Mobile TV: Cultural Based Evaluation

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***Abstract*— This paper examines and presents the finding of the correlation between culture, education and Mobile TV's design principles. Design guidelines are formulated by pinpointing the limitations of handheld devices that concern viewer's experience and combining them with an investigation on how culture and education is affecting the human perception of interfaces and interactivity. Additionally, the guidelines are incorporated into a video player in order to test and evaluate them. The player was distributed and with the help of a questionnaire a survey was conducted. The results of the survey suggest that the player was successful in giving a pleasant experience. The results also reveal a correlation between culture and Mobile TV software design. Some differences in preference according to the education level were found. Finally, the findings are discussed in the context of future research and the prospects of Mobile TV with further suggestions offered.**

***Keywords*— Mobile TV, User-based design, Evaluation**

I. INTRODUCTION

The subject of this study is an investigation of Mobile TV HCI (Human Computer Interaction), specifically, the examination of the effect of certain user characteristics in Mobile TV's interaction design. Previous research regarding this from a user based prospective was not extensive [1]. As a result, this new research was conducted from a user centred standpoint that attempts to take into consideration the factors of culture and education. According to Love, the user characteristics that may affect the process of use are some of the elements that play an important role for designers to understand the correlation among humans and mobile devices [2]. Initially, culture influences the way people perceive the surrounding environment and respond to it with a different style [1]. In addition, studies have shown that there is a correlation between culture and mobile interfaces [3]. Respectively, education is also a factor that affects interaction in Mobiles according to other research [4].

Hence, the purpose of the study is to make an effort to provide design engineers with specific results in the form of guides. These design suggestions can contribute to the unproblematic construction of Mobile TV software that will provide a high level of Quality of Experience (QoE) and be commercially successful. Furthermore, by examining the technologies used in Mobile TV and how they affect the audience's experience an attempt was made to correlate the two investigations. As an emanation of this research, design guidelines were formulated. The proposed guidelines were incorporated into the features of an Adobe Flash Lite® based prototype constructed for handheld devices with specific system requirements. The capability of achieving an Internet connection and a QVGA screen resolution are among those requirements. The type of the application is an on-demand video player that delivers streamed video clips from a supposed provider. Finally, the video player was distributed to a group of people. The user sample tested the software and with the use of a questionnaire results were formulated and analysed.

II. METHODOLOGY

A. Literature Research

Mobile devices are a part of a fast evolving industry with a highly developed technology behind it. Mobile TV technologies were examined and several findings were discovered. There are many limitations that constrain the user experience. Device performances, power consumption, signal reception, screen size, interoperability in input methods and technical specifications are some of the factors that result in a poor QoE [5][6].

The next part of the research was to examine the human dimension of Mobile HCI. Mobile device users have many idiosyncrasies. Mobile TV can be watched anywhere, at any time and in any context with a user that is always on the move and who can be easily distracted. The investigation on personal characteristics was mainly concentrated on the factors of culture and education. The Mobile TV market is one of global scale. Most of the software is being created in the USA and thus the designers use metaphors, representations, colours, navigation logic and text layouts all adjusted to the American perception [3]. Research that has been conducted concludes that Westerners can focus on a single object, recognize its properties and categorize it (analytic perception) while Easterners have the ability to detect more background information and detect relationships between objects (holistic)[7]. Finally, a case study that considered these differences was conducted on 20 subjects (10 Westerners and 10 Easterners) and showed that there is indeed a correlation between culture and icon recognition on mobiles [3]. Therefore, cultural sensitivities must be addressed during the software design process.

Analogous studies that concluded in specific design rules concerned other forms of interactive TV and handheld devices as the ones conducted by Chorianopoulos [8] and Gong [9] respectively. The analysis of the mentioned above research axis resulted in the following guidelines:

1. Provide interactive features
2. Allow personalisation
3. Provide with validation feedback
4. Allow users to have control
5. Create a consistent interface theme and navigation
6. Rely on connectivity as less as possible
7. Tolerance in errors
8. Design for users with short attention span
9. Design for small devices
10. Design for spontaneous interruption and resume
11. Provide with hierarchical information and allow the user to choose
12. Provide an untraditional content delivery

B. *Prototype*

After establishing the main rules of interface design and interaction, the next stage of the research was to apply those rules to an application prototype. The application has a five-button menu that signifies the basic actions as shown in Figure 1 and 2. The functions include: a "watch-now" option that instantly plays a random clip; the ability to see the available clips categorised; the option to search for a clip and finally a button to customise the application. The customisation options include: language selection, theme selection and categories filtering. Moreover, the clips have full playback control. The user can: play, pause, stop and hop the clips. Pausing serves as a halt of the entire application. To adjust the sound, the viewer can use a volume slider alternately to his device slider. Also, an information button is positioned next to the thumbnail of every clip and when pressed the application opens an Internet browser window and redirects the user to a relevant webpage. The graphical interface is consistent and it's based on a grid layout. The icons are designed to have comprehensive metaphors and the first theme (Figure 1) has buttons with a text "tooltip" while on the second theme the text is absent. Moreover, a small vibration of the device each time a command was given by the user was intended to give a validation feedback.

