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Exploring non-textual interaction. User responses on the TIFF event assistant.

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Abstract

This report describes the features of a mobile event assistant for people visiting film festivals and analyzes user responses collected when demonstrating the assistant. Use of images as a starting point for retrieving information was appreciated by the users and more than half of the users would like to take the assistant into use if it had been available. Enjoyment turned out to be the most influencing factor for use intentions, followed by usefulness and social influence.

Keywords

mobile search, visual search, barcodes, streaming, user experience

Preface

This work is part of the joint efforts between the Department of Computer Science, University of Tromsø and Telenor R&I to explore non-textual queries and to better understand the acceptance factors of mobile search services. Resources raised by the *CAIM project* and the *Agreement on co-operation between Telenor* and the *University of Tromsø* have been used.

Thanks to Tromsø International Film Festival (TIFF) for welcoming us into the festival location, for their kind assistance in retrieving film trailers and all other support.

Contents

1 Introduction

Mobile phones are equipped with an increasing number of features, and the continuously upgrading of bandwidth, the exponential growth of digital content and software available expand the scope of mobile phone usage. Still, usage beyond speaking and messaging is limited and the characteristics of the successful future mobile service are hard to define. Obviously one cannot expect the success factors of fixed line services to be repeated on mobile phone services. One might alternatively explore the opportunities given by the mobile phone strengths and perhaps their weaknesses. Thus the following suggestion might make sense: the rather cumbersome user interface of mobile phones (small displays and keys) makes ordinary text based search queries effort expensive and inconvenient. On the other side, the presence of image/video and audio capture facilities and the device's readiness to visual and audio presentations make non-textual approaches to mobile search services very interesting. In this study we want to 1) investigate how people react upon searching (or information retrieval) by means of scanned images and 2) better understand general mobile service acceptance factors.

To study these issues a set of prototypes has been implemented. The first one, a mobile service addressing tourists' information needs (Schürmann et al. 2006), actualised the role and capability of present image recognition software. In parallel efforts have been directed towards sources of context information and use cases utilising context information to possibly strengthen management and retrieval of images (Akselsen et al. 2007; Bakken 2007; Bakken 2007a; Egeland 2007; Egeland 2007a). This is the very scope of the CAIM[1] project. Further the Shoot'n Buy scenario has been explored and an extensive search for high quality image recognition systems has been done (Canright et al. 2007). The prototype used in this study however, is based upon barcode readers. Utilising barcode scanners already installed on many mobile phones means that the conceptual idea of image based queries can be tested without actually having an adequate image recognition module available.

This prototype, a film festival assistant, was completed in January 2008, just in time to be tested at Tromsø International Film Festival 2008 (TIFF)[2]. It was consequently named the *TIFF assistant* and offers the user an alternative way of finding information: The mobile phone is used to scan a barcode printed in the festival program – resulting in a matching WAP page being shown, including the film trailer. The prototype was demonstrated on one of the festival locations, and an arbitrary sample of festival visitors were asked to comment on its usefulness, efficiency, appearance and so on.

This report describes the prototype in technical terms (chapter 2) and the specific problems being addressed and the hypotheses and method chosen (chapter 3), before the results are discussed (chapter 4) and future work is suggested (chapter 5).

[1] CAIM (Context Aware Image Management) is funded by the NRC programme VERDIKT. For more information see http://caim.uib.no

[2] TIFF is an annual event held in Tromsø. TIFF attracted 47 522 visitors in 2008 (January 15th-20th), which made it Norway's largest film festival. It included more than 100 films and 272 picture shows. For more information see http://www.tiff.no/

2 The prototype

The TIFF assistant is based on the assumption that festival audience would like more and other types of information about the films than what is available in the festival catalogue (TIFF 2008). Being a small computer with internet access, the mobile phone could provide more extensive and up to date information about the films, and also present other types of media like videos of the movie trailers. However, how to inform users that this information about the movies is available and how to access the information from the mobile phone in an easy and user friendly way has been a challenge. In this prototype we have utilized 2D barcodes, as displayed in figure 2.4, to make a *physical world connection*[3] to the mobile phone.

