

## **EXPERIENCES FROM USING AUGMENTED REALITY IN COMBINING PRINT WITH DIGITAL**

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This paper combines results and observations from two on-going research projects, Future Magazine and Ubimedia. In Future Magazine one of the aims is to get an understanding of the global potential of Augmented Reality (AR) applications in combination with printed products. Augmented Reality (AR) is the technique of superimposing virtual objects in the user's view of the real world, providing a novel visualization technology for a wide range of applications. Hence, it is a user interface technology that combines the perception of real environments with digital, virtual information. Examples from using AR in the publishing field start from 2000, but the number of examples has rapidly increased during the past couple of years. In this paper, on the one hand we aim at getting a better understanding of the consumers' (users') readiness to start using mobile AR applications together with printed magazines. This approach comes from the Future Magazine project and is theoretical in nature. Information is mainly searched through the net and from future scenarios. On the other hand, through the Ubimedia project we also have a very practical approach, as we aim at creating a mobile AR application that enriches and adds value to the reading experience. The application will be published in Aller Medias magazine and the design process will be carried out together with the consumers and with one advertiser. Even though it is a research project, it will be carried out as a real life case, enabling a learning process for all the parties involved in the project. The paper will be divided accordingly in two parts: first looking at the potential of AR applications in theory and second evaluating it with a real life case.

### **Technology for mobile and interactive applications**

Technology for combining print with digital has been available for several years now, and different commercial applications have been tested and used since the early 2000's. The applications designed with 2D barcodes, such as QR or Ucode, to be used with mobile phones to link physical products with digital content have been very popular in Japan, but only recently have more and more applications emerged also in Europe and the US.

The growing use of smartphones and reading pads are changing people's media reading habits. Because access to web services is everywhere, consumers are more and more used to getting updated information based on their instant needs. This sets increased demands for printed products in order to compete with other media. At the same time, a sophisticated combination of media could generate benefit for both consumers and partners in the production chain.

As several examples of connecting print with digital media are already on the market, this study outlines noticeable trends that have a clear effect to the media mix and presents some innovative approaches – especially in the case of magazines. This study concentrates especially on applications connecting magazines to other media and *mobile* terminals. Rapid development of technological devices makes way to new interesting mobile applications. At the same time publication of these new applications is easy through the net.

Deloitte's trend report from 2010 gives a forecast of increasing business areas in future. "Going Interactive" represents traditional media sectors that are beginning to use digital and interactive technologies to reach customers:

- Interactive television and film
- Interactive radio and music
- *Interactive publishing services*

Even though the magazines market is seen as mature, the market still presents opportunities. Based on Deloitte's analysis in US, UK and Japan, traditional media is expected to offer low growth rates while interactive services market is expected to grow much more, especially in the "going interactive" segment. According to data in Figure 1 (Deloitte 2010, Source: Wilkofsky Gruen Associated 2008) there is a steady annual growth of traditional media markets except physical recorded music. On digital media market the growth in percent is clearly higher but the volumes are still quite reasonable. Multichannel advertising is the largest digital media market.

It should be noted that a single innovation may not always turn into new business. But a combination of new ideas in developing project may result as a totally new business concept. The International Federation of the Periodical Press (FIPP) has published a report called “Innovations in Magazines 2010”. The following examples – which are related to interactive applications in magazines – are extracted from this report.

- **Mobile phones.** Publishers are keen to edit their content also to smaller screen and offer magazine apps for smartphone users
- **2D barcodes.** Reading the tag by camera phone creates a link from printed material to information, game, video, etc.
- **Magazine TV station.** A TV magazine has an own channel in YouTube video service. Up-to-date-information and niche content is published every day.
- **Augmented reality.** Computer’s web cam is pointed to square symbol on a magazine page. A plug-in software opens living content on the screen. This can be living addition to editorial material or an advertisement.
- **Embedded video.** A cheap video device consisting of thin monitor, a speaker and battery is inserted into a magazine. The “video in print” concept may contain editorial or advertising material.
- **Gaming.** A magazine uses content-related games to extend its brand to readers. Access to the games is via the website of the magazine. Part of the games may be open for everyone but more sophisticated versions are only for subscribers.

What is common for all the previous examples is that new output devices create possibilities. Several output channels create the need to have knowledge and technology to combine and edit all material for publication. Some innovations may not have a short payback period but they can strengthen the position of the magazine on the market.

