The Influnce of Gender on QoE Subjective Assessment for Video Services

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Abstract—**The video quality is an essential element of technology domain that decisively influences the QoE. A high-quality video service always brings an enjoyable experience. Quality of Experience has become a significant parameter in evaluating and rating video services.This paper presents the impact of gender on the Quality of Experience for video services. Initial results from subjective tests show that male viewers requested higher video quality compared to female viewers, while female viewers concentrated more on the contents of the video.**

Keywords-Quality of Experience; video services; subjective test; gender

I. INTRODUCTION

In the recent years, video has become the dominant consumer traffic due to high data rates and affordable costs provided by network operators [1]. Customers who watch video online via mobile devices, laptops and PCs demand high bit-rate videos with high-definition (HD) standards.

Network and service providers have realized that the traditional method to evaluate video service quality such as Quality of Service (QoS) is no longer appropriate. Instead, Quality of Experience (QoE) is a measurement used to reflect customers' perception. Thus, more and more network and service providers have begun to concentrate on inferring, predicting and improving perceptual experience to satisfy customers.

QoS has been used in computer networks to ensure the quality of network traffic considering parameters such asdelay, packet loss, jitter, and bandwidth. However, QoS could not reflect the characteristics of subjective perception on video service. End-users do not care about how these QoS parameters influence the video quality. They are concerned about their feelings regarding the current video frame. Meanwhile, QoE is dedicated to evaluate human experience, and is therefore, the best method to characterize the subjective perception on video services, which are used to evaluate network performance.

To measure user experience of videos services, QoE has recently become a prominent concept. In contrast to the traditionally used QoS, QoE not only involves objectively measuring the delivered service but also takes into account the user needs and desires when using the service, emphasizing on the user's overall acceptability of the service.

A. Video quality assessment

Video quality can be assessed using either subjective or objective method. Subjective quality is the users' perception of quality (ITU-T P.910). Mean Opinion Score is the most widely used metric for subjective testing. The most reliable method of measuring video quality is through subjective test approach. On the other hand, objective measurement can be performed in an intrusive or non-intrusive manner.

- *Subjective video quality assessment*

International Telecommunication Union (ITU) and the Video Quality Experts Group (VQEG) have both defined the subjective methods as a testing method whereby a number of viewers are selected to watch video clips under test in a controlled environment. These viewers are asked to grade the quality of the video clips on a five-point Mean Opinion Score (MOS) scale which may range from 'bad' (1) to 'excellent' (5). Subjective testing can be time-consuming and expensive because a large sample of participants is needed to obtain results that are statistically meaningful.

The subjective test can be conducted in two kinds of environment: controlled environment and uncontrolled environment. In our experiment the participants evaluated the experience of video service in an uncontrolled environment where they had the freedom of completing the evaluation at home or in their office. The uncontrolled environment is more close to the users' real viewing experience. However the controlled environment is often used in subjective tests, which is not the usual place where the common viewers watch video. The results may not be an accurate reflection of viewers' true viewing experience in the wild, where other factors, such as delay, may also have an influence on QoE.

Considering the costs and time demands by this testing method, recently, uncontrolled testing environments such as crowdsourcing have emerged as a cheaper and quicker alternative to traditional laboratory-based quality evaluation for video streaming services.

- Objective quality assessment

The subjective tests are expensive and time-consuming because a large sample of evaluators is needed to obtain results that are statistically meaningful. These challenges have limited the implementation of subjective test assessment methods, especially for research purposes. Additionally, the subjective test cannot be used in real-time video quality evaluation. Objective testing methods on the hand are quick and easy to set up, thus making them highly desirable for video quality evaluation.

B. Context parameters

Context is any information that assists in specific situations related to a user, network or device [2]. We consider context as information that assists in determining users' QoE. There are two types of context: static and dynamic. Static context does not often change, while dynamic context changes over a period of time and is difficult to predict. Static context may include user application preferences, their security requirements and cost. In real-life environments, context can be highly dynamic and randomly determined. For example, it can be imperfect, exhibit a range of temporal characteristics, have several alternative representations, be interrelated, or distributed, and it may not be available at a particular time [3]. The timely collection and processing of context may be crucial as it may lose its accuracy. Dynamic context may include user location, velocity, network load, battery power, memory/CPU utilization, presence and signal to noise ratio.

