

Preliminary Findings from a Cross Cultural Usability Study on the Internationalization of User Interfaces

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Abstract. This paper reports the findings from a second preliminary study concerning the Internationalization of User Interfaces. It is a follow up to an initial study conducted on American users [4]. Undergraduate Zambian subjects from the University of Zambia (UNZA) completed a web-based application to gauge their understanding of cultural variables commonly used in user interface development. In general, the findings indicate a distinct affinity towards culturally familiar attributes. The authors conclude that the use of culturally sensitive variables in development of user interfaces can have an affect on the acceptance of technologies.

1 Introduction

The user interface (UI) is the first line of interaction between users of a product and its' developers. A lack of knowledge and understanding of the cultural backgrounds of the users can impact the development of the product. This in turn might impact the acceptance of the technology. Extensive research has shown the usefulness of cross cultural models in UI development. However, very little research has focused on the use of hybrid models. It is the purpose of this study to demonstrate the effectiveness of hybrid cultural models in UI development.

2 Background

The majority of researchers in the Internationalization of UI domain acknowledge the cultural model of Geert Hofstede [9] and use it to explain their findings. Hofstede's

model of cultural dimensions is derived from a factorial analysis of over 116,000 international personnel at IBM from 1967 - 1970. His questionnaire on work-related values related to universal aspects of social relationships collected data from subjects from 72 nationalities and in over 20 languages. As a result of this research he derived five different macro-cultural level cultural dimensions. They are Power distance, Uncertainty avoidance, Masculinity vs. Femininity, Individualism vs. Collectivism, and Time Orientation. Based on the results of the compiled data, Hofstede came up with a score for each nationality or culture. In each case, a high score refers to a higher value of that cultural dimension.

Using Hofstede's work as a template, UI researchers have analyzed cultural variables to help developers design culturally attuned products. Nielsen proposed a set of culturally relevant heuristics that are applicable in some product designs [16]. Marcus and Gould used Hofstede's cultural dimension model to propose a set of examples of website designs [15]. Other prominent works include those of Kaplan and Triandis. Kaplan researched the correlation between language and thought pattern and proposed several types of patterns, namely Linear, Semitic and Oriental [11]. Triandis carried out extensive research on Individualism and Collectivism and proposed a methodology to measure these cultural attributes [21].

There literature revealed extensive sets of cross-cultural studies where the researchers studied one or more cultural attributes using one or more different cultures. However, little research has been conducted on the use of hybrid cross-cultural models. Khaslavsky carried out one of the few hybrid studies. She selected cultural dimensions from the works of Halls, Hofstede and Trompenaars to come up with a model to study similarities and differences in the usability of interfaces between American and French users [8, 9, 12, 22].

This study extends the efforts of Khaslavsky by combining the most common variables studied by researchers into a hybrid model. The following variables have been found to be the most widely researched in the UI domain: Color, Symbolism, Individuality, Knowledge Processing and Local Variables. Research into color and symbolism is quite extensive [10, 13, 17, 19]. Using this research, the color and symbolism choices were made. Marcus provides examples of images that are representative of individualism and collectivism [15]. Kaplan's research into Language and Thought patterns provides the framework for the selection of this factor [11]. The literature is abounding with examples of research into the necessity of understanding countless other local variables. Such is the diverse nature of local variables that the collection of an exhaustive list would prove very difficult given the number of global cultures [1, 2, 3, 5, 7, 10, 14, 17, 18, 23]. However, the several local variables are repeated quite often. As a result, these variables were chosen as part of the preliminary study. These include: date and time format as well as local language.

The goal of this study is to demonstrate the effectiveness of this hybrid cross-cultural model in UI development using one culture. The results of this second

preliminary study will dictate if this model warrants and further evaluation using different cultures.

3 Methodology

A browser-based application was developed to automate the process and eliminate the concerns. The application collected the respondents' demographic data and responses to the visual stimuli. The pictures were displayed in a proprietary browser-based application, and the responses to the associated Likert scale questions were collected using that application. No information was collected that would identify respondents. The application was developed using Active Server Pages (ASP) running on Windows Server 2000 platform and Internet Information Services 5.0. The data was stored in Microsoft Access 2003. The choice of using ASP and MS Access was based on the simplicity of the application and database as well as the server's operating system. However, this limited access to the Internet Explorer web browser.

