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Evaluation Framework for Mobile Rich Media Services

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ABSTRACT

This document describes the PhD study entitled Rich media services on mobile devices: evaluation and optimization of usability and end user experience conducted jointly by Motorola A/S and Aalborg University. The study aims at designing, implementing and assessing an evaluation framework dedicated to the usability and end user experience with mobile rich media services, such as mobile TV or multimedia content sharing. Two main activities will be carried out in parallel during the study: definition of mobile rich media services and evaluation of these. The former activity aims at answering the question "What are the services customers will use on their mobile devices?" while the latter focuses on "How to evaluate those new types of services?"

Keywords

Study plan, user experience evaluation, mobile services

INTRODUCTION

Out of the 2.5 billion worldwide mobile subscribers, only a few million used mobile TV in 2006 [20]. The mobile TV market is still in its emerging phase yet it demonstrates a huge growth potential for the near future. Although today most mobile TV consumers are located in Eastern Asia (mostly Japan and South Korea), market analysts such as Rethink Research Associates or RNCOS estimate that Western Europe is expected to gradually take the lead in revenues from the global entertainment mobile market by 2011.

As defined in [19], the mobile TV value chain involves various actors from mobile device manufacturers to network providers and payment agents. All contribute to the end user experience either by supplying a handheld platform supporting the technologies concerned, a broadcasting format or some content to be consumed.

The work introduced in this document takes place in the context of the Converged Advanced Mobile Media Platform (CAMMP) project which aims at building "*a proof of concept service infrastructure on top of the converging technologies*." One of the project's R&D objectives is to "*identify and evaluate new types of personal, mobile services that go beyond existing TV and radio combining traditional push broadcast with user generated audiovisual content and shared immersive experience*."

In this document, the "State-of-the-Art" section introduces the areas that either are directly covered by the study or otherwise influences or bounds it. Then the section "Research Questions, Hypothesis and Methodology" introduces three of the main research questions the study will answer, and for each of them, the starting hypothesis and the foreseen methods employed to answer it are presented. Furthermore, "The Evaluation Framework" which will be implemented is introduced together with the related areas investigated during the study. Finally, the "Conclusion" summarizes the work achieved so far and presents the coming next steps.

STATE-OF-THE-ART

In this section, the review on mobile broadcast introduces the technological basis of the study. Then, the review on mobile video/TV illustrates the need to identify key issues in order to understand the end user experience. Finally the study's primary focus is introduces through a selection of hot research topics.

Mobile broadcast

The European Commission recently decided in June 2007 to support DVB-H (Digital Video Broadcast for Handhelds) as the recommended broadcasting technology for European countries [4]. As a descendant of the DVB-T standard (where T stands for Terrestrial), DVB-H adds features to receive digital television on mobile handheld devices, described in [5, 13]. The two documents also provide results from extensive performance measurements conducted in laboratories, which demonstrate the standard's efficiency, especially in terms of error correction and power saving.

Although DVB-H is mainly present in Europe, it has also been launched in other parts of the world, where it competes with three main other standards: Digital Media Broadcasting (DMB) which is mainly used in South Korea and can operate either via satellite (S-DMB) or terrestrial

(T-DMB) transmission; 1seg which operates mainly in Japan and Brazil; and MediaFlo™, the proprietary format from Qualcomm® which is mainly used in the United States.

Mobile video/TV

Consuming video when on the move implies various factors related to the surrounding environment, such as the context of use or the location's network capability. Therefore it is vital to understand the users' habits and needs prior to developing mobile TV services. It is also equally important to understand the technology involved and the challenges it introduces to anticipate how it will influence the end-user experience with the service. These two lines of research are illustrated in the two following paragraphs.