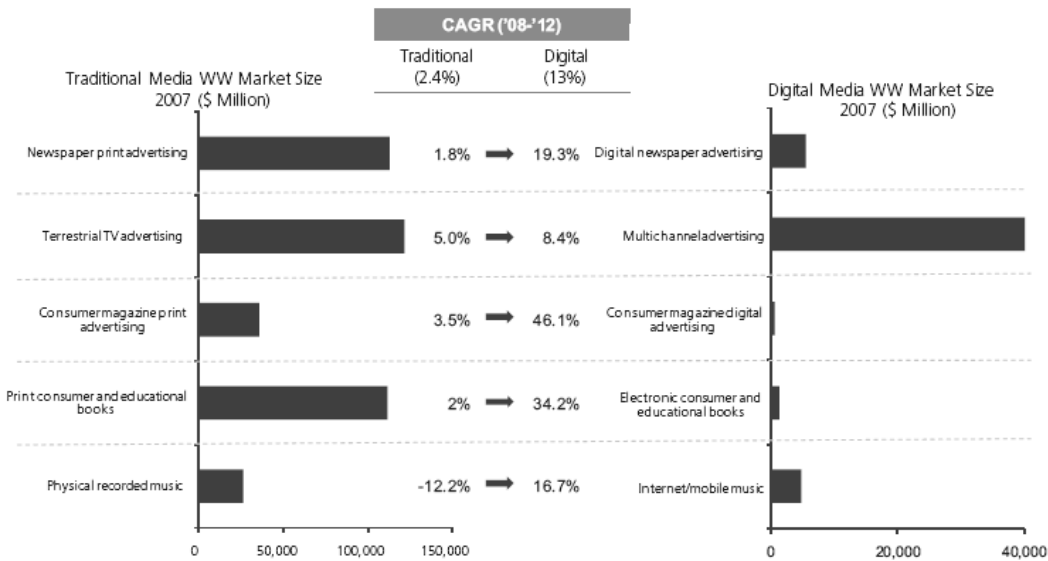


Figure 1. Comparison of traditional media vs. digital media market size and annual growth (Deloitte 2010).

**Consumers and mobile devices**

Mobile device producers are competing intensively with each other. Mobile device sales to end users in Finland are presented in Figure 2 (Forecast: Mobile Devices, Worldwide, 2008-2015. Gartner Market Statistics 2011). The device types are divided into four device categories: low-cost, basic, premium communication (smartphone) cheaper than \$300 and premium communication more expensive than \$300. It is not a surprise that total volume of sales grows continuously. When the device categories are compared there is a clear trend: cheap smartphones interest the consumers the most. It should be noted that operators in Finland enhance people to buy smartphones by combining the sale of a phone and a data connection.

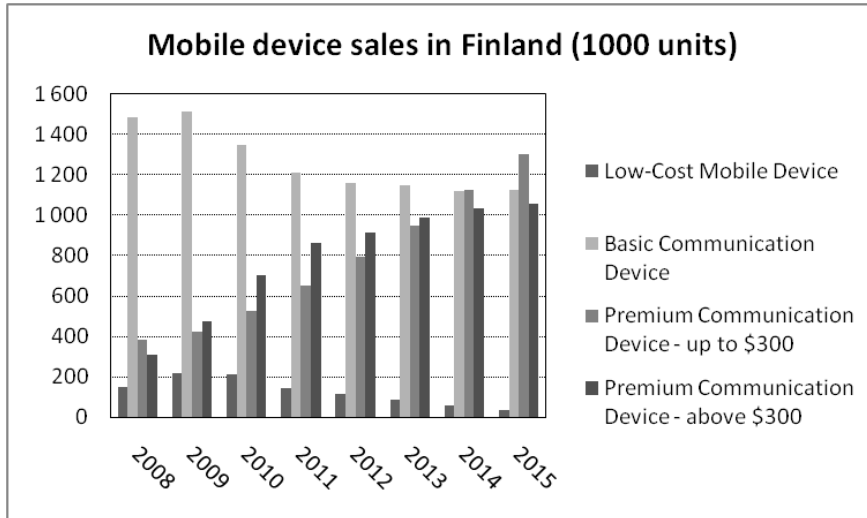


Figure 2. Forecast of mobile device sales in Finland (Gartner 2011).