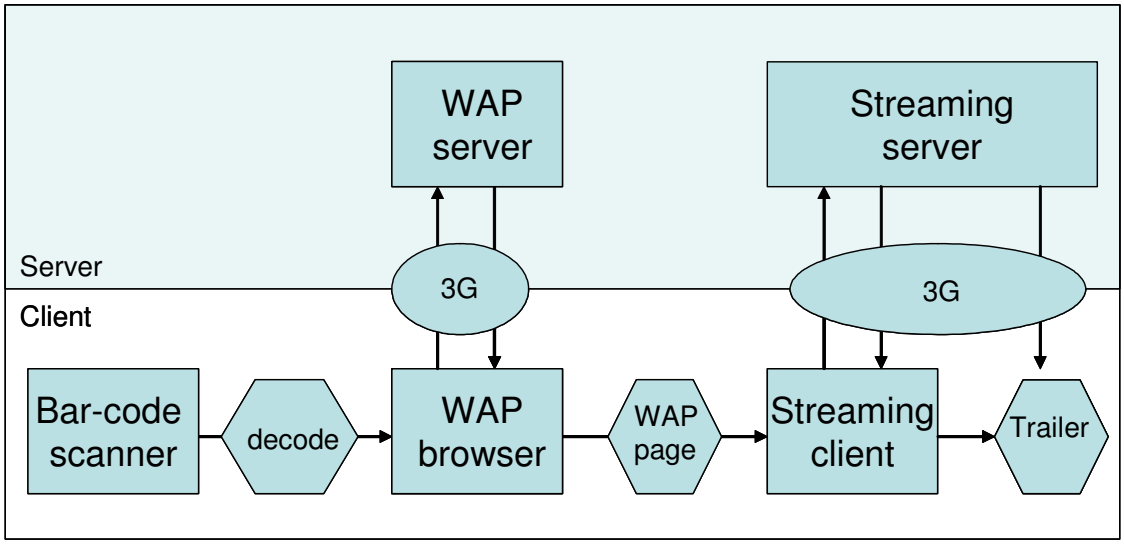

Figure 2.1 System overview

2.1 The prototype step by step

The prototype is based on the TIFF catalogue, which is published some weeks prior to the festival, and contains information about all the films. For some of the films we have adapted digital content to be presented on mobile phones. For these films 2D barcode stickers have been added to the catalogues which were used with the prototype. Figure 2.1 illustrates the sequence of interaction in the TIFF assistant.

[3] *http://theponderingprimate.blogspot.com/2006/05/physical-world-connection-makes-wall.html*

Figure 2.2 Interaction steps in the TIFF prototype.

1. The user starts the barcode scanner on his mobile phone. The scanner uses the camera on the phone and continually scans for codes that are within the viewing area of the phone, changing the focus and contrast settings if no barcode is recognized.
2. When the whole barcode is within the viewing area of the scanner it will be recognized and the content of the barcode will be translated into text which is readable to human beings. In this prototype the information encoded into the barcodes are links to WAP pages. By clicking on the link the mobile phone's WAP browser launches and displays the WAP page.
3. The WAP page contains information about the film which was not available in the TIFF catalogue. This includes the cinema where the film is played, and the option to see a trailer of the film. The bottom of the WAP page also contains advertisements for festival sponsors. There are clickable icons for streaming of film trailer and festival sponsors.
4. Clicking on the icon of the film trailer launches the mobile phone's media player. After a few seconds of required buffering the player will play the trailer of the film. The trailer is not downloaded to the phone, but streamed over the 3G mobile phone network.

Each step is explained in more detail in the following chapters.

2.2 Barcodes

Traditional one-dimensional barcodes, as depicted in figure 2.3, are well known from retail stores and retail distribution. These codes are essentially a representation of 0s and 1s which can be read by a barcode scanner in order for easy processing by a computer. In recent years a new kind of barcode has become available. The two dimensional barcode (or 2D bar-code[4]) resembles a chess board, and is able to hold much more information than the 1D bar-code, since the information is encoded in two directions.

After the introduction of mobile phones with cameras, software has been developed for these phones in order to enable them to use the camera, take an image of the barcode, and decode the information in it into human readable text. These applications have become very popular in parts of Asia[5], and a barcode reader is usually pre-installed on all handsets.

Figure 2.3 Traditional one dimensional barcode

Since there currently is no single standard for 2D barcodes, they come in many different formats. Barcode readers are usually able to decode several of the most popular formats. In this trial we have used the QR-code (Quick Response Code). This format was chosen because the QR-code has seen extensive use and is the format we found most support for in barcode reader software. An example of QR-code used in the trial can be seen in figure 2.4.

Figur 2.4. A QR-code used in the study

Tests were made of various barcode readers currently available. All barcode readers were tested on Nokia N95, and some on other phones. Finally we decided to use the Nokia N95 (and Nokia N82) preinstalled barcode reader. Our other main contenders were the Kaywa Reader and Quickmark, both of which are a little faster than the built in scanner but had other drawbacks. See table 2.1 for details.

[4] *Also known as matrixcode*
[5] *http://whatjapanthinks.com/2005/09/26/qr-codes-extremely-popular/*

Table 2.1 Barcode readers – test results

Name	Positive features	Missing or negative features
Kaywa Reader[6]	Fast, only one key press needed from start-up until camera starts scanning. J2ME client available. Accurate.	Does not support RTSP[7] link (streaming) in text message. The picture is rotated 90 degrees when used on a Sony Ericsson (SE) W880. When used with a web address, an intermediate page is shown before redirect (possible advertisement plan)
Quickmark QR Reader[8]	No key press needed between start-up and camera starts scanning. Simple and easy to use. Fast and accurate.	Only available for Symbian and Windows Mobile. Limited amount of SE phones supported. Does not support RTSP or http link in text.
I-nigma[9]	Supports many phone models. Support for RTSP when specified as a link. Accurate.	No J2ME client. No support for RTSP link inside text. GUI too flashy to incorporate into TIFF demo.
Semacode[10]	J2ME client, and SDK.	Standalone version tested. Slow processing, up to about 30 second. Not very accurate.
QR Midlet[11]	J2ME	Many key presses between start-up and scanning. Not very accurate.
Readbar[12]	J2ME, Open source	Picture distortion on start-up. ¾ screen green and red, ¼ camera.
Smartpox[13]	J2ME	Complicated registration. Not very accurate. Text cannot contain characters such as /.
SnapBar Reader		GUI does not work on Nokia N95.
Zxing[14]	Open Source. New, and expect rapid improvement.	Unable to install.
Shotcode[15]		Barcode does not contain text, but rather a reference number for lookup online. Not suitable for TIFF demo.