As stated in [16, 19] users have very different needs regarding mobile TV content and interaction when on the move from when watching TV at home. These studies' findings emphasize that mobile TV is principally consumed outside the home environment to manage solitude, disengage from others, manage transition between places or juggle commitments. It also appears that people tend to use mobile TV services at home, in order to coordinate TV content with the family or simply to combine TV consumption with other factors such as devices sharing or need for togetherness. In a Norwegian study of Mobile-TV users' behavior, the authors of [1] confirm that home is the privileged place to use mobile TV through a study.

A parallel line of research covers more technical domains related to mobile TV, including the imaging issues related to the use of a small screen. For instance, the authors of [10, 11, 12] derive requirements from case studies for mobile TV interfaces with regards to image resolution, bandwidth and user interaction. The main issue in terms of image resolution concerns the level of image details offered to users, especially with textual information associated with a very popular content like news. However, a smaller resolution does not automatically result in a worse user experience: although users express their wish for the highest image quality possible, these studies demonstrated that users tend to accept more easily low bandwidth when associated with a small resolution. Concerning the interaction with a software interface, users demonstrated recurrent wishes such as using TV guides, the possibility to suspend the content played and to have access to live content.

Usability and end user experience evaluation

When it comes to evaluating an electronic consumer product, numerous empirical studies conducted by industrial and educational institutions illustrate the strong impact of usability on the degree of service acceptance by end users. For instance, the extensive bibliography used in [3] provides a valuable source of information regarding methodologies and setups used to evaluate various aspects of mobile usability. These cover issues from design guidelines for handheld applications [2] to comparison between laboratory and field testing of mobile applications [8].

The authors of [14] emphasize three key areas to take into consideration: usability, experience and functionality. While the latter is clearly a technical issue, the definitions of usability and experience appear more confusing. It is today generally accepted that usability is strongly related to the user experience, if not part of it [15]. Indeed, usability is often defined as a combination of various factors. For instance in [6], the authors develop the four ideas of *ease to learn*, *usefulness*, *ease to use* and *pleasantness to use* while the author of [18] introduces the "5Es" (*Effective*, *Efficient*, *Engaging*, *Error tolerant*, *Easy to learn*). Those definitions illustrate the close relation between usability and user experience and the possible confusion about the concepts they cover. As a result of this confusion, current discussions try to state a clear definition of user experience and its relation to usability.

Finally, the field of mobile usability evaluation is animated by an interesting discussion on the benefits of field trials over experiments conducted in laboratory. Numerous studies have compared both approaches [7, 8, 9] and have agreed that if field trials provide more reliable output due to the realistic environment surrounding the test users, the actual gain of the field trial method is difficult to quantify, especially when rated against additional parameters such as costs or practical issues. For instance, [7] describes and assesses an implemented framework to evaluate the mobile and ubiquitous user experience 'in the wild' during large test campaigns. Both methods present advantages depending on the experiment's focus and its expected outcome: while studies focusing on software applications might benefit from the test framework discussed in [7], grip studies might gain more via studies similar to the one presented in [9]. Concerning grip studies, the study presented in [17] demonstrated that the hand position variation when people hold a mobile phone has a strong impact on the signal absorption. This indicates that the user experience may be decreased simply by the way users hold their mobile device.

RESEARCH QUESTIONS, HYPOTHESIS AND METHODOLOGY

This section presents the lines of research identified at the beginning of the study as the main directions to investigate. Those directions might however be adapted later on according to the study's findings, the project orientation or the relevance of the research.

QUESTION 1: *How will subscribers use mobile rich media / TV services?*

Hypothesis: most users will consume mobile TV for short durations between activities or while transiting from a place to another. Thus the content provided should be formatted for short watching duration (news/sport summaries); offering easy hopping, pause/resuming.

Methodology: literature review, in-the-wild surveys, use studies in a controlled environment.

QUESTION 2: *What is the best methodology (trade off between reliability, repeatability, speed, unobtrusiveness) to evaluate the usability of rich media services on mobile devices?*

Hypothesis: "in the wild" experiments present numerous advantages as it implies real environment, but suffers from poor user experience assessment methods.

Methodology: usability lab, framework for user experience evaluation, comparison between in-the-wild and controlled environments.

