REGULAR PAPER

'Podracing': experimenting with mobile TV content consumption and delivery methods

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Abstract Recently, mobile TV has been launched in several countries. While mobile TV integrates television contents into mobile phones, the most personal of communication devices, it becomes interesting to know how this feature will be used throughout the day and in varying contexts of everyday life. This paper presents empirical results on the use of mobile TV with different delivery mechanisms and both quantitative and qualitative results on how end-users prefer to use mobile TV contents in different situations. The data is based on ongoing empirical research in Finland in 2006 and 2007. The mobile TV services under study included both news and entertainment contents, and were tested in 3G, DVB-H and Wi-Fi networks using different delivery paradigms: broadcast, on-demand and download. To explore the use of different delivery methods and content consumption, we have developed a mobile TV service protoype, called Podracing. The analysis shows that users appreciated up-to-date information and information-rich media forms and contents especially for mobile news delivery. There was high demand for only the latest news on mobiles. The real-time property was considered important. Most of the users looked at the headlines or followed the news several times a day – much more often than the traditional TV and news prime times would allow.

1 Introduction

Being able to view news and other media contents, on the go has a definite value. On public transportation mobile TV services can provide a feeling of being up-to-date all the time. Also in private spaces there is a need for mobile media, as some family members may wish to have their own personal mobile media device at home [20, 36]. With regard to technology use trends, we see a shift in a focus away from devices that depend on a physical context towards more portable and mobile devices [2].

In recent years, different mobile broadcasting technologies have been proposed to support the efficient transmission and reception of Mobile TV services in real-time. In addition to real-time transmission, mobile TV services are distributed by other means, for example, by subscription from Podcasting sites or as streaming services offered by 3G network operators [28]. Alternatively, viewers could also download recorded TV programs from Internet sites using their mobile phones.

Obviously, the mobile phone currently still has its own limitations as a broadcast medium, such as battery life, screen size, poor network coverage and design implications [3]. The efficient use of bandwidth while minimizing battery consumption are the requirements to be met. However, mobile TV also offers the potential to develop for a wide range of

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new, for instance interactive services. Taking into consideration the interactivity definition given by Jensen, mobile interactivity should allow the end-user to influence the form or content of the mediated communication, thus giving the user more choice and different action models [11].

Yet, the question of what kind of mobile interactivity is feasible with respect to user behaviour still needs to be explicated further [9]. Predictions concerning the adoption of new mobile technologies and services are sometimes based on over-optimistic expectations. There are many factors that influence the adoption of new mobile services, such as perceived value, ease of use and trust. Design of mobile media services should facilitate momentary usage sessions on the move, and provide end-users with easy access to services. Mobile devices are above all personal devices, key values of which include personally relevant content and communication. Thus mobile services need to provide users with topical information; less important information can be received elsewhere and at other times [12]. Moreover, the extent to which end-users will value the functional blending of mobile telephony—which people seem to experience more or less as a personal form of communication and mass media broadcasting—and how valuable the mobile TV service would be for users is not yet clear [27].

As a whole, this paper is organized as follows: Sect. 2 takes a closer look at some earlier findings of mobile TV user trials; Sect. 3 presents the tested mobile TV technologies; Sect. 4 gives mobile TV system requirements; Sect. 5 and introduce the research questions and the methods used; Sect. 7 presents the empirical findings of our mobile TV user study; Sect. 8 discusses the findings of the study in relation to the results of some earlier use trials and Sect. 9 summarizes conclusions and future works.

2 Some earlier experiences of mobile TV use contexts

Mobile TV services have been launched in several countries. The services are based either on 3G or on mobile broadcast networks. Korea was first to start commercial mobile TV broadcasts via both satellite and terrestrial networks in 2005. Korean mobile TV has over 2 million subscribers and it is based on DMB technology. Italy, on the other hand, started DVB-H mobile television in June 2006. In Norway, Ericsson and the Norwegian Broadcasting Corporation were the first to experiment with an interactive mobile TV. This interactive pilot is based on games, chat and messaging. In Finland, Digita and Nokia launched a commercial mobile broadcast network in December 2006 [1].