Mobile phone cameras differ greatly in quality, resolution and focus ability. We performed several tests to investigate how small barcodes the cameras on our mobile phones would be able to scan.

[6] *http://reader.kaywa.com/*
[7] *Real Time Streaming Protocol*
[8] *http://www.quickmark.com.tw/En/basic/index.asp*
[9] *http://www.i-nigma.com/personal/*
[10] *http://semacode.com/*
[11] *http://qrdemo.com/qrmidlet/*
[12] *http://sourceforge.net/projects/readbarj/*
[13] *http://www.smartpox.com/*
[14] *Part of Google Android SDK, http://code.google.com/p/zxing/*
[15] *http://www.shotcode.com/*

We first used the Lens Eye Test Chart, by SimpleAct[16]. This is a chart with barcodes printed on it in different sizes. Not surprisingly the results varied greatly by which mobile phone we tested. The phones tested were Nokia 6630, Nokia E65, SE 880W, and Nokia N95. Overall we got the best results using the Nokia N95. This is probably mostly due to the fact that it is the only camera with an auto focus lens, giving it the capability to focus on objects close to the lens.

We then performed several tests where we printed out barcodes in various sizes suited to the TIFF 07 paper catalogue. The Nokia N95 could pretty consistently scan barcodes, containing a simple web address, as small as 2,7 x 2,7 cm. This was a suitable size for the top right corner of a TIFF catalogue page. The other mobile phones could not read barcodes this small. To get acceptable results, we had to increase the size to approximately 4 x 4cm.

2.3 Streaming

There are numerous challenges in designing a system for streaming video to mobile phones. Most of the challenges are related to the diversity of mobile phone models and network speeds currently available. To overcome these challenges and deliver the best possible user experience on a mobile device, the media should be adapted both to the capabilities of the user mobile phone, and to the network connection used. These two factors combined determine the maximum quality possible for a video stream to a mobile phone:

- Network bandwidth and speed. The client's network speed, and the server's bandwidth will determine both the maximum quality of the video stream, and the maximum number of simultaneous users. This is because faster networks allow video to be encoded at higher bitrates.
- The mobile phone's support for streaming media formats, and codecs[17]. Support for newer and better codecs, means that better quality video can be encoded using lower bitrates.

Mobile phones differ in their support for streaming video playback. Some phones only support certain video formats, for instance Windows Media Video, or RealMedia, while others offer support for several formats[18],[19]. The most widely supported format for streaming video to mobile phones is the 3GP format, and we therefore made an early decision to base our system on 3GP[20].

The choice of media format also helped determine what streaming server to use. There are only a few open source streaming servers that support the 3GP format. Among them are Open/Catra Streaming Server[21], Darwin Streaming Server[22] and the VideoLAN server[23].

Of these the Darwin Streaming Server is the oldest and perhaps best developed open source streaming media server available. Over the last few years it has expanded and improved upon its support for 3GP streaming, and it was therefore a logical choice for us to use. In the past we have had some trouble

[16] *http://www.quickmark.com.tw/En/diy/?adPrintKnowhow*
[17] *http://en.wikipedia.org/wiki/Codec*
[18] *http://en.wikipedia.org/wiki/Windows_Media_Video*
[19] *http://en.wikipedia.org/wiki/RealMedia*
[20] *http://en.wikipedia.org/wiki/3gp*
[21] *http://sourceforge.net/projects/openstreaming/*
[22] *http://developer.apple.com/opensource/server/streaming/index.html*
[23] *http://www.videolan.org/*

with the way Darwin handles firewalls and Network Address Translation (NAT) in mobile networks. Thankfully we had no such issues this time, and installing and configuring the server was quite straightforward, only requiring us to open our network firewall on TCP port 554, and UDP port range 6970-6999.

We ran quite a few tests on our server, including a simulated stress test to determine how many simultaneous connections our internal network and server machine could handle. The results indicated an upper limit of around 150 simultaneous 160 Kbit/s streams.

To further test the mobile network, we conducted about 20 tests in various parts of Tromsø to determine if the 3G network in the area could handle our video stream in a reliable way. For this we used the same 160 Kbit/s test video. 160 Kbit/s is quite a bit below the theoretical limit of the 3G network of 384 Kbit/s for mobile systems, and it streamed perfectly well in all these tests[24]. The one unknown in these tests was whether increased traffic in the 3G mobile network, during the TIFF festival, would affect the network speed. To further reduce the risk of this becoming a problem, we decided to limit the video stream to a total of 132kbit/s for video and sound combined.

2.4 Adapting film trailers

The quality of streaming video is determined by several factors, among them the quality of the original source video, the algorithm used to compress the video (the video codec), and how much compression is used.

We received a total of nine film trailers from TIFF, and they varied in length from less than two minutes to almost five minutes. The picture quality also varied quite a lot, from excellent to quite poor. Some of the trailers were in QuickTime format, some in Windows Media Video format, and one was only available as an embedded flash video file in a web-page[25]. This complicated conversion and we used a number of different tools to accomplish it. Since our final conversion to 3GP format would be done with QuickTime Pro, we made an intermediate lossless version of all trailers in uncompressed QuickTime Animation format. This was done using a combination of Adobe products and open source tools such as Super and FFmepg[26] [27] [28]. Having an intermediate version of all trailers in QuickTime format made it easier to quickly convert multiple videos. We converted and hinted[29] all trailers for streaming using QuickTime Pro.