The trend shown in Figure 2 appears to be quite typical in Western Europe as similar trends can be found in other countries as well, e.g. in the UK and Germany. The forecast for the US market is slightly different (Figure 3), as growth is predicted for all the other segments but the basic communication device. Premium communication devices show clearly larger growth rates in the US market than in Western Europe. On the other hand, when statistics from India and China are plotted the main interest there is still in low-cost and basic communication devices. This is quite obvious because many of the consumers are just buying their first mobile phones.

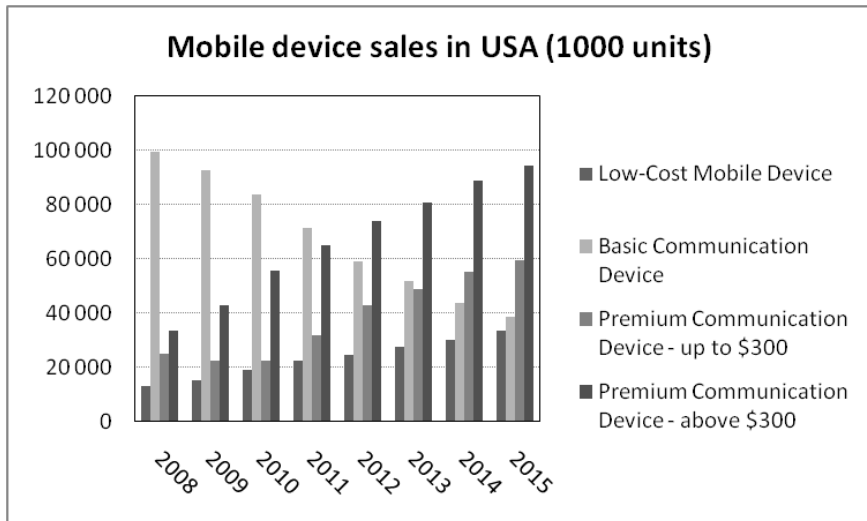
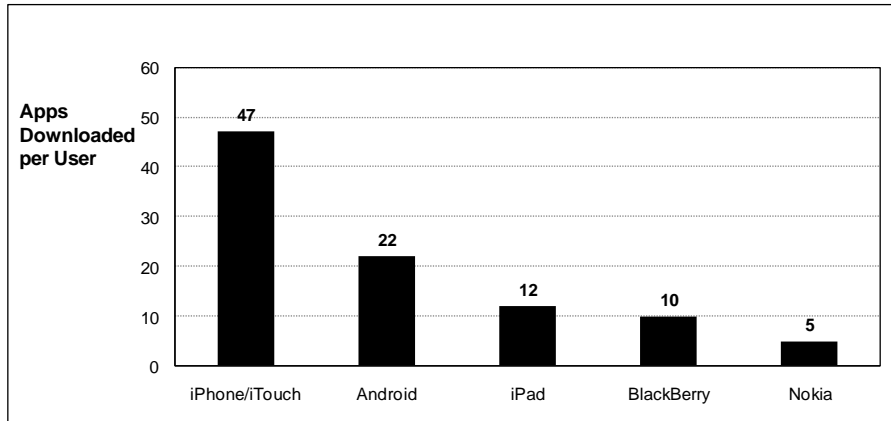


Figure 3. Forecast of mobile device sales in USA (Gartner 2011).

The smartphone needs an operating system. The competition is hard and everyone wants to have the biggest market share. Large distribution of a certain operating system gives great possibilities to application developers and is also easier for ordinary

consumers. One presentation of available applications and their downloads can be found in Figure 4. According to the figure, an average iPhone user downloads more different apps than users of other systems, but there are also considerably more applications available for iPhones than the others.



Apps Available	200K	50K	3K	5K	7K
Apps Downloaded	4B+	400MM	12MM+	-	-
Installed Base	86MM	10MM+	2MM	20MM*	50-70MM*
Launch Date	7/08	10/08	4/10	4/09	5/09

Figure 4. Average number of applications downloaded per user. (Morgan Stanley, Internet trends 2010).

Even though the technology is here for very different ways of combining printed and digital content, it is by no means easy and simple to be a pioneer in this field. All parts of a marketing campaign should, of course, be ready and tested before launching, but still there are attempts that just don't work. A typical bad example is like this: a campaign consisted of a printed catalog, which had a link to on-line shopping platform. A 2D barcode was printed on the catalog, and the user was instructed to use his or her smartphone for shopping. However, in real life the catalog was delivered before the data of the new products was put into the shopping system. Hence, in practice the consumers could not buy the items on-line. This led to diminished trust of the company. Several examples of failures can be found from (<http://mobilemarketingfail.com>).