By the end of 2005, mobile television services had over six million subscribers. According to some forecasts, mobile TV services will have up to 514 million subscribers worldwide

in 2011.[1] Nokia estimates that a mass market for mobile TV will open up in 2008. Even with more conservative thoughts about market predictions, mobile TV has clearly been one of the most appealing mobile services, according to several user-pilots all over the world. According to a Siemens survey, the most attractive applications for American consumers are mobile email, mobile music and mobile TV [33]. In mobile TV two major media services are amalgamated: TV—the most important medium at home, and the mobile phone—the most personal medium people have [1].

2.1 The contexts of use

Quite typically, mobile TV services are used in the public sphere, for example while waiting or commuting. They are used to kill time and to keep their users entertained or up-to-date.[2] Whereas the public sphere is going to remain an important area for mobile TV usage, some studies have shown that mobile TV services are measurably used in the private sphere, too. For example, a BBC's trial with its Intergrated Media Player in UK, revealed that about 50% of the test users viewed loaded TV programs at home with their laptops and did not move anywhere for watching. Typically, mobile TV was used late at night, in bed, just before falling asleep [4]. Södergård et al. who tested mobile TV with both a pocket-sized PDA and an A5-sized tablet PC, found out that different use groups had different prime times, for instance the workers' test group couldn't find time to use the mobile TV during the working day and the children watched programs especially in the late evening. Against expectations, the test users clearly considered the mobile TV service to be a television, not a wireless multimedia service. The programs were selected by familiar channel, not by topic. The most liked feature was the possibility to watch programs from the archive whenever possible [36].

The use of mobiles in the public sphere has certain limitations. Users have been worried about becoming too absorbed in mobile multimedia content, which requires their visual attention. They fear increased risks of accidents and lapses. Also, text legibility may be difficult when on the move [15].

2.2 From news to user generated contents

The findings of a number of studies made on mobile TV confirm that the most popular mobile TV content is news [16,24,36]. Different mobile TV content types listed by their popularity are: (1) News, (2) Music, (3) Sports, (4) Cartoons, (5) Movies, (6) Soap operas, (7) Sitcoms [16].

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[1] http://www.abiresearch.com/abiprdisplay.jsp?pressid=668

[2] According to a Finnish mobile television pilot, 43 % of test users used mobile television for killing time and 40 % to stay up-to-date while on the move.

News is well suited to mobile phones, because the duration of a mobile TV session often lasts less than 10 min.[3] The limited time of mobile TV use has ramifications for both the type of content and the way that people consume it [14,24, 36]. Most likely, customized services that address specific interests of the individual user will become more important in the future [5,6].

User-generated content is regarded as one of the most potential content types for mobile TV. On the Internet, the success of services like Youtube and Flickr have shown that there is public interest in content created and shared by amateurs.

The results of the Finnish mobile TV pilot in 2005 show that people use different content types in different locations. News and information services are used everywhere throughout the day, and the mobile phone is regarded as a valuable channel especially when something newsworthy suddenly happens. Live broadcasts of sports are watched anywhere if there is no conventional TV available. Series and entertainment services are viewed in short periods for example on public transportation. Films and longer programs are only watched when the conventional TV is not available. Users may start watching a movie on the mobile phone and continue watching it on their main TV when they get home. Mobile TV is often watched during the daytime, which differs from the peak viewing times of traditional television [23].

Clearly, user choices and preferences will determine the success of mobile TV services. Indeed, for consumers, mobile media is nothing new. Print media such as newspapers and magazines are mobile; the same holds true for media such as the car radio and the Walkman [5]. Thus, if new mobile broadcast services are to be successful, questions regarding the relevance and the value of the service to consumers need to be asked. It is also important to consider the issues of when and where the usage will take place, as the mobile broadcasting services will most likely to be used in different locations and times than the fixed media and information technologies [26]. Taking all the above points into consideration, the paper will next present the tested mobile TV systems and the findings of a user study.