In Table I we enlist several context parameters related to application, device, network and the user environment that may assist in computing QoE. Along with context, there can be a plethora of QoE parameters such as enjoyment, user satisfaction, technology acceptance, efficiency, accuracy and perceived ease-of-use [4, 5, 6]. Studying and modeling these parameters to determine QoE is a challenging task [4,5,7,8]. There can be inter-dependencies and non-linear relationships between context and QoE parameters [9, 10]. Furthermore, some parameters may be hidden. The term "hidden" means that some parameters may not be observed directly. Thus, these parameters may be hard to measure and quantify. QoE modelling and measurement may require the combination of several QoE parameters to determine the overall QoE. For example, QoE parameters such as "user satisfaction" and "technology acceptance" may be combined to compute users' overall QoE. This problem can be aggravated by the fact that each QoE parameter can be measured on a different scale or by considering different units of measurement [4]. For example, "user satisfaction" can be measured on the scale of 1 to 5. On the other hand, "technology acceptance" can be measured using simple "yes" or "no".

Table 1: Context parameters

Context classes	**Context parameters**
User and user environment	location, temperature, heart rate, eye movement, amount of sweat, social context, people nearby, light, background noise, age, gender
Tool/device/object	Screen size, design layout,resolution, general intuitiveness, buttons placement, input/output methods, appeal, usability
Application	type, requirements
Network	type, bandwidth, delay, jitter,packet loss, RTT, lossburst size, protocols used,received signal

C. User profile

As users are the consumers and revenue generators of video services, their expectation and attitude governs the direction of service provision. While different people have different appetites and desires, it is essential to define user types and analyze their needs. Generally, researchers aim to distinguish users by age, gender and education background.

The user profiles consist of several aspects: age, gender, education background for video content type, prior experiences in viewing videos and mobile videos, and technology background (especially in information and computer technology). Although some research has observed the behavior differences of using mobile video TV between groups classified by age, gender and technology [11,12,13], the comprehension on how the differences influence user experience is inadequate.

For example, are young people (males) easier to satisfy in terms of quality of mobile video service than older people (females)? How does prior experience in viewing videos impact current viewing? A few studies have addressed the positive correlation between user preference (also called interest) for video content and overall user experience [14].

Recent studies have found that people's desired quality of mobile video varies with their preferences for video content, viewing experiences of mobile videos, technical backgrounds, and even their genders. There may also be an interactive impact across these aspects of user profiles [15, 16]. For instance, frequent male viewers of mobile video may request a higher quality than occasional viewers [17].

The remainder of this paper is structured as follows. Section II discusses the research challenges while Section III

discusses the quality of experience modeling and existing literature. Finally the experiment setup, results and conclusions are reported in Sections IV, V and VI respectively.

II. QOE RESESRCH CHALLENGES

Researchers considering the problem of QoE modeling, measurement and prediction face a number of challenges. These include:

A. QoE modeling

QoE measurement and prediction may involve a large parameter space comprising of several QoE and context parameters as shown in Figure.1 [6]. There can be N context parameters affecting M QoE parameters. Further M QoE parameters can affect each other. Thus, selecting relevant parameters and finding relationships between these parameters can be challenging. The relationships between these parameters are usually non-linear and hard to quantify. This necessitates the development of novel QoE modeling techniques to model all these parameters efficiently. The QoE models should not only be conceptual, but should also transcend to solving the challenges associated with QoE measurement and prediction. For example, rather than simply classifying and representing the parameters, QoE models should directly be used for QoE measurement and prediction.

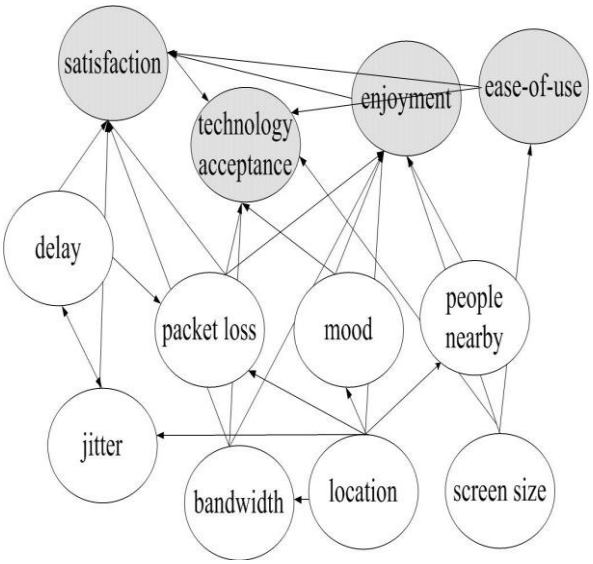

Figure.1: Parameter relationships between context and QoE parameters.Grey ovals depict QoE parameters and white ovals depict context parameters.

B. QoE measurement and prediction

The challenge of QoE measurement and prediction involving multiple QoE and context parameters is not well addressed. Considering Figure.2, each QoE parameter can be measured on a different scale and may involve different units of measurement [4, 18]. These scales can be qualitative (Figure.2 (a)) or quantitative (Figure.2 (b)).

