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Augmented Reality Enriches Print Media and Revitalizes Media Business

Sanni Siltanen, Maiju Aikala, Sari Järvinen and Ville Valjus

VTT Technical Research Centre of Finland

Firstname.Secondname@vtt.fi (ä->a)

ABSTRACT

Print media is in a crisis; it is losing its share of advertising — its main source of income — to digital media. Our aim was to determine how augmented reality (AR) and other hybrid media solutions change print media's value chain and what kind of opportunities they offer. We studied both human and technical aspects and the critical challenges. We interviewed 20 actors of Finnish advertising and media business; they are very enthusiastic towards AR enriched interactive hybrid media. The user behavior measurability was found important. We present a sketch of the hybrid media value chain with the actors. We describe and discuss also selected AR applications. The AR technology is mature enough for mass market; the technical performance of smartphones is high enough for AR applications and also the penetration of smartphones is increasing rapidly. Our main conclusion is that hybrid media is essential in the future of print media.

INTRODUCTION

Major source of income in print media — newspapers and magazines — is advertising. The financial investment on advertising correlates strongly with the global economic situation; the value of media advertising dropped remarkably after year 2008 along with the global economy and it still has not recovered to the former level. Besides, the value of advertising in the print media is currently growing slower than the economic situation or investment in advertising in general would indicate. At the same time, the advertising in Internet is growing rapidly being already the third biggest advertising medium after newspaper and TV. (Antikainen & Kuusisto, 2012) Thus, the actors in print media are highly interested in finding ways how digital media could be used in print media to make it more desirable from advertisers' viewpoint.

Hybrid media can be seen as one solution to enrich the printed publication to allure advertisers. It is defined as the solution to link the printed product with the digital content. In its simplest form it means adding a tag or marker to a printed publication to be interpreted using a digital device such as a smartphone or tablet to access additional digital content or service. (Lindqvist et al., 2011)

Augmented reality (AR) technology enhances the real world by overlaying digital content and objects on top of user's view of the environment in real-time (Azuma, 1997). The AR services are currently used by means of camera-equipped devices: smartphones, tablets or PCs with webcam. The arrival of head-up-displays such as Google Goggles will open up new possibilities to AR service developers as the AR information can be presented proactively without user initiative. The AR applications rely on data provided by different sensors of the user device. Most often the solutions are based on computer vision technologies. The AR application detects the environment and tracks the movements of the device based on camera

input. Mobile AR applications can also utilize several other sensors (GPS, digital compass, inertial sensors etc.) to deduce the location and orientation of the user. (Schmalstieg et al., 2011) The AR application knows the relative orientation of the user compared to real world and it can augment the user view inserting virtual objects with natural placement.

A rational approach in hybrid media is to combine AR with print media using specified objects or markers in the printed publication; the AR application detects pages of a magazine or special 2D barcodes, which are used to activate the digital augmentation objects. The printed markers also reveal to the user the existence of additional digital content to be provided using the AR application. In practice, the user scans a magazine with a smartphone that shows augmentation on display on top of the camera image. Alternatively, the user can show printed material to a web cam on PC environment and the augmentation is done on top of the web camera's image on the display or laptop's screen. The AR applications either update and download the content from a networked service or are stand-alone applications with fixed content.

The usage of AR applications with PCs equipped with web cameras is cumbersome. Fortunately the current development of mobile devices – smartphones and tablets - supports easier access to AR content and applications. The processing capacity of smartphones has increased, they support graphics features, and they have enough memory and bandwidth to support functionalities of AR applications. Moreover, tablets have large displays that support visual applications such as AR visualizations.

Mobile AR applications can be divided in two main categories: stand-alone applications and AR browsers such as Junaio, Wikitude and Layar. Mobile AR browsers use two main approaches; they augment geotagged information based on user's location or they use vision based system to detect objects and augment object-related data. Typically, the data is divided into information environments. (In Junaio, the environments are called "channels", in Wikitude "worlds" and in Layar "layers"). An environment is restricted to certain type of data, or a certain set of objects. The user can upload new environments and decide which information to see; in a location based service, e.g. tourist information or restaurants nearby, in a vision based system e.g. data related to pages of a magazine, or information about paintings in a museum.