3 Mobile TV technologies

As a simple definition, "mobile TV" refers to television that is mobile. Typical properties of television are the ability to receive and reproduce video as well as audio related to the video. Moreover, TV is a medium that has the ability to reach a very large audience, which makes it not only a technology of communication but also a powerful institution and the dominant mass medium of modern society [37]. Mobility in turn refers to use of a device when the device and the user are moving in relation to their surroundings. Mobile technologies are often characterized in terms of access to information "anytime, anywhere", which affords users greater freedom as to when and where they access information. However, this concept of mobility may also embody simplistic assumptions about the nature of mobile technology use. For instance, a mobile device is not always used to support mobility in relation to locations, but may be used primarily as a personal data documentation device. Often, more than anything else, the changing contexts and environments determine mobile users' activities [25]. In this article, we refer to mobile TV as a service that is capable of receiving, reproducing and distributing broadcast video and audio content through different networks and that can be used via the mobile phone when in motion. Mobile TV is an outcome of the convergence of communication systems [23].

In mobile TV the most convenient technology for on-demand streaming services is third generation or "3G" mobile telephony. 3G bit rates vary from 144 kilobits to several megabits per second. As an example, European 3G UMTS has a maximum bit rate per user of 384 Kbps [33], which may be increased to several megabits per second with a HSDPA (High-Speed Downlink Packet Access) upgrade [19].

Current 3G networks provide an easy launch for mobile TV as existing networks and terminals can be used, but when the number of users increases, 3G streaming fails to scale up to a mass market of mobile TV services [1,18,20]. 3G networks are expected to eventually get a broadcast upgrade, MBMS (Mobile Broadcast for Multimedia Services) [7]. In the future, IP-based wireless technologies like WiMax may play a substantial role as a competitor in mobile streaming.

Topologies of traditional television networks do not support mobility: They are optimized for stationary reception and highly directional receiver antennas. Neither of these can be applied to mobile terminals. Consequently, broadcast networks optimized for mobile use have to be built. Currently there are three technologies for mobile broadcast: European DVB-H, Korean DMB (T-DMB for terrestrial, S-DMB for satellite networks) [13] and MediaFLO [29] by the US-based company Qualcomm Inc.: All of them can deliver the same bit rate per channel, which is around 300 Kbps.

It should be noted that while a mobile broadcast network provides the same bit rate for every receiver, the bit rate in a 3G network may become lower from time to time and from place to place. For instance, every 3G base station has an upper limit for total bandwidth, shared by the users in its coverage area. Additionally, the transfer speed for each terminal depends on the quality of the received signal.

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[3] In a Finnish mobile television pilot the average duration of mobile television use was 5–20 min daily. Only very active users viewed mobile television more than that – up to a maximum of 40 min per day.

In practice, current mobile TV bit rates over 3G are significantly lower than the bit rates provided by mobile broadcast networks—typically less than half.

In addition to broadcast technologies and streaming services, there is a third method for delivering mobile TV content to mobile terminals: download to memory. Music downloads to portable players, like Apple's iPod, have been paving path for downloading media files in general: virtual radio stations, videos and user-generated content on the Internet can be downloaded to portable players like iPods, thus giving the name "podcasting".

Downloading content in advance has been enabled by rapid developments in non-volatile memory technologies. Increased production volume, mainly caused by digital photography, has slashed the price of one gigabyte to a fraction of the former level within just a couple of years. A reasonably priced 2GB memory chip can store 15 h of 300 Kbps video. Consequently, music players such as the above-mentioned iPod have turned into general media players, premium mobile phones such as the Nokia N93 have quality video record and playback capabilities, and portable game consoles such as Playstation Portable (PSP) can reproduce decent quality video.

The third delivery method used in this research was downloading. The users had an opportunity to download mobile TV content: The content was delivered to a user's mobile by subscriptions using the same metaphor as subscribed podcast feeds. In this model of podcasting, the information provider chooses which files to offer in a feed and the subscriber chooses among available feed channels. Stored locally on the handset, this content can then be viewed without network connection. A service provider can schedule the delivery for a suitable time, for example during the night. Podcasting makes it possible for users to subscribe their favorite series to the memory of the mobile phone and watch them at any time later (Fig. 1).

In the project the same content was broadcast and podcast through 3G and WiFi networks. It was possible for the users to view entertainment and news channels 7 days a week and 24 h a day and to get podcast feeds from the same entertainment and news content.

