
- Nature of the dimensions – is it possible that interfaces that display characteristics of one or more particular dimensions will provide for better performance, and if so, which ones?
- Heuristics – is there a relationship between Nielsen's heuristics for evaluating interface usability and cultural dimensions?
- User performance – which measure is the most important when determining usability?
- Other cultural dimensions – which cultural dimensions, other than those identified by Hofstede, should be accommodated into the design of user interfaces?

11.3.2 Research Design Changes

Due to the limitations identified, the impact of Hofstede's cultural dimensions on user interface design has not yet been identified. Whilst a number of strategies have been identified for overcoming these limitations, it is possible that additional limitations have not been identified in this research effort. It is therefore recommended that further research be conducted to ascertain both the limitations as well as the strategies used to overcome them. Once all the limitations and strategies have been identified, it is recommended that this research be redone, with an appropriately adjusted research design.

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13 REFERENCES

- AHITUV, N. AND NEUMANN, S. 1982, Principles of Information Systems for Management, Wm. C. Brown Publishers, Iowa
- BAILEY, R. 1996. Human Performance Engineering, Prentice Hall PTR
- BOURGES-WALDEGG, P. AND SCRIVENER, S.A.R. 1998. Meaning, the central issue in cross-cultural HCI design. *Interacting with Computers*, (9)3, 287-309.
- CAREY, J.M.. 1998. Creating global software: a conspectus and review. *Interacting with Computers* (9), 449-465.
- DEL GALDO, E AND NIELSON, J. 1996. International User Interfaces: John Wiley & Sons
- DIX A, FINLAY, J, ABOWD, G AND BEALE, R. 1998. Human Computer Interaction, Hemel Hempstead: Prentice Hall International (UK)

- DUNCKLEY, L. AND SMITH, A. 2000. Cultural Dichotomies in User Evaluation of International Software. In *Designing for Global Markets 2*, IWIPS'00, Baltimore, MD, Backhouse Press
- EVERS, V. 2001. Cultural Aspects of User Interface Understanding: An Empirical Evaluation of an E-Learning Website by International User Groups, University of Amsterdam
- HALL, E. 1959. *The Silent Language*. Doubleday
- HEIMAN, G.W. 1996. *Basic Statistics for the Behavioral Sciences* (2 ed). Houghton Mifflin Company
- HOFSTEDE, G. 1991. *Cultures and organisations: software of the mind*. New York: McGraw Hill
- HOFT, M. 1996. Developing a Cultural Model. In *International User Interfaces*, E DEL GALDO AND J NIELSON, Eds. New York: John Wiley & Sons
- HONOLD, P. 2000. Culture and Context : An Empirical Study for the development of a Framework for the Elicitation of Cultural Influence in Product Usage. *International Journal of Human-Computer Interaction* 12(354), 327 - 345
- MARCUS, A. 2000. Cultural Dimensions and Global Web User Interface Design : What? So What? What Now? In *South African Human-Computer Interaction Conference*, May 2000. <http://www.chi-sa.org.za/abstracts.htm>
- MARCUS, A. 2001. Cross-Cultural User-Interface Design for Work, Home, and On the Way. <http://www.upassoc.org/conf2001/reg/program/tutorials/t5.html>
- MARCUS, A. 2002a. Mapping user-interface design to cultural dimensions. Based on a paper prepared for a CHI 2002 Workshop and a paper prepared for Advanced Visual Interfaces, 2002. [http:// www. Amanda.com](http://www.Amanda.com)
- MARCUS A AND BAUMGARTNER, V.J. 2002. Personal e-mail correspondence
- MARCUS, A. 2002b. Personal email correspondence
- MAYHEW, D. 1992. *Principles and Guidelines in Software User Interface Design*. New Jersey: Prentice Hall
- NIELSEN, J. 1993. *Usability Engineering*. Academic Press (paperback edition)
- NIELSEN, J. 1996 Top Ten Mistakes in Web Design. <http://www.useit.com/alertbox/9605.html>
- NIELSEN, J. 1999 The Top Ten New Mistakes of Web Design. <http://www.useit.com/alertbox/990530.html>
- OLIVIER, M. 1999. *Information Technology Research - A Practical Guide*. MS Olivier
- RUBIN, J. 1994. *Handbook of usability testing : how to plan, design, and conduct effective tests*. John Wiley
- RUSSO, P. AND BOOR, S. 1993. How Fluent is your Interface? Designing for International Users. In *Proc INTERCHI'93 Conference on Human Factors in Computing Systems: INTERACT '93 and CHI'93*. ACM Press, 342-347
- SHNEIDERMAN, B. 1987. *Designing the user interface : strategies for effective human-computer interaction*. Addison-Wesley
- SPOOL, J.M., SCANLON, S., SCHROEDER, W., SNYDER, C., DEANGELO, T. 1999. *Web Site Usability: A Designer's Guide*. Morgan Kaufman Publishers Inc.
- TROMPENAARS, F. 1993. *Riding the Waves of Culture*. Nicholas Brealey Publishing
- VICTOR, D. 1992. *International Business Communications*. Harper Collins