Global smartphone markets

The total volume of smartphone sales globally continues to grow strongly. Figure 1 shows a forecast of global smartphone sales 2010-2015 (Frost & Sullivan, 2012). The global unit shipments are estimated to rise from 300 million to exceed 800 million by 2015. A trend in Finland (Gartner, 2011) shows, that from the four device categories: low-cost, basic, premium communication (smartphone) maximum price $300 and premium communication priced over $300, the cheaper smartphones interest the consumers 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. This trend observed in Finland appears to be quite typical as similar trends can be found in other countries as well.
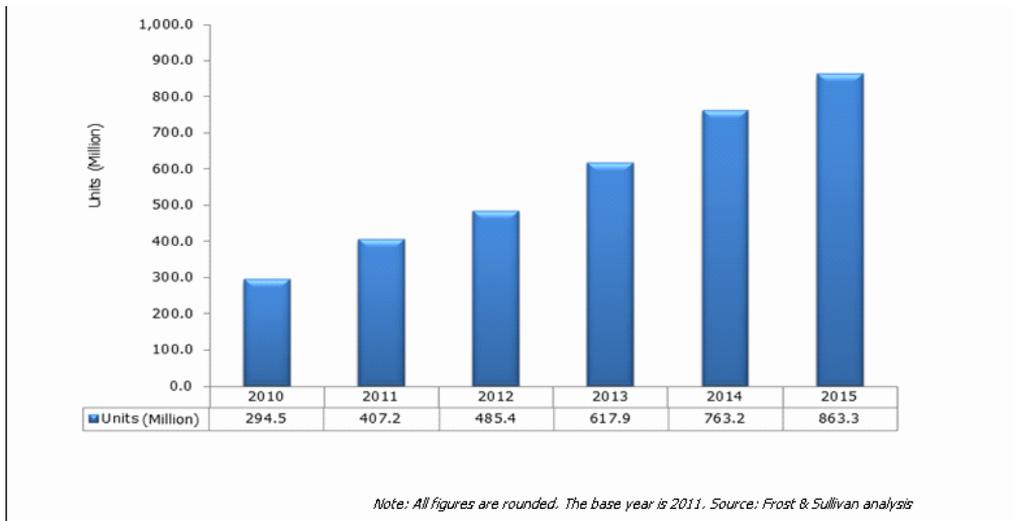
Figure 1. Forecast of global smartphone sales (2010-2015) (Frost & Sullivan, 2012).

Also the user behavior is changing. For example, mobile barcode activity is rapidly increasing, as shown in Figure 2 (3G Vision). Based on situation in the third quarter of 2010, the usage increased almost 500 per cents during one year. Interactivity gives an important additional value to advertisements. Besides advertisements 2D codes can be used also in editorial content.

(basis: Q4/09 = 100)

Figure 2. Global growth in mobile barcode usage Q4/2009 - Q3/2011 (3G Vision).

User acceptance

Together with the technology development, the usage of mobile applications has reached the majority in the technology acceptance model. The characteristics of the technology and use

situation influence the technology acceptance process: what advantages new technology brings compared to other technologies, how complex or simple it is (Rogers, 2003; Compeau & Higgins, 1995). In addition, the assumed benefit and attitude towards use affect how users come to accept and use a technology, as well as voluntariness of use, experience, output quality, demonstrable results, perceived ease of use and social acceptance (Davis, 1989; Venkatesh & Davis, 2000).

The user acceptance of consumer level mobile nternet and location-aware information services is built on three factors: perceived value of the service, perceived ease of use and trust (Kaasinen, 2005). These three factors affect the intention to use a mobile service. Other studies show similar results concerning the user acceptance of different mobile services, e.g. the expected user experience of mobile AR services in a shopping center (Olsson et al., 2011). Therefore mobile hybrid media and AR services can be assumed to follow the user acceptance model of mobile services in general. With mobile services targeted at consumers, taking the services into use has often been considered to be a major obstacle to the user (Kaasinen, 2005).