4 Mobile TV system requirements

Nowadays, most handheld devices with network capabilities are Java-enabled and support some of the Mobile Information Device Profile (MIDP) versions. Java applications developed for a certain version of MIDP, called midlets, should be runable on all devices supporting that profile. Even though MIDP only supports a few video and audio coding formats, it is possible to develop a mobile video news service completely in Java code [17]. However, due to the constrains of


Fig. 1 Podrace mobile TV service prototype offers news and entertainment 24 h a day and 7 days a week. The second version of the service is designed for use with Nokia N92, N93 and N95 phones

playing audio and video files, it would be recommendable to use a native media player.

User interfaces can easily be created and dynamically adapted when using XML languages, which separate the document data from the presentation. Different UI descriptions, each one of them targeting a specific device type or screen resolution, can exist for the same document. XHTML Mobile Profile and DVB-HTML [25] are two examples of XML languages that target mobile and television browsing respectively, and are two options for creating the UI of a Mobile TV system. Finally, those XML documents are interpreted by a browser that can be developed as a J2ME application [35].

As mentioned above, handheld devices share common characteristics, e.g., both memory and processor capacity are very limited, and J2ME applications are widely supported. However, different devices can provide different media frameworks and network capabilities. Hence, J2ME-based SW development is recommended, and run-time memory should be used as little as possible.

UI designers targeting mobile phones must take into account that the size of the display and its resolution are different for almost each device. Hence, the procedural environment should be avoided to create the UI, since it presents more problems for dynamic adaptation than the declarative environment. Navigation should be simple and the user should reach the content with the fewest possible number of clicks. There should always be an easy way to get back to the front page. This should not rely on specific buttons, like the back button, which might not be available in all devices [31]. To ensure text legibility, the font should be large enough for users with normal vision. Based on the on-going
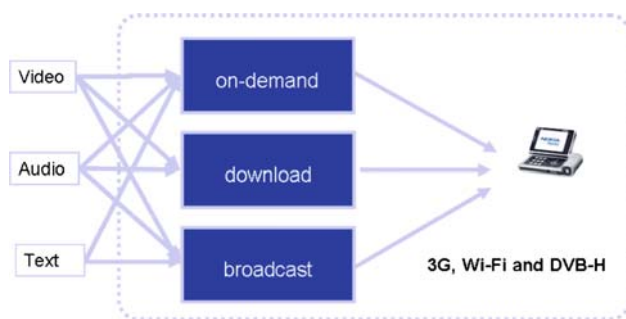
Fig. 2 Trial setup: three different media formats were delivered using three different delivery methods

work, it was decided that the size of character should be at least 2 mm. The application requires the platform to support audio and video playback. Selected audio and video formats should be widely supported in handheld devices and should be very efficient, to minimize mobile bandwidth. Moreover, video and audio network streams should also be supported over 3G or Wi-FI networks.

5 Research questions

To find out how people would like to use mobile TV services, this article focuses on three main research themes based on empirical research:

- *Primary use contexts*: In what kind of contexts and situations people would like to use mobile TV? Is it used as an individualized media device or in social situations, in fixed locations or mainly when the user is on the move?
- *Mobile prime time*: When is the mobile prime time? Is it the same as television prime time, or perhaps a little bit earlier, or later?
- *Preferred mobile TV contents and delivery technologies*: What kind of content would people choose to watch on mobile TV? What mobile TV delivery methods would the end-users prefer to use, when and why?

6 Research aims and methods

The aims of our study emerged from the integration of different media formats and delivery technologies. The first phase of the study concentrated on different media formats: video audio and text as on-demand services. The second and third phases concentrated on different delivery methods: content download and broadcasting (Fig. 2).

The focus of our research is on developing mobile TV technologies and services and enhancing knowledge of content consumption, usage situations and user experiences.

With our methodological approach, we hope to gain new insights into users' requirements and expectations of mobile television.