Cultural Dimension Models: Who is stereotyping who?

GABRIELLE FORD
University of KwZulu-Natal, Durban
and
PAULA KOTZE
University of South Africa

The objective of this paper is to present evidence that Hofstede's [2001] cultural dimensions model is a relevant paradigm for research into ways of managing the subjective cultural aspects of usability.

The literature contains as many arguments against as supporting the accommodation of subjective culture into user interface design. Consequently a need exists for further research to establish the aspects of subjective culture that influence usability, and to what extent. Such research requires the use of a valid and relevant cultural model. The use of cultural dimension models in general, and Hofstede's model in particular, has been widely criticised as being stereotypical and rigid [Fitzgerald, 2004; Bourges-Waldegg & Scrivener, 1998; Jagne, et al., 2004; Light, 2003], resulting in the rejection of this model as the basis for this further research. This paper argues that there is sufficient theoretical evidence to suggest that Hofstede's cultural dimensions do influence usability, and is therefore a relevant paradigm for further research into the effects of subjective culture on cross-cultural usability.

A literature review was undertaken to identify and analyse the results of studies previously undertaken that were based on Hofstede's cultural dimensions model. Only a handful of studies [Straub et al, 1997; Smith and Chang, 2003; Anadarejen et al, 2002; Forer and Ford, 2003; Hall et al, 2003; Massey, et al, 2001] were found. Synthesis of the results of these studies suggests that Hofstede's cultural dimensions are related to usability from three different perspectives, namely user acceptance, context of use and objective usability.

From a user acceptance perspective, Smith and Chang's [2003] study suggests that the users' subjective cultural profiles (as defined in terms of Hofstede's cultural dimensions) influence the users' preferences and acceptance of interfaces. This is supported by three other studies, the results of which suggest that:

- the users' subjective cultural profile influences their acceptance of e-mail as a communication medium [Straub, Keil and Brenner, 1997];
- cultural differences in terms of uncertainty avoidance, context and individualism/collectivism affect communication behaviour and hence perceptions and preferences [Massey, Hung, Montoya-Weiss and Ramesh, 2001]; and

- cultural tendencies towards high uncertainty avoidance, high power distance, collectivism and masculinity disassociate usefulness from acceptance [Anandarejen, Igbaria, and Anakwe, 2002]. This suggests that the influence of certain variables on user acceptance is dependent on the subjective cultural profile of the intended users

The Forer and Ford [2003] study reported that users with a specific cultural profile achieved higher accuracy and faster speed when using an interface that matched their cultural profile than when using an interface with an opposing cultural profile. This suggests that for at least one cultural profile, Hofstede's dimensions influence the objective usability of user interfaces. In addition, analysis of the design characteristics required to implement Hofstede's cultural dimensions, as proposed by Marcus [2000, 2002], indicates that accommodating these dimensions into the design of user interfaces would decrease the cognitive load of the users, thus enhancing usability and performance.