Today the development of mobile application market places, such as App Store and Play Store, has made buying and installing mobile applications routine for many users. The overall mobile ecosystem supports mass market mobile applications, including AR hybrid media applications, and people have represented many individual AR and hybrid media applications. In addition, the availability of AR applications pre-installed on mobile devices decreases consumers' threshold for taking them into use and thus supports the adoption of AR technology in the mass market. The latest Nokia Lumia smartphones have the City Lens application and Samsung Galaxy tablets the Layar AR browser installed on them, for example.

Markets are ready for AR

Augmented reality solutions have been used to enrich print media since 2009. Magazines and newspapers such as Esquire and The New York Times, for example have provided AR content. AR has been used in brand campaigns by Pepsi, Coca-Cola, Benetton, Calvin Klein, Ikea and others. Although the big brands have used augmented reality technology in their marketing, the AR business is still in its infancy.
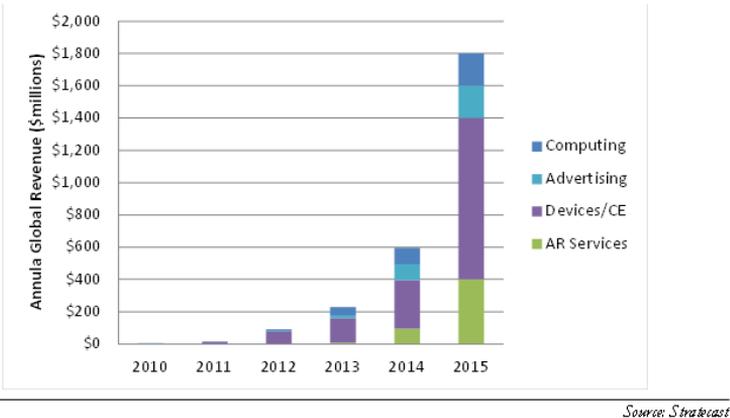

Source: Stratecast

Figure 3 Global AR Market Projection 2010-2015 (Frost and Sullivan) (Jude, 2012).

Stratecast (Frost&Sullivan, 2012) projects that finally, starting at the end of 2012, total global revenues associated with AR technology and solutions will experience rapid growth. By 2015, the global market could exceed $1.8 billion. Most of the revenue, $1 billion, is expected to come from the devices and consumer electronics. The second largest share from AR Services ($400 million in 2015) and the remaining $400 million equally shared from AR related advertising and computing required to implement AR applications and services. (Jude, 2012)

The development of AR into a mass market technology is believed to depend on the brand owners. Juniper Research expects the industry and consumer adoption to lead in to mass retail and brand adoption of AR in advertisements and applications by 2015. In this stage there will be approximately 950 million AR capable handsets and more than 50 000 applications available for the mainstream smartphone audience. (Juniper, 2011)

Research aim

In this research, we studied the future framework of AR advertising in print media, beyond individual cases and demonstrations. Although this research concentrated on advertising it is clear that AR can be used to enrich editorial content as well. We also investigated the implementation specific issues of AR applications for advertising in print media and present selected use case implementations.

The aim of this study was to clarify, how the current actors in print products' value chain see the applicability of hybrid media and particularly augmented reality solutions in the print product of the future. Discussions about the future of the print media and how the augmented reality could change it were conducted with several professionals in the print product's value chain.

We interviewed 20 representatives of advertising and media business: brand owners, advertising agencies, media agency, publishing business and printing business (see Table 1). The focus was on the practical implementation of augmented reality solutions. The interviews were conducted at the end of 2010 and the data was analyzed 2011.

METHODOLOGY

Due to the objective of the study, i.e. understanding the current mindset towards AR in print media value chain, the qualitative research approach was utilized. We studied the subject in depth and across many organizations in order to find patterns in data. A qualitative research method is applicable, when the area being researched is not well known beforehand or the target is to reveal new and unexpected viewpoints from the area of interest (Gephart, 2004). The selection of the interviewees was based on their assumed ability to give new viewpoints on the subject. Companies in this study represent the different actors in different kinds of print products' value chains. The selected 12 organizations represent advertising, publishing and printing sectors. Thus, the sample gives an overview on the future of print media business in Finland. The interviewees are characterized in Table 1.