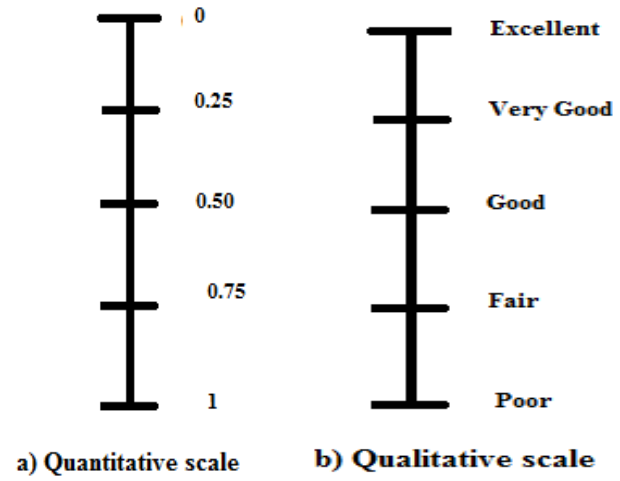

Figure.2: Typical scales for QoE measurement:

III. QOE MODELLING

QoE is considered by video service providers to reflect service quality from users' perspective. However, the estimation of QoE is hard due to multiple factors involved in the complicated service context and the divergence in users' perception. In order to evaluate the QoE from a holistic and unified view, it is necessary to understand the communication ecosystem where various factors interactively affect users' experience [4].

A user centric communication ecosystem incorporates different domains such as technology, business, context, and human. The technology domain is concerned with the service itself, which is provided by the equipment manufacturers, the networked operators, and the service providers. The business domain provides the metric to regulate the utility functions of the actors in the ecosystem, which directly influences the final intention of purchasing a service and the price at which a provider can offer the service.

The context in a communication ecosystem represents the circumstances and situations at the time of interaction among human, technology, and business entities [5], which includes both the natural factors and social factors. For instance, the natural factors consist of noise, illumination, temperature, etc, while social factors include the policy, custom, relationship and so on. The human domain focuses on users' needs, feelings, performance, and intentions for services, and includes the psychological, physiological, and cognitive factors. This domain interacts with the other domains, and its influence in the communication ecosystem directly forms the QoE [6]. To evaluate the QoE accurately, the influences of these domains should be taken into consideration.

A number of mathematical QoE metrics have been developed and used for quality management in video services in order to achieve a high user satisfaction. However these

metrics are limited as they take only a few aspects of user experience into consideration.

In [19] the authors proposed a model of QoE evaluation for networked services regarding the communication ecosystem. In this model both the technology and the human domain are considered and incorporated to evaluate the users' (QoE) of a realistic context in an IPTV service. The QoE influential factors of the human domain including watching duration, the frequency and duration of fast forward, are integrated with those in the technology domain such as video quality, to establish the objective model for accurate QoE prediction. The proposed model is well consistent with the subjective QoE .This model needs enhancing and improvement by adding more influential factors .In addition, the model does not define contextual parameters.

A mobile video environment model is described in [20]. The proposed framework is simple but encompasses many factors and clearly states each factor's contribution to the overall user experience. It may benefit in user-centred design of mobile video delivery and relative research. Mobile video vendors may develop effective strategies to improve user experience by taking into consideration the factors in different components of the framework. This model does not propose exact formulae for QoE calculation. It organized QoE influential factors into three components: user, system, and context and mapped their impacts upon four elements of the mobile video delivery framework, namely, mobile user, mobile device, mobile network, and mobile video service.

Authors of [21] presented a QoE model for measuring user experience of videos services. Their model produced very interesting categorization of QoE, QoS, and business aspects based on measurable and non-measurable parameters. They considered technical parameters as measurable parameters and subjective user parameters such as satisfaction and attitude as non-measurable parameters. However, in our view, subjective context factors can also be quantified using some empirical approaches

The work in [22] presented a simple and intuitive interaction between a person, technology, and business. However, it neither provides a classification of QoE factors into subcategories nor any details on the taxonomy. More importantly, Kilkki's model does not define contextual parameters in any way.

The Authors of [23] presented an initial conception of a QoE framework with a special focus on human behavior, technology, and business. We demonstrated its application through a use case based on service delivery of composed services. The initial QoE conceptualization needs further enhancement and improvement in terms of considering more concepts, taxonomy, and inter domain mapping using the Template.

IV. EXPEREMENT SETUP

In our experiment a total of 34 people took part in the study on a volunteering basis. Participants have been chosen with respect to their gender (17 male and 17 female)that we used in the subjective test. Also, no participants were working in video quality assessment.

