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Converged Mobile Media: Evaluation of an Interactive User Experience

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ABSTRACT
This paper describes a PhD thesis exploring various aspects of the end user experience with mobile rich media services. First, the author briefly introduces the background fields that frame the study. Three research questions are then formulated and their scientific contribution is justified. Subsequently the author proposes a methodology to investigate these questions and reports on two initial user studies. Finally, the thesis' ongoing work and intended future steps are introduced.

Categories and Subject Descriptors
H.5.2 [**Information interfaces and presentation (e.g., HCI)**]: User Interfaces – *evaluation/methodology*

General Terms
Human-computer interaction, convergence, interactivity

Keywords
User studies, mobile television, study plan

1. INTRODUCTION
This thesis explores the potential of mobile devices to support the shift from fixed to mobile in media related practices within today's converged media landscape. The thesis initially argues that this shift can be successfully achieved if the concepts of mobility and interactivity are naturally introduced in the context of media consumption. The thesis will therefore investigate how the establishment of the mobile device as a complement to home media equipment impacts the perception and usage of media services. In particular the research pursued throughout this project will examine the development of the Danish mobile television and associated services as its main case study. In fact, the thesis takes place in the context of the Converged Advance Mobile Media Platforms (CAMMP) project[1], which addresses the convergence of media services with mobile technologies. In this purpose, the project partners merge mobile technologies with Internet, digital TV and radio and investigate the potential of the resulting infrastructure that combines traditional media and user-generated content.

1.1 Previous Research on Mobile TV
A large body of research has been dedicated to the various aspects of mobile media in general and mobile television in particular since the early 2000s. However, only few studies involving users have been conducted in Denmark so far, due to the lack of infrastructure enabling such tests. This thesis will try to fill in this gap by not only verifying previous results and their applicability to the Danish environment, but also investigate uncovered issues within the fields described in details in section 2.

One of the first large scale studies about mobile TV involving users has been conducted in 2003 as part of the Finnish Mobile TV project [15]. This comprehensive study covered topics from the possible content of mobile TV to design requirements for the graphical user interface (GUI). The participants in the study responded in general positively to the concept of watching mobile television on a mobile device, however they expressed their concern about the usability of watching video content on a small screen. This concern has been extensively investigated by H. Knoche and his colleagues. For instance in [10], they investigated image resolution and bitrate requirements for delivering an acceptable watching experience on 3.5 inches displays; and in [11] they focused on the effect of zooming on the perceived quality of experience (QOE).

While early studies focused on the challenges of watching television content on mobile devices, more recent studies have been increasingly focusing on the mobile and social aspects of watching TV on the move. As explained in section 2, this PhD thesis follows these tracks.

2. FIELDS OF STUDY
Three general themes ground the dissertation's research questions based on an initial literature review. This grounding material provides opportunities for not only validating and extending previous results, but also for studying new issues via a cross-disciplinary approach. The literature study focuses on the themes introduced in the following sections.

2.1 Mobility
Within this theme, focus is put on the study of the contexts in which media content is consumed on mobile devices. The objective is to build on previous work by for instance J. Chipchase and his colleagues [4], who investigated four primary contexts in which mobile TV is consumed. The PhD study will mainly focus on the home, macro-break and public transportation scenarios in the Danish context.

Inferring contexts from data collected on the participants' phone during longitudinal studies is also a critical aspect of such research. Many tools have been designed for recording and processing contextual data but there is a noticeable lack of standardization and common agreement on methods and tools to be used in such studies [6]. Input in that domain will be provided via collaboration with senior researchers in this area.

[1] http://www.cammp.aau.dk/, April 2010

2.2 Interactivity

Focus within this theme is put on the interaction between end users and mobile media related products (devices or services). The starting point for this study is the previous research on the second screen approach reported in [2], which investigated peripheral activities TV viewers engaged in while consuming television on their home equipment. Findings from this experiment and from other similar ones will be further developed, mainly through scenarios involving content transfer between fixed and mobile equipment, as well as manipulating the electronic program guide (EPG) while watching a TV program.

2.3 Usability Evaluations

Mobility arguably introduces constraints on the design and execution of user studies. This part of the review builds on the work reported in [9], targeting methods and tools dedicated to field and lab trials and their suitability for mobile media studies. In particular the interactions between researchers and test participants and the involvement of users at various stages of the experiment are to be scrutinized. Since the whole PhD project relies on conducting such user studies, it is intended to follow the theories and guidelines introduced in [12] and [15].

3. RESEARCH QUESTIONS AND METHODOLOGY

Three research questions have been identified as of primary interest for the thesis. As detailed in this section, the contributions to the research community evolve with the questions from general to specific.

1. How does mobility impact media consumption and creation in a society that is always connected

Answering this question will contribute to the validation of new HCI patterns in mobile media consumption. The expected outcome is a deeper understanding of the effects of the ubiquitous access to digital media on consumption and creation practices.