The purpose of the first field study was to explore users' media choices in different situations. The tested media service prototype combined text, audio and video and included only news contents. Qualitative and quantitative methods such as user logs were combined to make sure that adequate data is collected. Semi-structured interviews and media diaries helped us understand users' media habits and how they voice their expectations and preferences. Log data revealed the time and duration of actual occurrences of service use.

The first field test started in March 2006 with users who used the service with 3G phones (Nokia 6630 and N70) for one month with an Elisa subscription. Before the test period, the users were interviewed and they received information concerning the test. Demographic data were gathered from the users and media user profiles were made. The ages of the users ranged from 23 to 56. All of them worked at least part time. During the test period, the trial participants reported their user experiences in a test diary. After the test, the users were asked to fill in the service evaluation form and they were interviewed again. The interviews were recorded and transcribed. The evaluation form covered questions such as navigation and the ease with which the different functions could be utilized. The test users were also asked to assess how enjoyable they found watching the news and other media on the screen of the mobile phone. The log data of the service use was collected and analyzed statistically. Similar methods were used in the second field test, which started in October 2006 and ended in with the exception that it was not possible to collect any log data from these applications. The main aims of the second test were to examine the user choices when different, more varied media content was available, to estimate the quality difference between 3G TV and DVB-H TV. Ten users tested 3G TV and DVB-H TV with a Nokia N92 (see Fig. 3) for a period of one month. The tested mobile TV services consisted of a wide range of different kinds of content: from all the main TV channels to sports and news channels, and from fashion TV to user-generated content. Podcasting was first tested in ISO9241-11:1998(E) defined laboratory usability methods: effectiveness, efficiency & satisfaction [10,32]. Users were asked to perform tasks which were important to the podcasting service. The time elapsed and number of mistakes were measured from every task. Users also evaluated the usefulness and ease of use of the service. The reliability of the networks and the quality of the video, audio and text content were also examined. The testing of the podcasting service was also later extended by field trials, in which 11 users tested the Podracing service for three months during the summer 2007 with Nokia N95 and N93. The testing methods were similar to described above.

Fig. 3 *Left* Nokia N92 displaying DVB-H broadcast. *Right* Mobile-TV application can be found in the phone menu

The test groups consisted of persons who have been using mobile services actively during the last few years. They were keen news and media followers, but they had different kinds of media-user profiles. Some of them were very loyal newspaper readers, while others regarded the Internet or TV as the best news or entertainment source. The test users had different kinds of hobbies, lifestyles and interests. During the test, they carried the test phone as their primary mobile, using it for both professional and personal communication.

7 Field test results

7.1 The primary contexts of use

The test users reported their media habits, expectations and preferences in their diaries. It appeared that they highly valued the possibility to watch mobile TV on the go. It was often used for just killing time, but it obviously in the beginning of the use periods it also possessed some novelty value which was present in the usage situations. It also aroused curiosity in situations with friends and colleagues. It was the most used media type in social situations when the service was tested with others.

> TV was the most interesting to me. The thing I used the most was TV news during my coffee break at work. That way I got to show my friends that I had a TV in my mobile. The size of the screen caused a little doubt about whether or not it's worth it. (Man, 56)

The test users considered the service most useful while they are on the move and not at home or in situations where they are unattainable by regular media. However they also used it at home for mainly quick check ups and as a personal media device if they were not close to a TV-set. Users appreciated the ability to watch news any time they felt like it.

> It is very handy indeed that you are able to watch the news whenever it is suitable for you. You don't have to care about times. (Woman, 43)

The ability to select the media format suitable for the situation at hand was considered important. Audio was perceived as

suitable for situations where the user was mobile him/herself, e.g. while walking, cycling or rollerblading. For situations when the user was sitting or standing still, the media form selected was more likely to be illustrated news, text or video.

> The significance of the media format (text, video, audio) depends on the situation you find yourself in. If you need to know the contents of a specific item of news, then I'd opt for a moving image, kind of like news broadcasts on TV, that's condensed information. If you want a more in-depth view, you read from the paper or an electronic service. (Man, 42)

The use of the mobile TV aroused interest and discussion in the immediate circle of the testers. The general view was that its use was best suited to situations where other media were not available or where people found themselves with time on their hands.