QUESTION 3: *How does the user interface (device form factor and Graphical User Interface) influence the user experience with rich media services on mobile devices?*

Hypothesis: the service's GUI and navigation model can influence the way users hold the device, thus preventing his/her hand to affect the reception quality. Additionally, an adapted form factor can improve the user experience with a device by implicitly forcing the user to hold the device in a manner optimized for watching video content.

Methodology: literature review, usability experiments in a controlled environment (simulated reality in user experience lab).

THE EVALUATION FRAMEWORK

This section describes the concrete issues that will be investigated during the study through the design and implementation of an evaluation framework. Some of its requirements are stated, examples of applications illustrate its envisioned use to deal with concrete metrics, and the three main elements which compose the framework are exposed.

Requirements

REPEATABILITY: the intention is to apply the framework to various combinations of devices and features to evaluate. The framework should therefore be based on standardized tools and methods that are easily adaptable to different test environments. Moreover, developing solutions offering a wide application choice increases the possibilities for assessing it while being developed.

SPEED: additionally, the framework should propose solutions that are fast to use and process. As they will involve real users, the test sessions need to be executed in

a timely manner as they imply direct and indirect costs. Such costs include paying the test participants and facilitators for the time spent, possible use of equipment (internal or external).

FEASIBILITY: finally, the framework should use reliable tools which demonstrated high capabilities, yet being implemented at a reasonable cost. For that reason, the first versions of the framework will be based on existing solutions in order to evaluate them and assess their efficiency. Later, when results from research will demonstrate relevance and efficiency, associated methods and tools will be concretely implemented.

Metrics

The evaluation framework will be built, tested and utilized in the perspective of the CAMMP project. Therefore, applications of the framework will be aligned with the project's goals and status. Two main categories of metrics will be considered: usability and user experience. While the former deals with how users interact with the service, the later investigates why do they use it. Foreseen usability metrics are *ease of navigating through the electronic service guide*, *readability of textual information embedded in video* or *speed to access specific content*. Similarly, foreseen user experience metrics are *comfort of use while watching video*, *importance of audio on perceived quality of service*, or *impact of context on content selection*.

Elements

ENVIRONMENT: the first question the study will address is *where* the selected feature should be evaluated. The main issue to tackle with that regard is whether to carry the experiment in a controlled environment or in the wild. Both setups will be assessed depending on the metrics to be evaluated. For instance, it is commonly accepted in the literature that the former is more suitable to track and discover usability issues while the later suits better the investigation of context-related issues and end-user experience. This statement will be verified through the implementation of use cases and test scenarios.

METHODS: the second line of research will address the question of *how* usability and user experience metrics should be evaluated. First, a list of metrics associated with the CAMMP issues will be identified, extending the preliminary list presented in the list mentioned previously. Then, adequate methods will be assessed against those metrics according to various factors such as ease of integration into the framework or *cost of implementation*.

TOOLS: In the same manner as for the environment and methods, this third line of research will try to answer the question of *with what* tools the identified metrics should be recorded and the collected data be processed after the experiment. The identified tools will be rated according to their *reliability*, *speed* and *robustness*. Tools include

recording material, such as cameras or accelerometers, as well as 3D rendering solutions such as POSER™, and data processing tools such as MATLAB™.

CONCLUSION AND FUTURE WORK

This document presented the main lines of a PhD study aiming at assessing and improving methods and tools dedicated to evaluate the usability and end user experience with mobile rich media services. The context of the study as well as a succinct state-of-the-art in the field have been presented, from which research questions have been formulated. Then, concrete directions for the study have been identified, providing examples of concrete areas to be investigated.

One of the next steps of the study will be to identify and validate methods and tools to capture how users hold a phone when interacting with rich media services running on a handheld device. This grip study will support the design of both an intuitive and pleasant Graphical User Interface for such service and an effective antenna to receive the broadcast content with limited loss due to the hand absorption.

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