[24] *http://en.wikipedia.org/wiki/3g*
[25] *http://www.apple.com/quicktime/*
[26] *https://ffmpeg.dev.java.net/*
[27] *http://www.adobe.com/*
[28] *http://www.erightsoft.com/SUPER.html*
[29] *Darwin requires 3GP files to contain hint tracks for both audio and video. These tracks "hint" the server about what frames are key frames (still pictures), and function as a sort of time code, allowing the server to know where in the stream it's playing. This makes it possible to pause, and navigate the video stream.*

Figure 2.5 Trailer as it appeared on the Nokia N95 display.

In choosing a format to encode the trailers in, we had to consider what mobile phones they would be shown on. Within the 3GP format there are several options for video codecs, namely MPEG-4, H.263 and H.264[30]. MPEG-4 and H.263 are almost universally supported on mobile phones with 3GP playback capability, while H.264 is a newer compression format that offers better quality, but is not as widely supported.

We tested different codecs, bitrates and screen resolution. The quality of the video was considered important for the user experience, and it was decided to target newer 3G mobile phones, with a minimum screen resolution of 320*240, and support for H.264. The final format that we used to encode the trailers is summarized in the table below.

Table 2.2 Coding formats used in this study

	Video	Audio
Codec	H.264 in 3GP container v. 5, two pass encoding	AAC
Bit rate	100 Kbit/s, 15 fps	32 Kbit/s
Resolution	320*240 Screen resolution	16khz, Mono
Other	Hinted for streaming. Optimized for server.	

2.5 Design of WAP sites

Designing WAP pages for mobile phones is a little different than designing for the web. The screen space and resolution is limited, and the lack of a mouse makes interacting with the pages more difficult. On top of that the screen resolution will often vary between different mobile phone models.

[30] *http://en.wikipedia.org/wiki/3gp*

There are in general two differing approaches to designing mobile WAP pages for different screen resolutions.

The first approach is to make the page resolution independent, so that it scales to fit any screen size. This approach has the advantage of only having to design the page once, but the drawback is a lack of control over how the page will look on the mobile phone's browser. The phone's browser will scale and reposition elements as it sees fit, and so the design has to be very flexible. This often results in WAP pages using very simple design elements, and they can sometimes appear a little "boring".

The other approach is to design multiple versions of a WAP page, each one for a different screen resolution, in order to gain more control over the appearance of the WAP page. This can be done using Cascading Style Sheets (CSS), or more manually by creating multiple versions of a WAP page by for instance using a table based layout[31]. CSS is unfortunately not yet well supported on mobile phone browsers, and so a table based layout may in many cases be preferable.

For the TIFF demo, we knew the screen resolution of the mobile phones that would be used during the demo. We also wanted to incorporate a movie theatre theme into the page, as well as have everything contained on one screen. We did not want the user to have to scroll down to see the information or the advertisements. We therefore chose to design a table based html page, targeted for mobile phones with 320*240 screen resolution.

2.5.1 Choosing design elements

When we started to design the WAP page, we already knew a few of the basic elements that had to be incorporated into the design. We would have to use some recognizable TIFF graphical elements that would identify this WAP page as being a part of the festival. Information for each film would have to include the title of the film, and we decided that venues and times of screening would also be included. This information is not printed in the regular TIFF catalogue, and may change during the festival. By including it here, we could provide a way for users to get updated information. We also knew we would like a picture from the film or poster, a link for the trailer, and finally advertisements for some of the sponsors of the festival.

Since this WAP page was for a film festival, we considered whether we could include some other well known elements of the cinema and tie it all together into a cohesive theme. From that came the idea of using a movie theatre theme. The filmstrip became a border around the picture, and the movie screen became the clickable link for showing the trailer. The incorporation of the advertisement on the back of the seats was an idea taken from the use of advertisements on airplane seats.

To maximize contrast and help legibility on the small screen, we chose an almost black background colour with just a little blue in it. This also matched well with our theme of a dark movie theatre. The text colour is pure white, to help separate it from the background.

[31] *http://en.wikipedia.org/wiki/Cascading_Style_Sheets*

Figure 2.6 The WAP page describing the festival opening film.

The elements that make up the TIFF WAP page are as follows (Figure 2.6):

- At the top of the page, there is the TIFF typeface and graphics, along with the spotlights illuminating our main points of focus below.
- The middle of the page is made up of a picture of the film's poster, the title of the film, and the times and venues where it will be shown during the festival. The picture of the poster is a link that, if clicked, will display the poster using the full screen of the mobile phone.
- Further down the page we have a movie screen graphics, which if clicked, will open the mobile phone's media player, and start to stream the film trailer. The movie screen graphics contains a countdown image sequence that is continuously counting down. This was done to attract the viewers' eyes to the moving graphics, and help them to see the link for the film trailer.
- At the very bottom of the screen, we have the seats of the movie theatre. On the back of the three most prominent seats, the logos for some of the festivals sponsors are displayed.

2.5.2 Advertisement

In the TIFF trial we also wanted to investigate users' attitude towards advertisements on WAP pages. Seeing as the mobile phone has a smaller screen area, the ads could be perceived as more intrusive and annoying compared to full-sized web pages on a computer screen.

