
# Augmented Reality and the Future of Printing and Publishing

## Opportunities and Perspectives

White Paper

Inglobe Technologies Srl

## Introduction

Augmented Reality (AR) is a hot topic that is growingly attracting the attention of insiders from Media and Technology Sectors today. But what is behind this enthusiasm? Specifically, will AR contribute to the improvement of the way information is delivered and received in the context of the Media and Publishing ecosystem? Will AR generate new "revenue streams" or improve the ones that already exist in the sector? This Whitepaper tries to address these questions by providing an analysis and perspective on the use of Augmented Reality technologies in the Publishing sector. In the wake of the rapid spread of such a technology in the last two years, the document highlights opportunities and benefits tied to its use in this sector. It also offers a review on the possible applications of AR in the context of different market segments (contextual and geo-located information, advertising, multimedia, entertainment, education) with reference to publishing products on one side (books, magazines, newspapers, collectibles) and technological platforms on the other side (print supports, personal computers, laptops, mobile devices).

## What is Augmented Reality?

The expression "Aumgented Reality" –usually abbreviated with the acronym AR- refers to the emerging technology that allows the real time blending of the digital information processed by a computer with information coming from the real world by means of suitable computer interfaces. Augmented Reality makes *explicit the implicit*, this meaning that the information that is implicitly associated with a context is made usable and directly accessible by means of the AR interface. AR technologies began to spread dramatically worldwide in recent years, with a big impact on society and human activities.

The phrase "Augmented Reality" was coined by Boeing Researcher Thomas Preston Caudell in 1992. Caudell used the phrase to describe a system that would assist the workers in the assembly and installation of electrical cables in the aircrafts (Caudell & Mizell 1992). In the following years, AR technologies have been primarily developed by Research Labs and Universities worldwide (Azuma 1997; Milgram & Kishino 1994). From about ten years, the technology has slowly begun to migrate from research laboratories to the market in applications ranging from marketing to entertainment, to advanced visualization, maintenance, design, medicine and publishing. On a first approximation, the meaning of the term "augmented reality" can be better understood as opposed to the more familiar concept of "Virtual Reality". While in the case of Virtual Reality a user is immersed in a virtual environment completely created at the computer, in the case of Augmented Reality the virtual elements are overlaid and integrated into the real physical space. This is essentially the opposite process of Virtual Reality. By means of suitable displays and interaction devices, Augmented Reality allows users to access information directly relevant to their contexts of use, overlaying layers of digital information to the physical space while at the same time allowing the interaction with those digital elements as if they actually belonged to the real scene.

Over the past two years, in correlation with the deployment of next-generation smartphones, a new type of augmented reality applications has made its entrance into the market. AR applications for mobile devices allow users to view "augmented" images of their immediate surroundings, directly on the screen of their phone. Using the video stream captured with the camera as the background, AR applications place

content and information layers in the physical reference system of the user. In addition, these devices allow an ubiquitous access to contextual information.

## AR ≠ Print + Digital, or when the whole is more than the sum of the parts

In the past, as it is widely acknowledged, print media and print content publishers were the unchallenged dominators of the world of information. Both public and private communication was possible thanks to paper and ink. But today we are in the middle of a transition phase (Perey 2011a). Content creators are moving from paper to digital media because by means of the latter they can best reach their targets. As a matter of fact, both print and digital media provide people with content. However, ever increasingly the digital versions of content, designed from the outset for the digital world, begin to manage resources comparable and in some cases even more than the print counterparts. This phenomenon is leading publishers to think carefully and critically about the future of publishing. Will publishers find themselves in the position of having to completely abandon the printed word in favor of the adoption of new media for their contents? Will the day come when someone will declare the press dead? We strongly believe that this will not happen as long as the direction taken by publishers will be the integration of media. The vision of the future that we share is well illustrated by Perey (2011): any printed materials (a poster, a sign, a box, the page of a newspaper, magazine or book) will provide additional content in association with a camera, an algorithm that recognizes the content of the page, and a platform for the retrieval of digital data associated with it. In short, the combination of an Augmented Reality system with the press will provide added value to what is possible with paper and digital content alone when they work in isolation from each other. This is a clear case where "**the whole is more than the sum of its parts** ".