These synoptically presented prototype features were chosen according to the previously mentioned guidelines. However, not all of the initial design goals were achieved due to problems encountered during the developmental process.

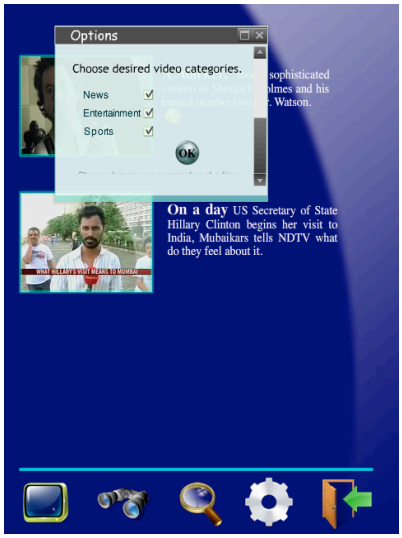

Fig. 1 The prototype showing the settings window.

Fig. 2 The prototype during video playback with an alternate visual theme applied from the settings window.

C. *Evaluation*

The next stage of the study was to distribute the application to a number of users in order to evaluate it. An amalgamation of sampling techniques was used to select the users. Firstly, the sample is biased. It was imperative to have people from both Western and Asian cultures, males and female, users that can understand English or Greek and from various ages and educational backgrounds. In that way features for specific user groups could be tested and the external validity would be improved as the conclusions could be generalized for a larger population. Furthermore, stratified (Table 1) sampling method was also used. The number of users was divided into strata in order to form the population into groups and sample from each group. In that way the final user group is more representative and reflects the target population. The strata are formed according to criteria that are of interest to the case

study, culture and education. Opportunity sampling was also a part of the amalgamation as the users were also selected because they were easily available. The size of the sample was ten users. It is relatively small to generalize conclusions; thirty would be a more accepted sample size. However, there are researchers who believe that five to ten participants are a sufficient number to get the main results [10].

TABLE I
THE EIGHT STRATA USED TO PERFORM THE SAMPLING

Culture and education of participants	Number of participants
Greek, Highly Educated	2
Greek, up to Further Education	2
Indian, HE	1
Indian, up to FE	1
British, HE	1
British, up to FE	1
Chinese, HE	1
Chinese, up to FE	1
TOTAL	10

In order to achieve final results with internal and external validity the users were carefully selected so that they were not biased or extremely friendly with the service.

The survey was performed with the use of a questionnaire (Likert questionnaire) and a short informal interview with the form of a discussion followed. The questionnaire consisted of sixteen questions as illustrated in Table 2. The users tested the application in their own time and location and filled the form after a few minutes of use. No guidance was provided to the participants on how to use the application. However, they were informed that they could ask for assistance if they would experience any problems. When they returned the form filled a short discussion took place. The participants were asked about their overall experience, if they found any significant faults and what would they add or do differently.

With the scaler questionnaire the users were capable in declaring the extent on which they agree or disagree with a statement. However, the answers were converted to a binary yes or no response. This was chosen because it is more convenient for the data analysis to have fixed answers and specific replies of approval or disapproval for each aspect of the video player. The sample size is not sufficient to create statistics for each degree of approval. Thus, the positive answers were converted to a "yes" and the negative ones to a "no".

TABLE II
THE SIXTEEN QUESTIONS USED IN THE QUESTIONNAIRE.

Question Number	Questions
1	How old are you?
2	What is your sex?
3	In which country have you grown up?
4	What is the level of your education?
5	Do you use mobile TV services?
6	Did you enjoy the specific video player?
7	Was it similar to normal TV watching?
8	Was it easy to use?
9	Did you stumble across any problems?
10	Would you add any additional features to it?
11	Do you prefer text or icons in interfaces?
12	Did you like the options of changing the looks of the app?
13	Do you think that the option of filtering the categories was useful?
14	Would you pay for a service with those characteristics?
15	Would you prefer to watch live TV?
16	Where would you watch it?