The mobile TV service was mainly used as an individualized, personal media format. However, while watching TV, the device occasionally became more social, but after the demonstration phase it was mostly used by one person only. One test user demonstrated the mobile television while coming from an ice hockey game by train.

> The train was quite packed by people coming from the game. Then I turned on the sport news, and everyone got quiet, curious to see how the game was reported by the mobile news. (Man, 52)

Mobile TV was obviously not used while driving as the test users were worried about becoming absorbed in mobile multimedia content, which requires their visual attention. Users mentioned that in noisy environments, like on a bus or in traffic, media types other than TV might be easier to use.
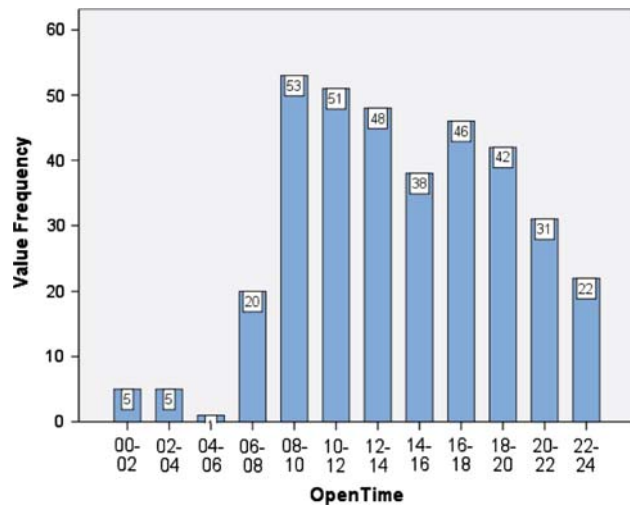
7.2 Mobile primetime

During the first trial the average viewing time for mobile TV news video was relatively short; clearly < 5 min (see Fig. 4). The median for video duration was 1 min 43 s.

The usage of mobile media services spread relatively evenly over the whole day, although use was more frequent during the mornings (from 8 to 10 a.m.) and before the noon (from 10 to 12 a.m.) and early in the evenings (from 4 to 6 p.m.). Chart 1 shows the sums all of "open mobile TV" commands at different times of the day during the first field trial. It appears that the peak watching times were in commuting times but there were also important viewing moments outside of them, for instance in the middle of the working day and early in the evenings. Even though the test users had many opportunities to watch mobile TV during the day in their privacy, the length of mobile TV watching session remained short during this first test period. It is very likely
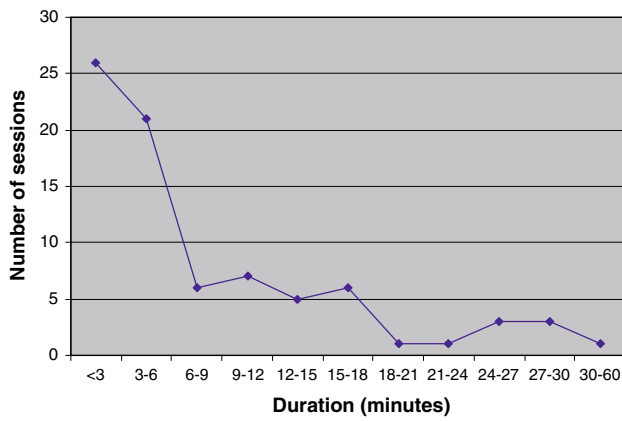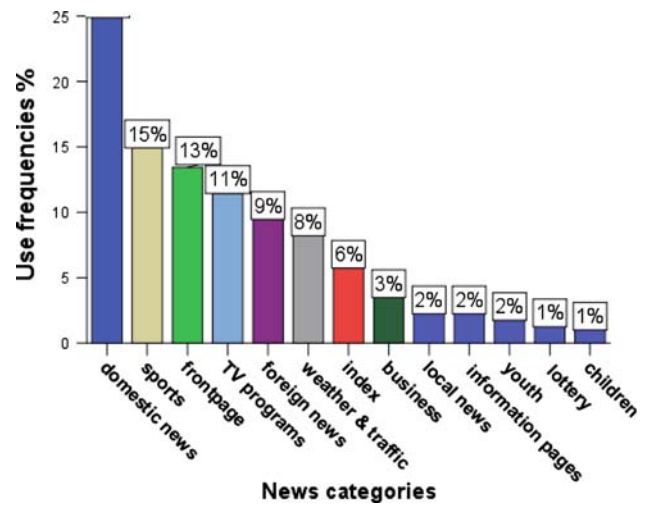
Fig. 4 The duration of mobile TV sessions. In this chart the first two testing days are ignored, as the usage activity tends to be especially high during the first couple of days