### AR applications in Aller Medias magazines

Achieving a convincing and believable combination of the real and the virtual worlds is possible with AR technology, but the system often requires a detailed and accurate model of the real scene and the virtual information. Hence, traditionally, AR applications are only available on high-end desktop computers or notebooks as they are the devices that have enough computing power. However, with the rapid revolution of mobile devices in the recent years, smartphones nowadays are often equipped with processors and memory that makes mobile AR applications possible. Another feature of the smartphones is that they come with camera enabled. This has resulted in increasing popularity of mobile AR applications on smartphones in the recent years. Juniper Research and Network Technology even project that there will be around US\$732 million revenue AR Market by 2014. At the moment it very much seems that mobile AR is becoming the star of the next century. In addition, it is believed that the gaming industry will have revolutionary influence by the prosperity of mobile AR entertainments development.

The first AR application published in a printed magazine in Finland was a joint effort by VTT and Aller Media in April, 2010 ([http://www.youtube.com/watch?v=O\\_51m\\_rttWU](http://www.youtube.com/watch?v=O_51m_rttWU)). The application was at the same time demonstrating an AR application for the readers of the TV magazine Katso and advertising a new TV program for children, the Dibidogs. The user downloaded a program from the webpages of the TV magazine, and by using a web camera they could "play" with the main character of the Dibidogs, Adi dog. The application had interactive features, as by shaking the camera up and down or sideways, Adi dog made some tricks. Co-operation continued in the end of 2010. At Christmas time two Finnish films had their premiers, and at the

same time these films were presented in the gossip magazine Seiska as AR applications (<http://www.youtube.com/watch?v=s1WfsnjJdu4>). This time, the users' didn't need to download anything, they just needed to go to Seiska's webpages and they could see advertisements of the films through the web camera. All applications attracted a good number of users, and received positive feedback.

With the prediction of Juniper Research of the growth potential of mobile AR applications in mind, also the AR application that will be presented the next in one of Aller Media's magazines will be a mobile AR application. Juniper expects that mobile AR applications will have seven primary uses:

- Location-based search
- Games
- Lifestyle/Healthcare
- Education/Reference
- Multimedia/Entertainment
- Social Networking
- Enterprise

Juniper also predicts that these seven mobile AR niches will produce three primary revenue streams: pay-per-download, incremental revenues (including subscriptions and preinstalled apps and browsers), and *advertising*. From the viewpoint of printed magazine, this potentially offers very new ways for the brand owners to get more detailed information of how popular their advertisements are, when do people enter the digital content, how long they stay with it and possibly also offer a purchasing channel of their products this way. Also in our case a mobile AR advertisement in a printed magazine was of specific interest.

### **Users involvement in the design process**

A lot of engineering work has been wasted over the years in designing and developing products that were neither wanted nor accepted by the users. User feedback often arrives too late, when it is no longer possible to change key design decisions. In this study, a user-centric approach was taken in the design process of the new mobile AR application already from the very beginning. The process was adopted from the ISO 9241-210 standard "Human-centred design for interactive systems" and is illustrated in Figure 5.

The process started with a state-of-the-art review of AR applications. Based on the review, the applications were roughly divided into three groups with applications that were purely entertaining, games and game-like applications and finally applications that intended to be useful for their focus groups. These applications were used as examples in focus group interviews carried out with the readers of three Aller Media magazines: ELLE (fashion, focus group interview: 6 female young adults), FIT (sports, focus group interview: 6 female young adults) and Seiska (gossip, focus group interview: 3 male and 2 female middle aged adults). Based on the results of the interviews, the most promising focus group and application type were chosen. In the second phase of the process the first version of the application will be built and used to demonstrate the application in the second interview. In this interview we will focus more on the technology acceptance of a mobile service (Kaasinen, 2005). Personal mobile devices are increasingly being used as platforms for interactive services, but as the approach and the technology are not well known for the consumers, it is interesting also to take this viewpoint. Ease of use is important, but the applications and services should also provide clear value to the user and they should be trustworthy and easy to adopt. Therefore, the aim in the second interview is to analyze the users from the technology acceptance perspective. The intention of the focus group to use the actual application and predicting the perceived ease of adoption will be studied. In the final phase of the process the magazine will be published (in October 2011), and comments from the users will be collected. In this paper we'll focus on the first and second phases of the design process.