Figure 2.7 Advertisements are modestly places at the "back row" in the "cinema"

We decided to incorporate the advertisements into the theme of the WAP page, by making the sponsors' logos seem to sit on the backs of the seats in the movie theatre. The intention was to present the advertisement in a non-intrusive way, as opposed to using for example banner ads, or other graphic elements that would stand out more from the rest of the page design and theme.

Figure 2.7 gives an example of how three advertiser logos were displayed on the cinema seats at the bottom of the screen. The leftmost logo "Nordlys", a local newspaper, is also clickable and links to the WAP site of the newspaper.

The example WAP page illustrates how a TIFF WAP service could be valuable to the film festival. Not only could the information and the trailers be of help to the audience of the festival, resulting in more sold tickets, but a part of the display area on the WAP pages could also be sold as advertising space to the festival sponsors.

3 Method

The main objective of this study was to collect immediate comments from ordinary people on this kind of services and to better understand how such services should be implemented to grant attractive user experiences. As the number of WAP pages and film trailers were limited and the barcodes had to be included manually, an open large scale field trial was out of the question. Thus a controlled demonstration followed by some hands-on launched as the basis of a one sheet questionnaire filled out in situ.

Tromsø International Film Festival (TIFF) was the chosen event due to good timing and also geographical closeness to the research group. No other event was seriously assessed as an alternative location for the pilot.

3.1 Research questions and hypotheses

According to the Technology Acceptance Model (TAM) people's actual use of technology can be predicted by their expressed intentions to use it (Davis 1989). Thus this model might be useful in testing prototypes or services in the early stages of commercialisation. However, the original TAM (figure 3.1) does not model mobile internet use very well (Svendsen 2006). The following outline is based upon Bergvik et al. (2006) where TAM and TAM extensions (among others: Venkatesh et al. 2003) are discussed in a mobile, non-office, and non-professional context.

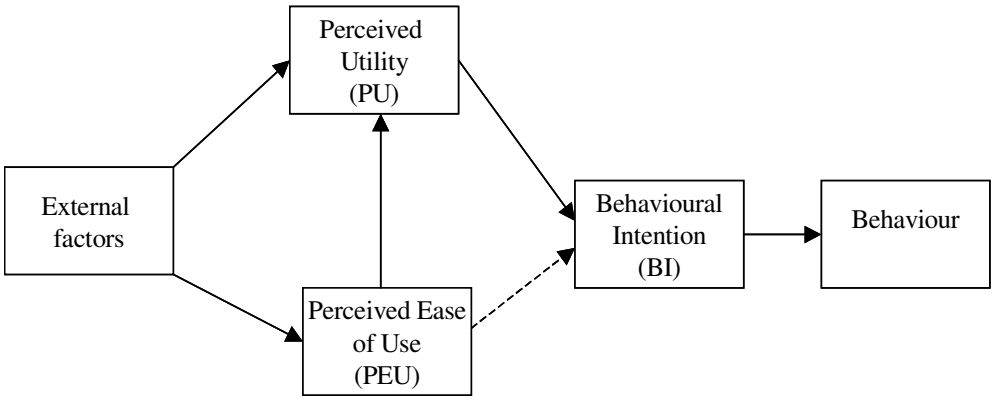

Figure 3.1 The original TAM dominated by usefulness and utility factors.

TAM proposes that intention to use is determined by the degree the technology is perceived by the user to be *easy to use* and to be *useful* (see figure 3.1). Davis (1983) concluded that usefulness was the major predictor while ease of use was a secondary predictor, influencing partly directly and partly by mediating usefulness. In an extended and more complex model Venkatesh et al. (2003) suggested four key constructs (performance expectancy, effort

expectancy, social influence and facilitating conditions), and a set of mediating factors (age, gender, technological experience and voluntariness of use).

These models were primarily utilitarian, explaining user acceptance as a result of the perceived usefulness of desktop technology in an office context. In studies of mobile services emotional and expressive factors seem to play a prominent role (Pedersen & Nysveen 2002; 2003; Pedersen et al. 2003; Leung & Wei 1999; Leung & Wei 2000; Wei & Leung 1999). Also social influence or social norms seem decisive to the acceptance and use of mobile phone services (Ling 2000; 2001; Ling & Helmersen 2000). Svendsen (2006) claims usefulness, enjoyment and social norms to be important, and enjoyment and social norms to be the only direct predictors when entertainment and social services are addressed. Usability factors have less effect (ibid). In the TIFF study the following factors are given special attention (see figure 3.2):

- Intention to use (IT)
- Performance expectancy / Usefulness (US)
- Effort expectancy / Ease of use (EU)
- Enjoyment / Affectivness (AF)
- Social influence (SO)

The mediating variables are those described by Venkatesh et al. (2003) except from the voluntarily factor which is regarded non-relevant in a non-professional setting. In this study the mediating factor attitude towards technology (AT) has been included, while gender and age were found not to have a significant influence. This gives the following model:

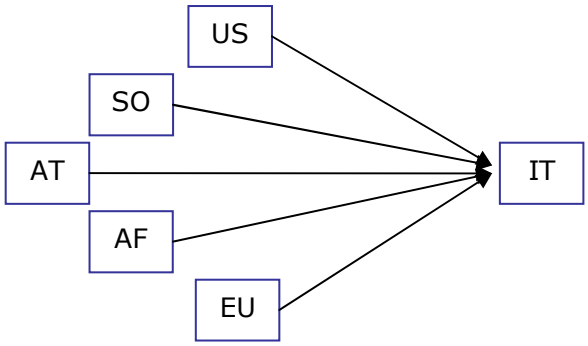

Figure 3.2 An simplified TAM model for the current study.