III. RESULTS

After gathering the result and analyzing them with the help of statistical software the following results were found. Fifty per cent of the participants used Mobile TV services in the past. Additionally, 70% declared that their experience was not similar to traditional television watching while 40% would actually prefer it. Moreover, 90% stated that they enjoyed the player in overall and that it was easy to use. However, 30% of the users did encounter some type of problem. All of the users thought positive of the personalisation options although 30% did not agree with the categories filtering feature.

As Figure 3 illustrates, participants who grew up in Western countries have the tendency of preferring text over icons, or the combination of the two, whilst Asian participants have the opposite tendencies. This can be explained from the fact that the first icon menu set in the application has a more concrete design with more obvious icon metaphors and rollover text.

Correlating the culture with the user preferences on the customisation features lead to the observation that mainly Asians approved the categories filtering feature while only half of the Westerners did so. The reason of this result can be that the three categories (music, news, sports) are not so famous among the Asian users. In addition, all the participants were satisfied with the theme change option.

Furthermore, the education parameter when correlated with the same answers did not form very interesting results. Users with a higher education approved the categories filtering

feature slightly more. The unexpected result is that in the icon or text preference question, the users with a lower education level tends to prefer text in interfaces slightly more.

Another observation includes the fact that almost everybody stated that they were satisfied with the application although only four would purchase it. Additionally, two users that answered positive about the service purchase also answered that they would prefer to watch live television instead although they would use the mobile service at home.

Finally, the informal interview also provided with some interesting information. The participants suggested additional features for the application. Western culture users focused on practical issues, watching news bulletin for example after a notification alerted them and adding more categories of videos. Another suggestion concerned an omission of the prototype; the language of the settings panel would not change according to the application's language. Other suggestions included the addition of a home button and rollover text for the rest of the buttons besides the main menu. Finally, users stated that the application was easy to use while on the go and additional features could help although, as they said, they would not like it complicated.

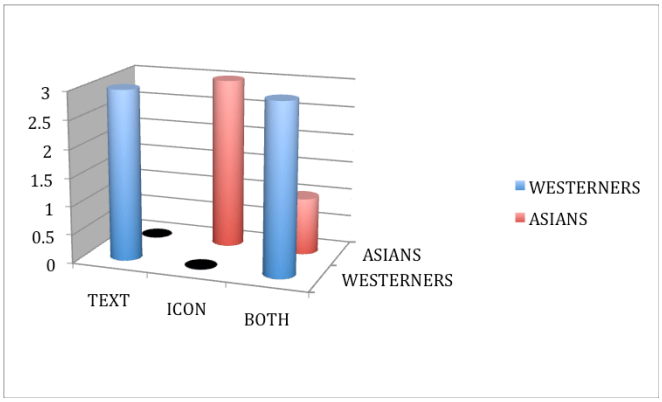

Fig. 3 Preference on icons and text by culture.

IV. Discussion and Further Suggestions

The survey indicated that overall the navigation and interface was pleasant for the test users and the general structure of the prototype was acceptable. Having analysed the user feedback conclusions can be drawn about the validation of the design rules. Approval of participants in their majority concerned the interactive features and they commented that there was a good balance between features and mobility. A feature that allowed the application to pause was also high in the approval rating thus confirming that the "Design for spontaneous interruption and resume" guideline improved the viewer's experience. "Provision of video with untraditional methods", is a guideline that was not validated. The prototype was designed to combine a television "feel" in a video carousel application. Most participants answered that they would prefer to watch traditional live TV. This finding may indicate that users are not very receptive in accepting new ways of video delivery.

Customisation and personalisation have proven to be an essential design choice in order to address cultural sensitivities. However, the Chinese participants encountered some difficulties - further research is needed to explain the cause of this outcome. In contrast with the cultural factor, no significant conclusions can be drawn when correlating the education level of the participants and their answers. Additional research is required that will focus only on this parameter with a bigger and more representative sample. The sample selection may have influenced this finding. It is also a fact that almost all the users are experienced with mobiles nowadays (in Asia and the Western world). Moreover, less than half of the participants would purchase the service. If we consider some of the comments of the participants during the interview, "the application reminded them of YouTube" another conclusion can be drawn from these two facts. The participants would not purchase a service with the same characteristics that a home computer or laptop could offer.

However, additional research is required in order to specify all the elements that are correlated with cultural-related perception; colours, icon metaphors, information layout and sounds all play a significant role in user-centred design. A future study should also investigate right-to-left writing cultures.

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