In order to answer this question, a hierarchy of situations in which mobile media is consumed will be created. Such situations can be characterized by a combination of dimensions, including the user's location and activity, the surrounding environment, etc. Then it is intended to study the evolution of media usage through in-depth interviews and remote logging of media consumption during field trials. Finally, a comparative study of common practices in two different markets (namely Denmark and Japan) will be performed through in-depth interviews with senior researchers, as well as active participation in research projects in both markets.

2. How do end users perceive and use the combination of mobile and fixed devices in their media experience?

This question aims at informing how consumers interact with multiple pieces of equipment when dealing with media. Emphasis is put on the usability of transferring content and manipulating services in a multi-devices environment.

This question will be tackled through the investigation of (1) the handover experience while transferring content between devices or varying nature, (2) the mobile phone as a second screen for interacting with television programs and services, (3) the mobile phone as a universal remote enabling the control of various home media appliances. Furthermore, it is intended to assess the acceptability of seamless integration across services through contextual data collection from field trials and in-depth interviews.

3. How to improve the researcher/test user communication and measure the test user's reliability?

This last research question addresses specific issues related to evaluation methods involving users. It is intended to answer the question of reliability by comparing media consumption intentions as expressed by users and their actual consumption when using a fully implemented service in their everyday life. Using multimodal analysis techniques during usability evaluations will also help assessing the reliability of test participants. Additionally, the impact of recurrent (educated) test participants on the evaluation results will be measured.

For what concerns the communication between researchers and test participants, the focus will be put on large scale unsupervised studies. Various communication schemes will be evaluated and compared. Finally, a cost benefit analysis will be conducted by comparing the results collected from various test settings and linking them to the cost of implementing the test setup.

4. PRELIMINARY RESULTS

Two user tests have been conducted so far in the context of CAMMP and documented in [4]. The studies aimed at defining basic knowledge about how Danes relate to mobile TV and provide indication about which specific areas should be further investigated in priority. Focus was put on (1) the acceptability of consuming mobile television in a social environment and (2) users' collaborative and competitive behaviors with regards to mobile media.

4.1 Situated Task-Based Interviews

The purpose of this first test activity was to investigate how users handle the consumption of rich media in a social context, covering the following questions:

- Is it natural for users to consume rich media in a social context?
- Do issues such as privacy and personal sphere play a role in such contexts?
- Does the social context with its inevitable auditory/visual impact call for specific needs, such as head-phones to cancel ambient noise?
- How does channel switching perform on the mobile device?

This first study showed that users would feel comfortable watching TV on their mobile phone when surrounded by strangers. However the use of earplugs would be necessary to ensure privacy and an appropriate experience.

4.2 Group Discussions

The purpose of this second activity was to investigate the concepts of competition and collaboration involved when using rich media services in a social mobile context. The results from this evaluation activity provide a basis for future elaboration on interactive rich media scenarios, associated services and their context of usage. Additionally, the study uncovered issues to be further investigated in order to ensure mobile participation to a collaborative service. Such issues include the rewards and the information quality.

5. CONCLUSIONS

This paper introduced a doctoral dissertation investigating various aspects of user interaction with mobile rich media systems. Three research questions relevant to the field of interactive television have been formulated and a list of intended user tests has been established. The following paragraphs conclude the presentation of the thesis by firstly summarizing the thesis' scientific contribution and secondly describing the future work being currently planned.

5.1 Contribution Summary

The three areas covered by this thesis (mobility, interactivity and usability evaluation), by answering the three research questions stated in section 2, will provide the scientific community with insights on key aspects of the user experience with mobile media service, and especially mobile interactive television. The challenges inherent to mobile services such as the editorial format of the content, the limited screen size or the effects of network coverage will be informed by end users. The enhancement of the fixed television experience by the introduction of services and devices allowing cross-platform scenarios will be scrutinized through the design and evaluation of prototypes. Finally, the involvement of participants in user studies and their influence on the results will be investigated and documented in order to facilitate further research involving test participants.

5.2 Current and Future Work

Currently the author is involved in designing the following test activities as part of CAMMP:

- Seamless handover experience across devices. It is intended to investigate how people perceive the transfer of content from a mobile phone to a television and the preferred set of actions to perform the transfer.
- Determination of acceptable content switching delays. The purpose of this activity is to assess the acceptability of various delays while switching content on a mobile device under various contextual conditions.
- Confirmation of specific content needs. This test aims at validating the results collected in previous tests with regard to the type of content wished by end users.

In addition to planning these test activities, the author is currently engaged in an extensive literature review on the themes of interactive television and especially the second screen approach. Concerning the former it is intended to review the work by J. F. Jensen (e.g. [6], [8]), which covers general aspects of interactive TV, while the latter concerns primarily the work by P. Cesar (e.g. [1], [3]) and A. C. Roibás (e.g. [13], [14]). Additionally, the work published in the proceedings of past EuroITV conferences is reviewed on a continuous basis.

Finally, the author has planned interviews and is conducting shared projects with colleagues from other departments at Aalborg University. Additionally, a visit to a Japanese research institution is to be confirmed in order to not only broaden the thesis' perspective but also to investigate specific issues of common interest in the field of mobile media creation.

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