Former studies indicate that the factor performance expectancy has been regarded most important by men and young people, whereas women and older people have been more affected by the effort expectancy factor (Venkatesh et al. 2003). Further the effect of effort expectancy and social influence might decrease among technology experienced. Also the effect of social influence might be gender biased. It is interesting to check whether similar correlations could be found in the TIFF case. This could provide ideas for refining the simplified model in figure 3.2.

The following main hypothesis is put forward:

> *The informant's perceived usefulness, ease of use, affectiveness, social influence, attitude towards technology, age and gender impact on his/her intention of use.*

The questionnaire consists of 19 statements addressing the constructs included in the model. To some extent indicators from Venkatesh et al. (2003) were used, applying Likert scale variables with scales ranging from 1 to 5. The initial items used by Venkatesh et al. (2003) were adjusted to fit the service and the particular circumstances on a film festival location. The questionnaire also held questions on familiarity with mobile phones / mobile phone services, willingness to pay etc.

3.2 Recruiting approach and demonstration procedure

The informants were recruited on one of the film festival locations. A random sample of visitors (if recruiting informants based on the researcher's inclination to ask one person and not another - can deserve the label "random") were asked to participate when staying in calm areas of the entrance to the cinema. It was the researchers' intention to recruit a wide spectre of personalities, both genders and all ages. A minimum of 40 informants should answer the questionnaire. The recruiting process lasted throughout three days, focusing on the periods of the day when most people visited the location.

A poster and flyers (see appendix 1) informed the visitors about the ongoing service demonstration. The informants were given a brief introduction of the project before the service was demonstrated on a Nokia N95 or a N82. The researcher described the service's main functionalities and how to operate it. The demonstrations were given on the project's mobiles only. No private phones were used.

A total number of nine pages in the festival program were equipped with barcodes. Thus nine WAP pages were implemented and 9 film trailers made ready for streaming. If the informant found a film of particular interest this film was chosen for the demonstration. Otherwise, a random film was chosen. The informant scanned the barcode and made needed navigations with the mobile phone mouse to start the streaming process. After looking at the trailer they were invited to pick another film and go through the procedure again – still with guidance from the research assistant.

Afterwards the informants were asked to fill in a questionnaire. Most informants completed the questionnaire within 5 minutes and total time spent was approximately 10 minutes. Comments given by the informants during the demonstration were annotated. No incentives were given.

During the film festival period the 3G network covering the area was unstable and partly not available, resulting in the video occasionally failing to streaming. The unstable conditions were probably related to recent upgrades of the network to 3,5G (HSDPA) with increased bandwidth. To circumvent this problem the location's WLAN network was used as all phones had WLAN capability. As the user experience was not influenced the informants were not informed.

3.3 Analysis

43 questionnaires were filled in, collected and manually registered. The analysis of the data reported in chapter 4 has been done using SPSS[32].

[32] *http://www.spss.com/*

4 Results

4.1 The sample

The sample includes 43 informants: 23 men and 20 women. The youngest one was 14 years old and the oldest one 71. 1 informant belongs to the kids age group (0-14 years), 23 informants belong to the youth age group (15-29 years), 14 informants belong to the established age group (30-54 years), and 4 informants belong to the senior age group (55 years and older). The average age was around 33 years with a standard deviation of 15,42.

Only 1 of the 43 informants did not own a mobile phone. More than 95% use the mobile for talking and SMS, around 55% for MMS, 20% for email, 30% for searching and reading news and 11% for buying products and services.

4.2 Technology acceptance

This section presents results to the various questions included in the following constructs: AT, US, EU, AF, SO and AT.

4.2.1 Attitude towards technology (AT)

The attitude towards technology factor (AT) includes two attitude statements:

> "It is a good idea to use the mobile in this manner" - 90,7% of the informants agreed (answered 4-partly agree or 5-agree)
>
> "I'm sceptical to new mobile services" - 9,3% the informants agreed (answered 4-partly agree or 5-agree)

The resulting AT distribution (after turning the scale of the last statement) shows a positive attitude towards technology in that around 70% of the informants got a combined score (average) for the 2 statements of 4 and higher.

4.2.2 Performance expectancy / Usefulness (US)

The usefulness factor (US) includes three attitude statements:

> "It is important for me to get info instantly (there and then)" - 51,2% of the informants agreed (answered 4-partly agree or 5-agree)
>
> "It makes the decision of which film to see easier" - 53,5% of the informants agreed (answered 4-partly agree or 5-agree)
>
> "It is practical to use the camera phone to retrieve information" - 59,1% of the informants agreed (answered 4-partly agree or 5-agree)

The resulting US distribution shows a moderate positive attitude with regard to usefulness of the TIFF event assistant in that around 42% of the informants got a combined score (average) for the 3 statements of 4 and higher.