We used focused interview, which is a semi-structured method meaning that some of the features of the interview, for example the focus and the themes of interest, are decided beforehand by the interviewer. The method has features from the unstructured interviewing, for example the objective is to understand respondents' point of view more than make generalizations of their actions. (Bryman & Bell, 2011, Fontana & Frey, 2005) Both

individual and focus group interviews were conducted. Representatives of same company were interviewed simultaneously.

Table 1. The interviewees.

Position in the	Expertise	Number of
Brand owner	Marketing	3
Brand owner	Product	3
Advertising	Digital content	1
Advertising	Digital content	1
Media agency	Media planner	1
Publisher	On-line	2
Publisher	Social media,	2
Publisher	Production	1
Publisher	Marketing	1
Printing	Sales and	1
Printing	Digital printing	2
Printing	Direct mail	2

At the beginning of the interviews, a brief introduction to augmented reality and the latest pilot applications in hybrid media field was given. The interviews were conducted as discussions starting from following themes:

Roadmap of print media and the role of AR in it: What is the role of print media and print advertising today and how it will change in next five years? What kind of opportunities and challenges AR will give to print media?

Target groups for AR applications: In what kind of print products will AR applications suit best? What target groups will be reached?

The new hybrid media value chain: How the print media value chain will change if AR applications will be integral part of print advertising? Who will take the leading role in AR production and who will make business out of it?

RESULTS

An interesting feature is that almost every interviewed party consider their own role and opportunities in the value chain stronger than the others (i.e. Media houses consider advertising agencies' role less important than advertising agencies themselves.) However, there is consensus of the components of the value chain, although the roles of the actors are not fixed.

AR advertisement and framework

So far, AR applications for print media have been separate applications created in separate projects, and often stand-alone applications that must be installed first. However, this is not how things should be. Our study shows that there is a need for a higher level system, where new content can be easily updated into the application, and where the authoring is independent of the end user's program. In this AR context, authoring means defining what is augmented where and how. For example, defining which 3D models are augmented on which pages, and defining also possible interactions, animation paths etc. for each augmented object.

With a framework, we refer to a whole system that defines all necessary parts of the AR advertising: how the content is authored and managed, how the augmented content is linked to the printed publication, how the applications are distributed etc.

In the sketched framework, the augmented reality advertisement consists of five different parts: printed advertisement, AR content, AR tool, AR viewer, and a terminal device (Figure 4). AR tool is an authoring tool, where the creator defines connection between digital content and printed publication. The intended terminal device affects to the content and functionalities of the AR. For example, tablets and smartphones have different graphics support.

Figure 4 Components of AR advertisement

In a hybrid media solution, a vision-based approach would probably be the best solution; the application would detect pages of a magazine and show additional data linked to each page. As the users shun starting to use new applications, a browser type application would be better than a stand-alone. The information environments could be e.g. magazine wise, printing house wise or brand wise content i.e. once the environment is selected the user can see all additional content in a magazine, in all magazines of a printing house or all advertisements of a brand.

Similarly as with website editors, users can update and define content to a webpage without any knowledge about HTML or coding. An AR tool should enable definition of content, relations and interactions without any knowledge about detection technology, rendering or coding. Also AR researchers consider user-friendly authoring tool as one of the key issues, before AR will be used in massive scale (Schmalstig et al., 2011).

In further considerations, augmented reality was considered more like to be part of a broader hybrid media framework. In figure 5, we present the value chain of hybrid media solution for print media. In this framework, AR tool and AR viewer are substituted with hybrid media tool and viewer.

Target users

Advertising agencies, brand owners and media houses had congruent opinion with each other about early adopters of the technology. Teenagers and active young people who swap between different media were considered as the first potential target users of this kind of service. However, depending on the application area, all technology oriented people were seen as potential users. The challenge in a small market like Finland is the low actual number of users even when the penetration in the target group would be high. The other interviewees did not have clear opinion on target users.