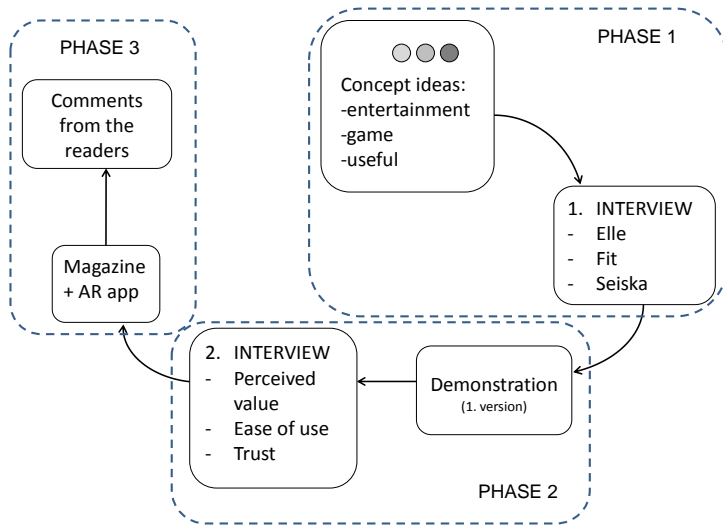


Figure 5. Structure of the design process and the different phases of user involvement for the AR application in a printed magazine.

### Results from the interviews in the first phase

In the first interview, different examples of mobile AR applications were presented to the readers of three different magazines. None of the readers were familiar with the term Augmented Reality, but when looking at the examples, all of them knew some mobile applications and nearly all of them had sometimes used a mobile application. About half of the interviewees thought of themselves as active users of mobile applications. The most enthusiastic users of mobile applications said that they are interested in technical devices and would be ready to personally invest on technology. They also owned a smartphone and/or a tablet. The ones that used mobile applications the most were clearly the ones with a busy and mobile lifestyle. For example, they found it convenient to use facebook, read e-mails or just surf the net while commuting. In addition, as they were on the move a lot, they also enjoyed having map and navigation services easily at hand. The positive attitude towards mobile applications in general aroused from this same need. That is, mobile applications were used to ease the ordinary daily routines and for achieving some personal goals. In other words, usefulness was the primary reason motivating the use of mobile applications.

Even though three different magazines and their specific focus groups were invited to the interviews, it was interesting to notice how similar the basic motivation for the use of a mobile application was. However, as the interests of the focus groups were different, also the issues they found useful were different. The ideas that the users came up with as useful applications were guided by their own interests themselves, which derive from similar needs as their choice of a magazine and is also supported by the content of the magazine.

It was easy to come up with different useful mobile applications for the interviewees in all three groups, but still it was not always easy to understand all the possibilities that AR technology offers. Especially with Group 3, the readers of the gossip magazine, it was quite difficult to discuss about applications that were not available yet and appeared quite futuristic to them.

In all three groups, the idea of achieving additional information of an article or advertisement in then printed magazine in digital form in the smartphone was well received. In all of the focus groups studied, games or game-like applications did not receive any spontaneous interest. However, competitions and discounts were found more appealing, at least to a certain point. In this case, ease of use appeared to be the most important factor. The readers felt that taking part in the competition should not be too difficult and that acquiring a discount coupon should not be too tedious. For example, if achieving a discount coupon required that the user was at a certain location, the first response was that the readers did not feel interested enough to travel very far from their own neighborhoods.

Based on the interviews and the specific user needs that could be analyzed, we chose the ELLE readers as the focus group to continue with. The attitudes of the ELLE readers were well in line with the aim of the study to make a real life case with an advertiser.

## Technology acceptance of mobile services

User acceptance is crucial to the success of new technologies but it is difficult to predict. User acceptance of new technologies that are not just incremental improvements on existing ones but cause clear changes in peoples lives, so-called disruptive technologies, is especially hard to predict because these technologies may take decades or longer to undergo the transition into everyday objects (Norman, 1998). Similarly, predicting acceptance in the case of radical innovations is challenging, since consumers are not always able to perceive or explicitly state the value of a radically new product, but instead, they need to learn the value by experimenting it (von Hippel, 1986).