3.1 Database

The database comprised of eight tables. These tables are as follows:

1. Table tbl_Major contains the list of majors. This was used to display a select list on the Demographic screen;
2. Table tbl_LikertScale contains the Liker scale weight and text. This was used to display answers to the Cross Culture questions;
3. Table tbl_QuestionDemographic contains the list of demographic questions: eleven total;
4. Table tbl_Question contains the list of Cross Culture questions: fifty-eight total;
5. Table tbl_Participant contains participant results of the Color Blind test, Consent acceptance, and the last page the participants was on when ending the study before completion.
6. Table tbl_ParticipantDemographic contains the participants' answers to the Demographic questions.
7. Table tbl_ParticipantQuestion contains the participants' answers to the Cross Culture questions.
8. Table tbl_RndNum contains a list of random numbers and whether or not the random number was presented to the participant upon exiting the study. This was used as a method of providing non-identifying participation credit.

Queries were created to display data on completed records. These queries combined the participant demographic answers with the Cross Culture answers.

3.2 Cultural Factors

Through the literature review, examples of common cultural factors that affect understanding and acceptance of UI were collected. These examples are as follows:

Familiar Colors



Unfamiliar Colors



Familiar Symbols



Unfamiliar Symbols



Individualistic Images



Collectivistic Images



Non-Linear Language Pattern Newspaper Article

'Timber production has potential'

INDIGENOUS timber production in Zambia alone, if well managed will give Government an annual revenue of about K80 billion, which would therefore not prompt the state to impose more tax on the industry.

Timber Producers Association of Zambia (TPAZ), says the sector working at full production capacity, indigenous timber production from a single district in a month would generate maximum revenue of K185,764,000.

Speaking in an interview, TPAZ secretary general, Charles Masange attributed low revenue collected by Government from the forestry sector to mushrooming of foreign owned urban sawmills causing a lot of illegal cutting of timber.

"Heaps of reports on this matter are gathering dust in Government offices without action, and the scourge is increasing at an alarming rate," he said.

Mr Masange said, the absence of political will, suppression of professional advice on forestry and general environmental issues has affected revenue collection from the industry by Government.

He noted that fees from forest includes production royalties at K135,000 per square meter, conveyance fees at K10,800 per square meter and the council levy that varies from one council to the other but averaging K3,000 per square meter.

Linear Language Pattern Newspaper Article

Subprime woes bite General Motors

General Motors Thursday reported improved results from its auto operations in the first quarter, but problems in subprime mortgages contributed to earnings that missed Wall Street forecasts by a mile.

The nation's No. 1 automaker said it earned \$94 million, or 17 cents a share, excluding items in the quarter, compared with adjusted earnings of \$350 million, or 62 cents, a year earlier.

Analysts surveyed by earnings tracker First Call had forecast earnings per share of 87 cents. The range of estimates was from 34 cents to \$1.40 a share.

Net income for the quarter tumbled 90 percent to \$62 million, or 11 cents a share, including special items, from \$602 million, or \$1.06 on that basis a year earlier.

GM (Charts, Fortune 500) stock sank about 2 percent to \$31.75 in early trading on the New York Stock Exchange.

GM reported an adjusted \$304 million in income from its auto operations worldwide, up from \$40 million a year earlier. Its core North American auto operations, though, lost \$85 million in the quarter, but that was an improvement from the loss of \$251 million a year earlier.

Non-American Text Variables

Háum fasteignagjöldum í Ísafjarðarbæ mótmælt
26.02.07 | 16:25

Vinnufélagar úr rækjuverksmiðjunni Miðfelli á Ísafirði afhentu í dag Halldóri Halldórssyni, bæjarstjóra Ísafjarðarbæjar, undirskrifalista með ríflega 400 nöfnum, þar sem háum fasteignagjöldum í Ísafjarðarbæ er mótmælt. Að sögn Guðbjarts Ástþórssonar, eins þeirra sem stóð fyrir undirskriftasöfnuninni, lágu listar fyrir á þremur stöðum á Ísafirði í um vikutíma. Hann segir þá féлага mjög ánægða með viðbrögðin og viðtökurnar sem listarnir hafa fengið og er hann sannfærður um að mun fleiri undirskriftir hefðu safnast, ef listarnir hefðu til að mynda verið látnir liggja fyrir á fleiri fjölförnum stöðum. Guðbjartur segir listana hafa verið setta út til þess að kanna hug íbúa til málsins og segir hann þá glögglega sýna hver hugurinn er. Halldór Halldórsson bæjarstjóri segist ánægður með framtak manna. „Ég er ánægður með það að íbúar hafi skoðanir á því sem hér er verið að gera og komi þeim á framfæri.“ Halldór segir að hann hafi lauslega farið yfir þessi mál og ástæður fasteignagjalda með þeim sem afhentu honum listann.