To verify the performance of the subjective test, 3 videos with video codec H264 were employed in the experiment with a variety of content as shown in the screenshots of videos (Figure.3). The duration of each video was less than one minute with frame rate ranging from 25-30fps and a resolution of 176 x 144. The laptop monitor that was used for display in our test was 14 inch monitor. All participants were allowed to view the videos as many times as they wish before making the decision, but they had to see them all at least once. Participants evaluated the experience of video service in an uncontrolled environment where they had the freedom of completing the evaluation at home or in their office. They were also asked if they like the video content.

Figure.3: From left, Akiyo, Bowing and Car phone videos

V. EXPEREMENTAL RESULTS

To evaluate the gender aspects on the quality of experience, three videos with different content and different quality were employed. We used gender (male, female) parameter to assess the quality of those videos. In addition, MOS was initialized for the subjective test.

According to the results that we obtained from the subjective test, considering the gender parameter as in Figure.4, we have found that people's desire in quality of video showed a statistically significant difference with the variation in gender ($p < 0.05$, from t-test method).

With respect to the gender parameter, we observed that the male viewers of videos may request a higher quality compared to female viewers as shown in Figure.5. We also observed that male viewers do not concentrate on the video content in contrast to female viewers who concentrate on the video content; if they don't like the video content they will give a low score.

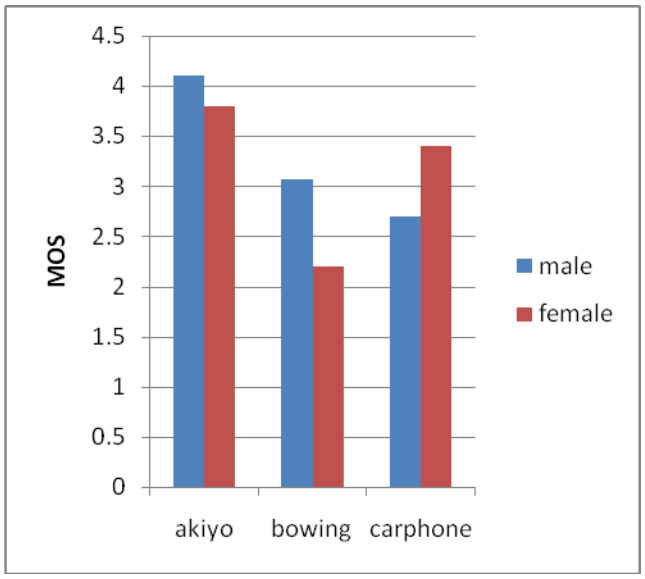

Figure 4: The Mean Opinion Score

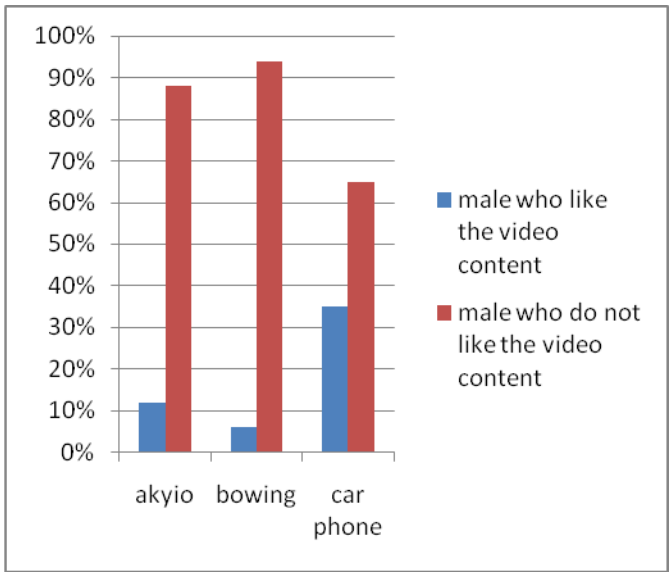

Figure.5: Male and female who like the content

VI. CONCLUSION

This paper has presented the impact of gender on the Quality of Experience for video services. Gender is part of user context. We mentioned several challenges related to QoE modeling. We have also discussed existing methods and explained their advantages and weaknesses. In addition, we have also shown some initial results for a subjective QoE assessment based on gender. The evaluation takes into account gender as parameters. We have found that gender influences the expected QoE ratings where male viewers notice the quality level of the video. Female viewers pay more attention to the content of videos.

We conclude that there are still open issues in evaluating QoE that require further investigation. We assert that the evaluation of QoE is an evolving process and it should be performed over a period of time. This leads to the development of more accurate and reliable QoE models.

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