Business and marketing research already have approaches where new technology is studied on a wider scale. The Technology Acceptance Model by Davis (1989) defines a framework to study user acceptance of new technology based on perceived utility and perceived ease of use. Each user perceives the characteristics of the technology in their own way, based for instance on their personal characteristics, attitudes, previous experiences or their social environment. Innovation diffusion theory (Rogers, 1995) explains the adoption of new practices and technologies in the society in different adopter groups (early adopters, early and late majority, laggards). The Technology Acceptance Model and Innovation Diffusion Theory have been evolved and applied widely, but mainly in the context of introducing ready-made products rather than in designing new technologies. In this study, the consumers are used to using the platforms that are utilized for the application. We are on the one hand using a traditional printed magazine as a starting point with an advertisement including an AR marker, and a smartphone to continue to the digital environment. On the other hand we are introducing a new mobile service in the form of an interactive advertisement. Therefore, neither of the theories fit our purposes as such.

Väänänen-Vainio-Mattila and Ruuska (2000) list characteristics of mobile contexts of use that should be taken into account in designing mobile services, classified as the technical context, the physical context and the social context:

- The *technical infrastructure* includes mobile networks that have lower bandwidth than fixed networks and may impose restrictions on usage. The user can be out of network coverage or have bad network coverage. The user needs to get feedback of the progress of data transfer and, moreover, (s) he will need to estimate beforehand how long certain operations may take.
- Regarding the *physical context*, user mobility may change the context within a usage session. The user may need to use the device in unstable and varying usage positions, and the user may use the device while moving. The usage may take place in a moving environment such as car or train. Other environmental factors such as variable lighting conditions, noise and varying climate may affect the usage situation.
- The *social context* may implicate needs to collaborate and share information with others. It may also mean a need to keep interaction paths relatively short and/or quiet.

Even though this study is more than ten years old, the characteristics are still valid, although the relevance from the users perspective may be somewhat different today. Especially the role of social context is very probably different now with people using the smartphone increasingly for social media services.

Kaasinen (2005) studied the user acceptance of mobile services, in particular mobile Internet and location-aware information services targeted at consumers based on a series of field studies of different services. Her studies took into consideration e.g. the following questions: What kind of general attributes can be recognized in the services that affect user acceptance? What kinds of service entities are acceptable both by the end users and the service providers? How can we balance user needs, the service provider's interests in providing services, and the possibilities offered by the technology?

Kaasinen's study has been used as a basis for the interviews in the second phase. In the second interview we will still focus on the focus group in general. Technology acceptance models aim at studying how individual perceptions affect the intentions to use (information) technology and further the actual usage as presented in Figure 6. According to the Technology Acceptance Model for Mobile Services, user acceptance of mobile services is built on three factors: *perceived value of the service, perceived ease of use and trust*. These three factors affect the intention to use a mobile service. With mobile services targeted at consumers, taking the services into use is often a major obstacle to the user. A fourth user acceptance factor, perceived ease of adoption becomes more prominent as the user proceeds from an intention to use to actual usage.

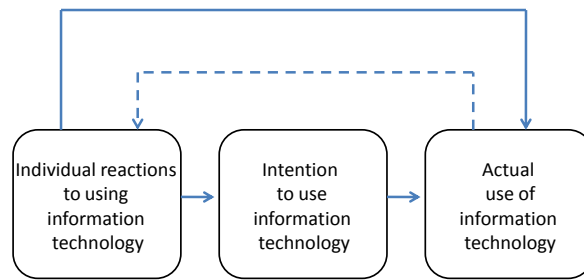


Figure 6. The basic concept underlying user acceptance models (Venkatesh et al., 2003).

- *Perceived value:* Instead of a collection of useful features, mobile services should provide value to the user. The value of the service can be based on utility, communication or fun provided to the user. The users value seamless service entities whereby the user is supported throughout the whole usage situation, even from one terminal device to another. Ease of use requires a clear overview of the service entity, fluent navigation on a small screen and smooth user interaction with the service.
- *Ease of use:* The users should get personally relevant services and information and the services should be designed to be adaptive to the wide variety of devices and networks.
- *Trust:* As individual users increasingly use mobile services in their everyday lives and the services increasingly collect, analyse and redirect personal data, user trust in the services becomes more and more important. The user should be able to assess whether (s)he can rely on the service being available when needed, and whether the service provides accurate enough information and functions in the intended contexts of use. The user needs to feel and really be in control, and the privacy of the user must be protected.