4.2.3 Effort expectancy / Ease of use (EU)

The ease-of-use factor (EU) includes five attitude statements:

> "I immediately understood how to position the camera" - 60,5% of the informants agreed (answered 4-partly agree or 5-agree)
>
> "It took long time to get the trailers" - 20,9% of the informants agreed (answered 4-partly agree or 5-agree)
>
> "It was difficult to catch the barcode with the camera-phone" - 11,6% of the informants agreed (answered 4-partly agree or 5-agree)
>
> "I immediately understood where to click to see the trailer" - 60,5% of the informants agreed (answered 4-partly agree or 5-agree)
>
> "It was too much information on the screens" - 11,7% of the informants agreed (answered 4-partly agree or 5-agree)

The resulting EU distribution (after turning the scale of the "negative" loaded statements) shows a positive attitude with regard to ease-of-use to the TIFF event assistant in that around 60% of the informants got a combined score (average) for the 5 statements of 4 and higher.

4.2.4 Enjoyment / Affectiveness (AF)

The affectiveness factor (AF) includes three attitude statements:

> "It is a pleasant info retrieval application of the mobile" - 72,1% of the informants agreed (answered 4-partly agree or 5-agree)
>
> "It would be attractive (interesting) to view trailers on the mobile" - 67,4% of the informants agreed (answered 4-partly agree or 5-agree)
>
> "I would like to use images as a starting point for finding information" - 67,4% of the informants agreed (answered 4-partly agree or 5-agree)

The resulting AF distribution shows a positive attitude with regard to affectiveness to the TIFF event assistant in that around 62% of the informants got a combined score (average) for the 5 statements of 4 and higher.

4.2.5 Social influence (SO)

The social influence factor (SO) includes two attitude statements:

> "My friends would like such a service" - 55,8% of the informants agreed (answered 4-partly agree or 5-agree)
>
> "I am expected to use such services" - 23,3% of the informants agreed (answered 4-partly agree or 5-agree)

The resulting SO distribution shows a neutral attitude with regard to social influence to the TIFF event assistant in that around 25% of the informants got a combined score (average) for the 2 statements of 4 and higher.

4.2.6 Intention to use (IT)

The intention to use factor (IT) includes two attitude statements:

> "I would resist to use such a service" - 11,6% of the informants agreed (answered 4-partly agree or 5-agree)

"If the service was available, I would start to use it now" - 51,2% of the informants agreed (answered 4-partly agree or 5-agree)

The resulting IT distribution shows a positive attitude with regard to taking the TIFF event assistant into use in that around 51% of the informants got a combined score (average) for the 2 statements of 4 and higher.

The mean IT score for the 23 men was 3,587 whereas the mean IT score for women was 3,825. Therefore the women seem to have a slightly higher intention to use the TIFF assistant than the men. This difference between groups was however not found to be significant.

Further, no significant correlation between age and IT was found.

4.2.7 Factors influencing the intention to use the TIFF event assistant

The research model proposed a connection between IT and the other factors (age, gender, AT, AF, SO, EU and US). Based on the findings of no significant correlation between age and IT and no differences in the mean IT between men and women, an analysis of remaining factors influencing IT was carried out. This was done stepwise by manually removing the most significant factors from the equation (IT=AT+AF+SO+EU+US) in each step.

The analysis showed that the model had a good fit and that AF was the most influencing factor followed by US and SO. These factors also showed significant correlations to the IT factor. AT had limited influence while EU was found to have minimal effect, if any.

4.3 Advertisements

37,2 % agreed that "Advertisements on the mobile are disturbing", yet only 32,6% noticed the ads (clickable logos on the upper back of the seats) shown at the TIFF WAP pages.

34,9 % disagreed and 41,9 % agreed that "Ads used this way is OK if it makes the service cheaper to use".

4.4 Willingness to pay

31% of the informants think the service should be free of cost to the user. 52% think that 1 NOK or less is an acceptable price to see a trailer in this manner. 83% think that 5 NOK or less is an acceptable price to see a trailer in this manner.

4.5 Summary

The analyses have examined the main hypothesis put forward in chapter 3:

> *The informant's perceived usefulness, ease of use, affectiveness, social influence, attitude towards technology, age and gender impact on his/her intention of use.*

We have found that the TIFF event assistant was well received among the informants and more than half stated that they would use it if it had been available. We found that affectiveness was the factor that had the highest

influence on the intention to use the assistant. The next most influencing factors were usefulness and social influence.

More than 2 out of 3 appreciated the use of images as a starting point for retrieving information about an object of interest.

No significant differences related to age and gender were found.

5 Discussion and further work

This study has addressed the challenge of making information more available to customers using non-textual interaction from mobile phones. The TIFF event assistant provides the user with a WAP page containing detailed information and including a trailer as a match to a scanned barcode.

Search based on visual markers is less time consuming than content based retrieval. However, the use of codes and visual markers presupposes a prior manifestation of the link between the physical and the digital world (see also Rahlff 2005). This is not the case when the searching key is an image shot by the user – as in the tourist case mentioned in the introduction (Schürmann et al. 2006). Here the image constitutes a non-persistent connection between a physical object (e.g. a tourist attraction) and digital information accessible by mobile phones or other devices. And further, by means of the image only the user is able to initiate a non-textual query for more information. The TIFF event assistant brings forward the strong non-textual interaction capabilities, but is otherwise dependent of pre coded physical markers to establish the physical-digital connection. In this very context pre coding or physical tagging is manageable, but in wider perspectives the potential of services based upon content-based information retrieval systems is far beyond those of visual markers.

In a follow up study by Telenor R&I the use of image recognition (in contrast to interpretation of barcodes) as a basis for an event assistant will be tested within the Visual Search Pilot (VISEP) project[33].