American Text Variables

Fed chief says that Tuesday's sell off did not sway central bank's view on U.S. economic growth.

02.28.07 | 2:15 PM

Federal Reserve Chairman Ben Bernanke told members of Congress Wednesday that U.S. financial markets appear to be “working well” and are functioning normally, one day after the Dow posted its biggest one-day point loss since the market reopened after the Sept. 11 attacks.

Responding to a question from a member of the House Budget Committee, Bernanke said that the central bank was closely monitoring the stock market after the Dow slumped 416 points Tuesday amid a sell off in stocks worldwide.

Bernanke said the sell off did not change the Fed's view on U.S. economic growth. “There is really no material change in our expectations for the U.S. economy since I last reported to Congress a couple weeks ago,” he said.

4 Procedure

Permission was sought from the Institution Review Board at the UMBC, UNLV and UNZA prior to the start of this study. Subjects were recruited from an undergraduate engineering program at UNZA. Recompense for their participation was provided in the form of five thousand Zambia Kwachas per person. Because of the web-based nature of the application, subjects were able to access the study from any computer which allowed internet access. Subjects were informed of their rights and their ability to cease participation at any time. Once they accepted that agreement, they were presented with the Ishihara color blind test to test for normal color vision. If they passed the test, they would be presented with the images that would comprise the study itself. In addition to the demographic questionnaire, the study sought responses from the

subjects regarding their familiarity with the visual representations. (For the complete set of questions, please email the author.)

5 Results

Data was collected from a total of 25 subjects of Zambian nationality. There were 2 females and 23 male students of various engineering disciplines who spoke English as their primary language. On average, these participants indicated that they had been browsing the Internet for approximately 5 years. They further indicated that they spent an average of 5 hours a day working on their computers of which an average of 2 hours was spent on the Internet.

The participants were asked to complete a 5-point Likert style questionnaire to gauge their level of understanding of the various cultural factors. The options for the subjects were: Strongly Agree (1), Agree (2), Neutral (3), Disagree (4), and Strongly Disagree (5). The first four sets of statements in the questionnaire were positive and grouped per variable i.e. Color, Symbolism etc. For example, participants were asked to respond to the statement “I am familiar with the color combinations” using the Likert scale. For the last set (Non-American Text Variables and American Text Variables), the statements were posed in the negative. For example, “I am not familiar with this date format.” The table below shows the average responses from the 25 participants.

Average Responses of Understanding of Cultural Factors

Familiar Color	2.04
Unfamiliar Color	3.27
Familiar Symbol	2.23
Unfamiliar Symbol	2.92
Individualistic Images	2.96
Collectivistic Images	2.65
Non-Linear Language Pattern Newspaper Article	2.35
Language Pattern Newspaper Article	2.91
Non-American Text Variables	3.37
American Text Variables	3.80

The table shows that on average, Zambian subjects displayed a greater understanding and acceptance of variables that are familiar to the Zambian culture.

6 Conclusions

This is the second preliminary study and analysis of the effectiveness of hybrid cultural models in UI development [4]. The results suggest that a culture (Zambian culture in this study) is more accepting and likely to display a greater understanding of UI features that are familiar to them. These findings were similar to the preliminary study carried out using American subjects. It can be observed that the results of these studies are not as clear cut as one might have expected. For example, participants in both the studies were familiar with non - U.S. date and time formats. The literature attributes this to the eroding of distinct cultural boundaries [2, 6, 20].

The results from both the studies are not surprising given the generally high level of interaction with the Internet that the American and Zambian participants indicated. The global nature of the Internet is likely to expose these participants to different standards which would have contributed to their understanding of non-familiar standards. The literature confirms these findings.

This study is far from complete. This report is the first of a series of on-going studies that are examining the effectiveness of a hybrid cultural model in UI development. The next step would be to reevaluate the questionnaires for to correct any deficiencies. It would be interesting to observe whether the results can be replicated on these two subject groups again to generalize the validity of the proposed hybrid cross cultural model. In addition, further studies should be carried out on non-Western cultures to test the effectiveness of this cultural model in different settings.

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