Roles in the hybrid media value chain

Different printing houses see their role very differently. Traditionally printing house is at the end of value chain, they just print what customer wants. Digital printing house might take more active role in advancing hybrid media solutions. They might even provide all-in-one

solution for their customers: Including everything from content, framework to personalized printing that enables personalized content and individualizing the users. Advertising agencies see their role as innovator and early adapters who market new technology for their customers i.e. brand owners.

Brand owners outsource campaign design and implementation for advertising agencies. They consider that they could own the framework i.e. brand wise application, but they hope for a bigger, standardized framework.
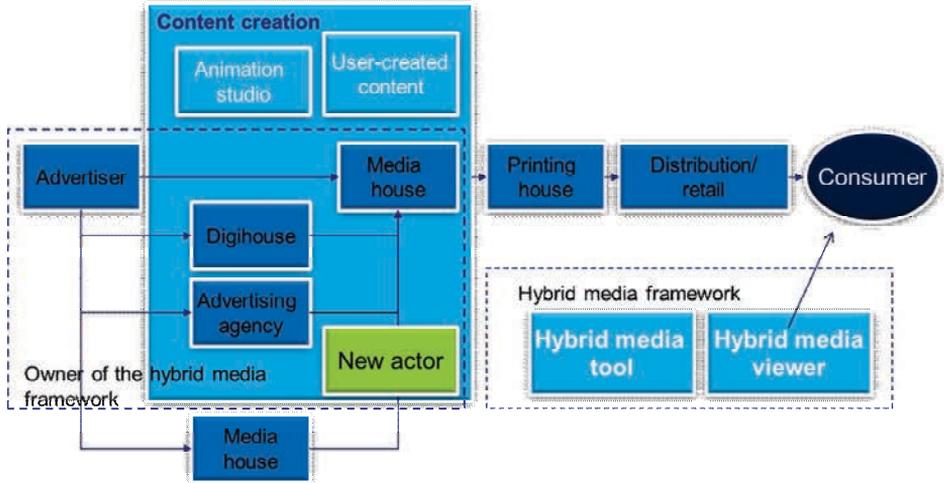

Figure 5. Value chain of hybrid media solution for printed publications.

Media houses' opinions on who is the driver of the technology vary; it can be a big international brand owner that has the possibilities to create a widely used system and thus manage the framework, or advertising and media agencies could ideate and apply AR in advertising for their customers. Some media houses see their own role as the framework creator and manager. They consider themselves as one of the brand owners.

Possible use cases

Augmented reality suits well for advertising because of its interactive and visual nature. One advertising agency considers campaign wise or event specific use as most interesting way to exploit AR. The other advertising agency and digital media house are into a widely used application. Media house would also prefer a widely used system or standard that they could exploit in all campaigns.

A new actor could provide a nationwide or international system. Creator of the framework can also be a software house who provides AR framework product. A new actor could also provide AR framework service, and may also master the framework.

User data and measurability

Media agency, as well as advertising agency, brand owner and media house, sees the possibility of measuring the user data especially important. It is of the utmost importance to get as much data from the users as possible: who uses the application, from which advertisement the user entered the Internet site, and how much time does he or she spend on

the site. The data makes it possible to segment the users, and thus, target the message more precisely. For the media house, in addition to the above-mentioned factors, the reliable user data is one of their key assets.

AR APPLICATIONS -- IMPLEMENTATION ISSUES AND EXAMPLES

There are various new AR tools for easy and fast AR application development e.g. Layar Creator[1], Metaio Creator[2] and Aurasma Studio [3] currently available. These all can be used together with an AR browser (available for various platforms: iPhone, Android etc.) from the same technology provider meaning only one software installation process needed for the user to access all the AR applications created using a specific AR authoring tool and browser pair. AR applications can also be developed utilizing various AR software libraries such as ALVAR[4]. These libraries provide usually more features and thus enable more flexible and customized application development compared to the AR tools mentioned above, but on the other hand the applications are much more laborious to develop as there is more work to be done manually and also necessitate more specialized developers with AR technology know-how.