Another interesting follow up study on making information more available could be through the use of NFC[34] technology as described in the Smart Movie Poster example by (Ailisto et al. 2007).

A further extension of a film festival assistant's functionalities could include options for:

- receiving updates to the program (including offers for cheaper tickets in case of lots of vacant seats short time before the show starts)
- receiving advertisements (coupons/vouchers tied to specific posters)
- buying tickets (e.g. through MobilHandel[35])
- voting (for various public awards)

The study has also contributed insights into factors influencing a user's intention to take mobile services into use. For this kind of service the hedonistic factor affectiveness seems to play a more important role than the utilitarian factors usefulness and ease of use. More detailed analyses will be made on this data in a follow up study where data from several pilot studies conducted by Telenor R&I will be analysed with a focus put on factors explaining technology acceptance for mobile services.

[33] *The Visual Pattern Recognition (ViPR) software by Evolution Robotics will be used as a basis for a mobile assistant to The Film fra Sør festival in Oslo, October 2008. See details in a forthcoming Telenor R&I report by Calicrates Policroniades et al.*
[34] *Near Field Communication*
[35] *http://www.telenor.no/privat/mobil/tjenester/mobilhandel/*

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Appendix 1 Flyer used on location

TIFF 2008 på mobilen

Mobilen kan brukes til så mangt: Samtaler, meldingsutveksling, nettlesing, radio, walkman, nøkkel, lommebok – og nye anvendelser dukker stadig opp. Ved Telenors forskningsavdeling i Tromsø utvikles nye mobile tjenester. Vi er opptatt av hvordan mobiltelefonen kan utnyttes og hvordan nye tjenester skal utformes for å møte publikums krav.

En anvendelse med stort potensial er *bruk av bilder for å søke etter informasjon*. Visjonen er her å forenkle formulering av et søk og utnytte ideen om at et bilde kan si mer enn 1000 ord. Mobiltelefonen har i dag kamera, og det er dermed gjort med et tastetrykk å beskrive hva du ønsker av informasjon – uten å skrive et eneste ord. Under TIFF vil Telenor demonstrere en tjeneste – en prototyp av en tjeneste – som er skreddersydd for publikum på filmfestivaler. Tjenesten gir brukeren informasjon utover det som finnes i festivalkatalogen. Brukeren "skanner" bilder (strekkoder) i TIFF-programmet med mobilens kamera. Tjenesten returnerer filmens visningstidspunkt og -sted, samt tilhørende filmtrailer.

Denne tjenesten kan videreutvikles slik at brukeren gis mulighet til å kjøpe filmbilletter eller stemme på årets publikumsfavoritt. Det vil også bli mulig å ta bilde av selve illustrasjonsbildet i filmkatalogen eller på filmplakaten, og bruke dette bildet som forespørsel etter mer informasjon. I tillegg kan det bli aktuelt å gjøre koplinger til sponsorer av festivalen.

Telenor undersøker folks holdninger til å benytte bilder i stedet for tekst for å søke etter informasjon. I forbindelse med demonstrasjonene vil vi be TIFF-publikum komme med sine umiddelbare reaksjoner. Demonstrasjonene vil bli holdt på en stand i KulturHuset onsdag, torsdag og fredag i festivaluka.

Har du innspill eller kommentarer, ta kontakt med

Telenor R&I ved Anders Schürmann
anders.schurmann@telenor.no

Appendix 2 Media coverage

Bladet Tromsø, January 18, 2008, page 16:

FILMFESTIVALEN 2008

TRAILER: *Bente Evjemo viser hvordan man i framtida enkelt kan se traileren til «No country for old men» på mobilen ved for eksempel å ta et bilde av en filmplakat.*

Mobil filmsjekk

Inger Præsterg Thuen og Ronald Johansen (foto)

Nå kan du se filmtrailere og søke om filminfo ved å scanne et bilde med mobilen din.

Tjenesten er foreløpig bare en test utviklet av Telenors forskningsavdeling i Tromsø. Men den kan i dag oppleves i foajeen til Kulturhuset der forsker Bente Evjemo demonstrerer mulighetene for interesserte festivaldeltakere.

– Poenget er at mobilen kjenner igjen det bildet du scanner, og deretter bruker bildet til å søke etter mer informasjon. Du kan altså spørre om informasjon ved hjelp av et bilde i stedet for ord, forklarer Evjemo.

Viser trailere

Som eksempel bruker hun filmen «No Country for Old Men» som er festivalens avslutningsfilm. I festivalkatalogen er det for anledningen klistret inn et visuelt symbol for filmen som blir gjenkjent av mobilen når man scanner bildet av det.

Der etter sender mobilen linker til sider med mer informasjon om filmen. Det kan være slikt som visningstid og -sted, samt trailer for filmen.

Tjenesten kan også videreutvikles slik at man eventuelt kan kjøpe billetter eller stemme på årets publikumsfavoritt.

Alt er foreløpig på teststadiet, og det er opp til kunder som TIFF eller andre om tjenesten blir tatt i bruk for eksempel ved neste festival.

Teknologien er uansett svært interessant for mobilselskaper. Prinsippet om å bruke et bilde – eller lyd – til å søke etter informasjon kan brukes på mange forskjellige måter.

– For eksempel bilde av et platecover. Da kan man søke etter informasjon om personene som er tilknyttet musikken, eller man kan høre smakebiter fra plata, sier Evjemo.

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