Chart 2 The most popular news categories in mobiles. The regular news categories such as domestic news, sports and foreign news attracted the most interest in mobiles

The service usage was most active in the beginning of the week. The usage tended to become less active during the weekends—even though there were no differences in the shape of the content distribution. The usage was remarkably low on Sundays, probably because people were at home watching regular TV broadcasts.

Chart 1 The primetime of a mobile news service

7.3 Preferred mobile TV contents

Clearly, as the earlier studies show, news was considered one of the most interesting media contents in mobiles. The categories of domestic (25%), sports (15%) and foreign news (9%) attracted the most interest. Also the TV-program guide was checked quite often (11%). The local news and children's sections were read more randomly. There was high demand only for the latest news—the older news from the archive were barely read at all (Chart 2).

Regarding the entertainment contents, mostly the same contents as on regular TV were watched, but also special channels were popular, e.g., a channel focusing on local cultural events. Thus familiarity was the most used criteria in choosing the TV channel. The test users mentioned the major Finish channels (MTV3, Nelonen and YLE) as the channels they watched most often.

that 3G network reliability and coverage problems affected the use.

Compared to earlier research findings, there was much less mobile TV usage late at nights (cf. [4,36]). Moreover, use at home was also a less prevalent contexts for mobile TV compared to some earlier studies (cf. [3,4,36]). It is possible that there are several reasons for this. Because of the testers adopted the test phone as their primary mobile, using it for both professional and personal communication, there was no need to carry two devices or use the test phone on a more limited basis. In addition, the size of the testing device was small enough to use it during the day in different public places and also at work. During this test, however, many of the test users were not able to get proper DVB-H or 3G coverage at their home, even though their lived in Helsinki metropolitan area. Thus the use was more focused on locations with proper coverage, e.g. on transportation or at work.

Moreover, the mobile TV changed their watching routines by offering the possibility to follow their favorite programs regardless of their location. The viewing duration was also shorter than usual, and they watched only the most essential or interesting parts of the programs.

> I could not watch the movies until the end, but watched them for about 15 to 20 minutes. I think I watched news more than usually. (Woman, 29)

Also, certain reality TV series that the users want to keep up with in real time were mentioned as interesting contents. During the test period an obvious example of this was the reality TV show Big Brother, which in addition to television, was followed also through other media.

7.4 Delivery methods and interactive services

The test users saw a quite clear difference in image, sound and text quality between 3G TV and DVB-H. In all respects, DVB-H quality was seen as superior, whereas the quality of 3G reception was variable.

> Mobi-TV (DVB-H), at its best, it is very good, excellent in fact. The picture, the sound, the text, everything. I don't see how you could make it work any better on a tiny little TV screen like this.   (Man, 42)

The quality differences resulted in the test users starting to use DVB-H instead of 3G during the test for their main mobile TV. Video watching durations were considerably longer than on the news field trial, approximately from 5 to 10 min (according the testers' own report) and also longer durations from 20 to 40 min were reported, which shows that long-form contents are not to be completely ruled out for mobile TV [20]. Besides the new contents, also the difference between 3G and DVB-H reception may have an influence on session durations.

Although podcasting via the mobile phone was quite a new concept for the test users, after the trial they all thought that this delivery method was a major addition for mobile TV: it would be most useful, for instance, on long journeys and in general in places with no 3G or DVB-H coverage. Podcasting as a delivery method was considered most suitable for loading entertainment contents such as TV series, but also news broadcasts were downloaded for later watching.