The AR applications require relatively high processing capacity of the target platform to execute e.g. the video analysis algorithms. Processing power has always been the strength of desktop computers as there is no need to make compromises between size of the device, the used components or the battery consumption. Thus, it has been possible to create AR applications that have only few limitations considering features such as the graphics quality and the complexity of 3D content. However, a disadvantage of traditional desktop applications is that they require separate installation procedure on every computer the user wants to run them on. Additionally, every operating system requires a dedicated version of the application to be developed and thus the portability of the application becomes difficult.

Adobe Flash technology enables developing portable cross-platform web-based AR applications. Flash based web applications can be executed without modifications on multiple operating systems and web browsers and they do not require each application to be separately installed. Flash applications are inferior to desktop applications when considering performance but with the latest generation of Adobe Flash (version 11) including the Stage3D API (application programming interface)[5]. Flash applications can nowadays handle much more complex 3D content than ever enabling also richer AR applications.

Downside in using Flash is that it is not properly supported by smartphone operating systems and thus it cannot currently be used on mobile devices. Currently the only feasible option for developing AR applications for smartphones is creating separate versions of the application for each platform. This brings forward the same problem as in desktop applications that the cross-platform support is much more laborious to achieve. A clear advantage in using a smartphone is that the device itself is much easier to carry around and use in different environments compared to desktop and laptop computers. While the processing power of

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[1] http://www.layar.com

[2] http://www.metaio.com

[3] http://www.aurasma.com

[4] http://virtual.vtt.fi/virtual/proj2/multimedia/alvar/index.html

[5] http://www.adobe.com/devnet/flashplayer/stage3d.html

smartphones may never reach the level of ordinary computers their performance is constantly increasing and, on the other hand, the development of high-speed networking technologies together with cloud computing offer new possibilities, when the processing can be done in the cloud network instead of the smartphone (Kovachev, 2011).

Fairly new approach for solving the portability problem is to use HTML5. Current version of HTML5[6] contains a work in progress version of the MediaStream API. From the augmented reality point of view an interesting feature in it is the support for accessing device's local camera stream. Thus, HTML5 could be used for developing AR applications and as it is a wide-spread standard and is supported by a wide range of devices and browsers, it could be the future platform of hybrid-media augmented reality applications (Oberhofer et al., 2012).

Examples of AR applications for print media

As described earlier, AR applications can be stand-alone or they may download information dynamically, and they can be mobile or PC applications. Thus, they fall in four different main categories: web applications, stand-alone PC applications, stand-alone mobile applications and mobile browsers (Figure 6). In the following, we present examples of real AR applications used in Finnish print media. The example AR applications are all implemented using the ALVAR library by VTT.

Figure 6. AR application types.

Dibidogs AR advertisement was launched in Katso magazine 13-14/2010 (Figure 7). Dibidogs AR application was a stand-alone PC application that user was able to download from a given webpage. It was implemented in collaboration with Futurecode and Aller Media. In the application an augmented digital figure (the dog) appeared on the top of magazine page. Also the **Dibidogs children storybook** contained AR markers to enrich the user experience of the printed book with an accompanying stand-alone PC application.

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[6] http://www.w3.org/TR/html5

Figure 7 Dibidogs AR advertisement and storybook.

The Sparkly mobile AR application was implemented in collaboration with Aller Media and Sinebrychoff (the brand owner of advertised Sparkly product). In the application a sparkling wine bottle appeared on top of magazine page, and the user was supposed to interact with the application and keep the bottle in balance for certain time to win a discount ticket. The mobile application for iPhone is available in App Store, and the printed add was in Elle Magazine 11/2012.[7] Readers valued the inspiration and connectedness that the use of the application offered (Seisto et al., 2012).

Figure 8 A screenshot from mobile AR advertising application "Sparkly".

Vares AR Flash application was developed in a commercial project for Aller Media, a leading entertainment and TV magazine publisher in Finland, and it was used for promoting two Finnish films, "Veijarit" and "Vares – Pahan suudelma", with markers printed on the magazine Seiska (Figure 9). The purpose of the application was to combine conventional print media and digital media by adding interactivity to the magazine and thus enrich the reading experience (Valjus et al. 2012).

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[7] www.vtt.fi/multimedia

Figure 9 A screenshot of application showing video and animation related to the movie "Veijarit" and a spread of the magazine Seiska containing markers related to the movie "Vares - Pahan suudelma".