From a context of use perspective, Hall, Lawson and Minocha [2003] argue that Hofstede's cultural dimensions provide the context within which different solutions to the same problem can be identified. These dimensions can therefore provide a high-level context of use within which the content and features of the interface should be designed. Furthermore, Gould (as reported by Light [2003]) points out that subjective cultural dimensions serve as design opportunities. This suggests that subjective culture influences the task context of use, as users with different cultures will want to perform different tasks appropriate to their respective cultural traits.

Thus, in contrast to the criticisms against the use of cultural dimension models, the synthesis of the results of the above studies provides strong theoretical evidence to support the use of Hofstede's model as a basis for researching the impact and extent of subjective culture on usability. Consequently, we believe that the assumptions surrounding the validity of cultural dimension models should be reassessed, and that such reassessment should be sensitive to the interdisciplinary framework within which human-computer interaction needs to operate.

References

Anandarejen, M., Igbaria, M. and Anakwe, U.P. 2002. IT acceptance in a less-developed country: a motivational factor perspective. *International Journal of Information Management* 22, 47-65

Bourges-Waldegg, P. and Scrivener, S.A.R. 1998. Meaning, the central issue in cross-cultural HCI design. *Interacting with Computers*, (9)3: 287-309.

Fitzgerald, W. 2004. Models for Cross-Cultural Communications for Cross-Cultural Website Design, National Research Council Canada, Institute for Information Technology

Forer, D. and Ford, G. 2003. User performance and user interface design: Usability heuristics versus cultural dimensions, in *Proceedings of the South African Computer Lecturer's Association*, June- July 2003.

Hall, P., Lawson, C. and Minocha, S. 2003. Design Patterns as a Guide to the Cultural Localisation of Software, in *Proceedings of the IWIPS 2003 conference*, Berlin

Hofstede, G. 2001. *Culture's consequences*. (2 ed) Sage Publications

Jagne, J., Smith, S.G., Duncker, E. and Curzon, P. 2004. *Cross-cultural Interface Design Strategy*, Technical Report: IDC-TR-2004-006, Interaction Design Centre, Middlesex University

Light, A. 2003. Culture and Usability: Will Design Patterns ease Problems of Context?, in *Usability News*. <http://www.usabilitynews.com/news/article1185.asp>

Marcus, A. 2000. Cultural Dimensions and Global Web User Interface Design: What? So What? What Now? in *South African Human-Computer Interaction Conference, May 2000*. <http://www.chi-sa.org.za/abstracts.htm>

Marcus, A. 2002. Mapping user-interface design to cultural dimensions. based on a paper prepared for a CHI 2002 Workshop and a paper prepared for *Advanced Visual Interfaces, 2002*.

Massey, A.P., Hung, Y.C., Montoya-Weiss, M. and Ramesh, V. 2001. When culture and style aren't about clothes: perceptions of tasktechnology 'fit' in global virtual teams, in *Proceedings of the 2001 International ACM SIGGROUP Conference on Supporting Group Work* Boulder, Colorado, USA, pp 207 - 213 ACM Press New York, NY, USA

Smith, A. and Chang, Y. 2003. Quantifying Hofstede and Developing Cultural Fingerprints for Website Acceptability, In *Proceedings Of The IWIPS 2003 Conference*, Berlin, Germany, July 2003, V. Evers, K. Röse, P. Honold, J Coronado, D.L. Day, Eds. University of Kaiserslautern.

Straub, D., Keil, M. and Brenner., W. 1997. Testing the technology acceptance model across cultures: A three country study, *Information and Management, Vol. 33, No. 1*, pp. 1-11