The comments about the interactive services of the mobile TV were varied. The test users were mainly interested in applications such as buying or reserving concert tickets. The test users seemed to understand interactivity mostly in connection with buying or advertising purposes. They disliked for instance the idea of voting for something trivial, just for fun.

The test users estimated that mobile TV would increase their media consumption from 5 to 10% or from 30 min to 2 h per day. The extra time would include watching TV on the way to work, at the office, and in situations they do not have access to a TV.

Most of the test users found mobile phone battery life enough if they loaded the battery once a day and the use of mobile TV was not very heavy during the day. Yet, with increased media use, the battery life became a problem.

8 Discussion

Previous findings made among mobile TV users are somewhat similar to findings of our use trials. Mobile TV is mostly used in public sphere [3,4] especially during commuting. Mobile prime times differ from conventional television watching times, so that the mobile TV uses spread relatively evenly for the whole day. In addition there are peak-times outside conventional primetimes, such as late at night. The test users picked mainly the content and channels which were already familiar to them, but watched the contents for shorter periods. In fact, people are often drawn to new services and mobile TV with the help of established brands and channels they already know. Only later on, when they get familiar with the mobile TV concept, their usage conventions may change to new channels and content types [6].

However, the expectations changed after the first testing periods. The test users expected mobile TV to offer additional services to conventional TV and media. In general, the interactive services were found interesting, and more innovative services could be expected developing in that area. There is a demand for additional services, especially the test users wished for more real-time and especially tailored content for mobile TV. The users stated that a mobile television service should be able to give a feeling that the user actually knows more than others. Producing that kind of a real-time service is challenging, especially in present media environment where everything is in the Internet in the delay of 10 min.

Of course, all these findings must be also set against certain empirical limitations of our tests. It is possible that the content preferences might have been entirely different, if the test group would have been consisting of younger age segments. In that case, the entertainment and user generated contents would probably have been even more popular and also sharing contents would have been more a concern.

On the whole, the estimated increase in media consumption caused of the mobile TV was surprisingly high; but the findings of the test confirm recent studies especially concerning the DVB-H TV usage [20]. Yet, the test users for the trials did not have pay for the services in question. The price of the mobile TV services, when they are finally finished products on the market, is also a significant factor that will affect their use. If mobile broadcasting services are to become commercially successful, the companies offering them will have to devote considerable attention to consumers and the market [7,27].

9 Conclusions

Although the field tests were conducted by testing mobile TV services in their early stage with quite small testing groups, they yielded interesting results on the uses of mobile TV services in different contexts of everyday life.

There was strong evidence that as a media TV terminal, the mobile phone is suitable for a variety of situations. The mobility, personality, diversity and real-time properties of the service are the characteristics considered to be the most important.

Users appreciated updated information and information-rich media forms for mobile news delivery as well as the ability to select the media format most suitable for the situation. Most users read the headlines or followed the news several times a day—much more frequently than would be possible with traditional TV and primetime news broadcasts.

There was high demand for the latest news in mobiles. In order to be more useful in everyday situations, the test users wished for more real-time and especially tailored content for mobile TV.

On the technical side, it appears that the quality of reception is still one of the major problems perceived in mobile TV use. The empirical results show that the users perceived a significant difference between different delivery methods, e.g. 3G, DVB-H and Podcasting, and the difference is likely to affect the length of mobile TV viewing sessions. During the test period especially 3G networks had some reliability and coverage problems. However, when the technology gives the users more bandwidth and larger coverage areas, the quality of the 3G TV viewing experience is more likely to improve. Podcasting via the mobile phone was quite a new concept for the test users. Nonetheless, they thought that this delivery method would be useful for instance, on long journeys, and in general in places with no 3G or DVB-H coverage. Obviously, the advantage of podcasting for the consumer is that watching the podcast content does not depend on the network connections—and thus can be done any time later, regardless of the location. Although mobile TV watching durations were generally quite short, also longer durations from 20 to 40 min were reported on later trials, which shows that long-form contents are not to be completely ruled out for mobile TV.

Moreover, the price of using the mobile TV services, when they are finally finished products on the market, is also a significant factor that will affect the use. In the next phases of this project we will also research users' expectations of the pricing models for mobile TV services in greater detail.

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