Fujitsu AR application (Figure 10) was developed for iPhone and iPad and was designed to bring life to Fujitsu's annual review publication. The main feature of the application was to show videos related to the annual review using augmented reality. The printed publication contained two black-and-white markers and when the mobile device's camera was pointed towards one of the two markers a video was played back on top of the marker in the camera view.
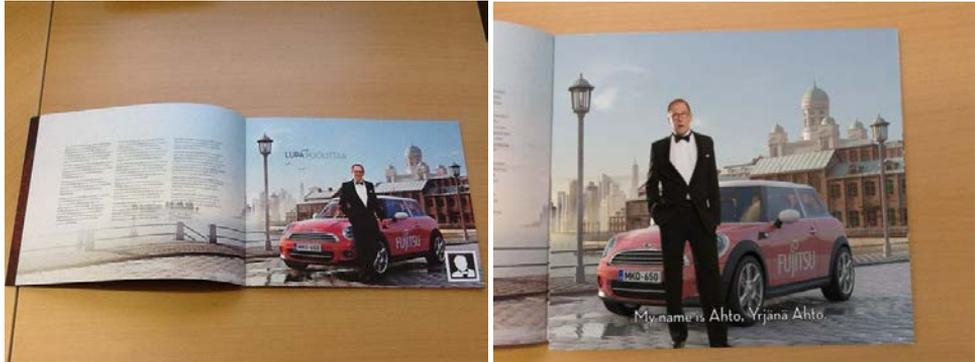

Figure 10 The Fujitsu annual review publication containing an AR marker and a screenshot of the application augmenting a video in the camera view.

Reflections on implementation issues

At the moment creation of AR applications is not cost-effective; the trouble of porting application to different platforms and the cost of content creation is high. This prevents applications targeted to small user groups — as often is the case in a small country such as Finland.

The trouble of getting the application into mobile market places (e.g. App Store) makes mobile AR browsers and web applications more desirable than stand-alone applications. However, web applications have limited graphics and other functionalities and have portability issues as discussed earlier. As for the browsers, the mobile application needs to be

approved into mobile market place only once, and user need to install it only once, later the application can download new information dynamically. Nevertheless, this requires data connection, and slower connections do not support e.g. video streaming. The user experience of real time AR is poor if data connection fails. In the Fujitsu AR application, the videos are part of the stand-alone application, but then there is no way to update the video content.

On the other hand, stand-alone applications targeted on special device e.g. high-end tablets or PCs can utilize special features: fancy graphics and interactions — the very features that make AR appealing in the first place. For example, the Dibidogs AR book has good quality graphics features and interactivity. Mobile browsers lack these and often present simple augmentations.

At the moment authoring tools, the tools for creating AR applications in conceptual level, are limited; they offer only basic set of features and limited functionalities. In order to utilize strengths of AR such as interactivity, high-end visualizations and customized actions the application developer must use some of the software libraries and create the whole application, which is not cost effective. In addition, creation of interactive graphics requires a lot of manual work and is expensive.

All in all, implementation of AR applications requires often too much resource to be beneficial compared to other technologies. In order it to be widely used better and more flexible authoring tools needs be available and the cost of content creation (3D graphics and videos) needs to pressed down.

DISCUSSION AND CONCLUSIONS

The main conclusion of this study is that augmented reality should be part of a broader hybrid media solution. Augmented reality as such is often not enough, but it enriches a hybrid media solution. The same application could also provide other forms of digital information i.e. videos, links to web pages etc. Based on the interviews, the ease of use is the most important aspect. The system must be easy for the end-user, but also for the application provider. The ease of use is highlighted also in the literature of technology acceptance (Davis, 1989; Venkatesh & Davis, 2000; Kaasinen, 2005). In addition, most of the interviewees highlighted the importance of a general widely used system, and the difficulty of downloadable software and desire of ready installed software.

In PC environment, Flash-applications were considered the most important alternative as they function on a browser, supposing commonly used Flash-player plug-in is installed. However, HTML5 was not yet available at the time of the interviews and we believe it to offer even better alternative to dedicated AR applications or Flash-based implementations. The most important aspects are all factors that help surpassing the critical chasm of technology adoption.