Occasional usage and momentary usage sessions on the move are typical of mobile services (Kaasinen, 2005). In addition, services are increasingly available only locally or in certain contexts of use. This indicates a need for disposable services: services that are easy to find, take into use, use and get rid of when no longer needed. The user needs realistic information about the actual values of the services, so that (s)he can realize how to utilize the service in his/her everyday life and innovate new usage possibilities.

Using the framework presented above helps designers of mobile services identify key issues on which the design should be focused in order to ensure user acceptance. When user acceptance studies are carried out in connection to technology research, the studies generate knowledge that can be utilized in future commercial service development. It is important to crystallize the key findings to design implications that direct the designers to focus on key user acceptance factors. As design processes are getting faster and the services and technical infrastructures are getting more complex, the Technology Acceptance Model for Mobile Services together with the design implications provide efficient tools to communicate previous user acceptance findings to the design. Human-centered design should involve all the actors that are needed in the business networks to provide mobile services. Service and content providers are not necessarily experts on the technology but they are the best experts to innovate how they can serve their customers better by utilizing new mobile technology. According to Kaasinen (2005) the wider view of human-centered design enables the assessment of new technologies from three points of view:

- what are the possibilities of the technology,
- what do the end users value, and
- how can the service providers utilise mobile technologies in their existing or future business.

The discussions between the publisher, advertiser and AR technology experts led to a conclusion to design an application that would start with a game-like element, which would lead the consumer to a discount coupon and a list of restaurants where the coupon could be used. The application would be designed for iPhones, but the user would be able to share it with friends, also with those who don't have an iPhone themselves. The restaurants would be from the four largest cities in Finland. The ELLE readers come mainly from large cities (more than 70% of the readers), and as they are interested in fashion and trends, the restaurants chosen for the campaign were all very trendy. Also, in this focus group the penetration of iPhones is larger than it is on the average. It is not a very large group in size, and therefore the possibility to take a closer look at this focus group from the research perspective is excellent.



### **To be considered in the future**

Based on the experiences we have from combining printed magazines with AR technology so far, there definitely is potential in this area. The applications offer excellent possibilities for interactive and valuable content, as long as the needs and interests of the consumers/readers are taken into account. Experiments in this field will continue, and the small size of the Finnish market offers very good grounds for close co-operation with the different focus groups. It makes it possible for all the parties involved to share information that is essential for the success of the applications. That said, co-operation between the different stakeholders, the publisher, the advertiser and the technology expert and close connection to the users of the application has made it possible to come up with an application that is not only new in Finland, but is unique also globally.

What will be analyzed later is how the readers of the ELLE magazine responded with the AR advertisement. In this stage we will most certainly be able to get user data that is unique both for the publisher and for the advertiser. Measurability has not been in the direct focus of this study but is of interest with future applications in mind. It is interesting to take the trust factor into account in this study, so that we will be well prepared to gather more user data in the future. Large amounts of data may be gathered anonymously without the consumer even being aware of it and even more data may be gathered if the user accepts it. Getting more experience of the user acceptance makes it possible to develop the whole ecosystem that is needed when AR applications in magazines become more common.

### **Conclusions**

- The magazine market offers great opportunities in interactive services. Multichannel advertising is the largest digital media market.
- Modern smart phones enable mobile applications of Augmented Reality (AR) and these applications show an increasing popularity.
- Applications of AR technology services in magazines enable at least three different revenue streams: 1) pay-per-download, 2) incremental revenues (e.g. subscriptions), and 3) advertising.
- AR applications have been piloted in several Aller Medias magazines and the readers' readiness to use them has been studied.

From the users' perspective:

- The most enthusiastic users already use mobile applications to ease their daily routines and to help them to reach their personal goals.
- It seems to be easy to develop new useful mobile service applications, but it is not that easy to make all users understand the possibilities of the AR technology – especially if the applications are not yet available.

From the design networks perspective:

- User acceptance is crucial for the success of new technology and become extra critical for disruptive technologies, which cause clear changes in people's lives. User acceptance of mobile services is built on three factors: value of the service, ease of use and trust.
- Our studies have presented a framework for designers of mobile services to identify key issues and user acceptance factors.
- In general, the Finnish readers of printed magazines are more interested in applications that bring direct use value to them than on game-like applications.
- The subjects of interest guide strongly the views and wishes for the content, i.e. it may be assumed that the application will be successful the more it is designed to take into account what is important for the focus group of the magazine and what eases the lives of this focus group the most.

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