So far it seems that the main reason for using AR applications stems from their novelty, instead of their practicality and relevance (Olsson & Salo, 2011). However, in the long run the personal relevance has an important role in the acceptance of AR technology (Olsson et al. 2011). Although web based AR applications provide interesting functionalities for electronic newspapers, print media would benefit more from mobile hybrid media solution. The user could enrich the reading experience with a mobile application independent of reading location.

The advancement of augmented reality technology and availability of simple AR tools for AR application development opens up new business opportunities in AR content and service

creation as the AR service implementation does not anymore necessitate in-depth understanding of underlying technology. On the other hand, lack of standards slows down the adoption. Today several incompatible systems exist and different software is used in separate projects. On the other hand, as the AR and hybrid media domains are still changing, there is an opportunity to create a de-facto-standard and integral system, but it requires a big player, which is able to ensure enough critical mass. It might be Google with Google Glasses, or some other new player from outside of traditional print media value chain.

The situation is the same as with mobile services in general: several resources are needed and no single organization is able to possess all resources needed for typical mobile services offering or AR hybrid media application. (de Reuver et al., 2009) Thus, a value network for providing AR hybrid media services will be needed. However, some actors of the current print product value chain may take new roles as service integrators and manage an AR hybrid media framework. The task of the service integrator is to integrate basic products and services in the value network to offer combinations that match the individual customers' needs. In successful value networks the focus of the service integrator is on relationship process. (Heinrich et al., 2011) One of our interviewees sums up the scenario of the field as "*Hybrid media is part of the future print media*".

Importance of the user data

In the media market user information has a central role. First of all, the user data reveals who uses the media or service. This information can be utilized in targeting the message. Secondly, the user data might also give information about the media use habits and changes in them. This information can be utilized in planning the communication strategies. Hybrid media solutions bring a new dimension to collecting of user information. Today media houses collect information of how many magazines are sold, and how many visitors a webpage has, and from which webpage the visitor came. In case the user comes directly to the webpage typing the URL, or using a search engine, there is no indication of how user got the idea in the first place. Hybrid media solution can collect the information through which printed publication the user came to a webpage. In addition, application may collect data about time of the day and location where user reads something. Actors of print media believe that measurability of user actions increases advertisers' interest in print media – this is exactly what print media needs. An immersive mobile application may increase the time user spends with the application, plus collect this information. Naturally, privacy legislation sets limits for data collection.

Augmented reality brings interactivity to the reading experience

Augmented reality definitely changes the reading experience: AR brings interactivity to reading experience. Instead of an advertisement, the application can be an interesting service for the user, "*Interesting encounter with the product or brand*". For instance, with a mobile device, a printed furniture ad transforms into a digital service where the user can furnish own living room with virtual furniture using AR features of the application. What is more, the application can link the user directly to the electronic market place. How often do people see interesting URL in a print, but forgot it before next time sitting next to a computer, or are too lazy to start typing it on the smartphone? Hybrid media solution, where user points a page with a smartphone, and the link to the service is done automatically based on visual recognition, pass this gap and have a lot of potential.

Together with other engaging technologies, AR can be the trigger that gets the reader to use the service. AR and hybrid media is not limited to the advertisements; it can also enrich editorial matter and be part of the magazine's imago.

Future work

In this research we described the framework for AR hybrid media application, and the important roles in hybrid media value network. At this point we have not concentrated on the earning logics of different actors of the value network, or made in-depth analysis of the managerial issues concerning the value network. The next step would be constructing the business model for the AR hybrid media service.

The mass market adoption of AR enriched hybrid media services relies on many issues from device and communication technology to AR content production process development. However, the user has the most important role in the success. In order to have mass adoption of a hybrid media solution — or an AR application in particular — the users need to gain benefit from using application and the user experience needs to be gratifying. Should the users adopt it, then the interest of advertisers is guaranteed. As a next step, the value of AR usage for the use in the hybrid media applications should be studied in detail compared to other ways of combining print media with digital content.

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