## Comparison of Print and New Media

What emerges from the discussions on the negative trend of the sales in the traditional print sector (except for the exceptional cases in which the strong differentiation determines a relative increase) is that, despite their advantages, traditional print media suffer from some important limitations with respect to new media. Among the characteristics of the print media (including books, newspapers, magazines and posters), we can mention the following:

- Unidirectionality and Linearity of communication
- Static Contents
- Poor or no interactivity
- “Closed” and “un-contextual” information
- “Passive” enjoyment
- High degree of opacity of contents
- Mono-media.

On the other hand, new media, starting from Internet to arrive to Augmented Reality, do have quite different features:

- Bi-directionality and circularity of communication
- Dynamic Contents
- High degree of interactivity
- "Open" and contextual information
- "Active" enjoyment
- Low degree of opacity of contents
- Multi-mediality and cross-mediality.

The figure below highlights the way traditional print media relate to new media and Augmented Reality. The strength of Augmented Reality lies mainly in the ability of the technology to "*close the gap*" between the digital world and the real world, thus preventing a potential and incurable fracture. Augmented Reality in fact would not only allow a less dramatic transition to digital media, but also the creation of completely new editorial products with novel and original features.

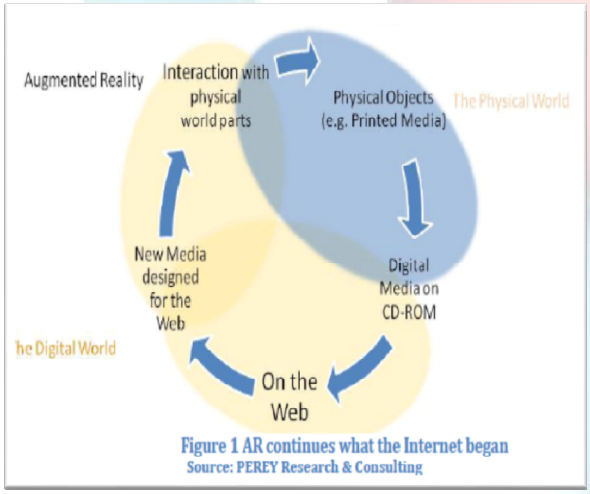



Fig 1. The scheme illustrates the relationships between Digital World on one side and Physical World on the other side. Print media are physical entities that belong to the physical environment. Websites and new media belong to the Digital ecosystem. Augmented Reality is located at the intersection between these two worlds (da Perey 2011a).

Here below some patterns are described that relate to the characteristics of the various technology platforms that support AR, from print to personal computers, up to the latest generation of mobile devices. The existence of these technologies and their increasing prevalence in the market creates an essential precondition for the adoption of AR in the publishing sector, where the printed paper is still the more widespread and dominant technological platform.

## PRINT MEDIA

Traditional media, especially those based in the **printed paper**, suffer from a number of intrinsic limitations. First of all, they are characterized by a **unidirectional** and **linear communication circuit** in which information is encoded and transmitted by a **sender**, who plays an **active role** in the communicative process, and is received by a **receiver**, who, on the other hand, plays a **passive role**. Information is transmitted as a product (newspaper, books, posters, etc..) in a channel and is then decoded by the recipient in such a way that the he/she cannot respond in any way to the sender during the communication episode. In addition, the information conveyed is typically **static**, this meaning that the text and printed images do not change over time, i.e. do not have a dynamic (time) dimension.

| |
|---|
| **Unidirectional/ Linear** |
| **Passive** |
| **Static** |
| **Closed** |
| **A-contextual** |
| **Low Interactivity** |
| **Maximum Opacity of Contents** |
| **Mono-medial** |
| **Handy and Portable** |

The information given is also **closed**, i.e. it is packaged in a manner that is given once and for all, and it does not offer inherently the possibility to deepen contextually the content conveyed (**a-contextual**). This closure leads to and is induced by a lack of explicit interaction between the printed product (the text) with its context and its users (**low interactivity**). With regard to the contents, they are typically **highly opaque** in the sense that they do not allow to trace back the references and sources of the text effectively. Finally, print is **mono-media**, in that it uses only one medium (the paper, indeed) to communicate the content; other information resources (such as audio, video etc.) cannot be included in the traditional paper publishing. For what concerns the benefits, however, the most important is that they are **handy and portable**, thus allowing a comfortable access to information.

## PCs, Laptops and Networks

| |
|---|
| **Bidirectional / Circular** |
| **Active** |
| **Dynamic** |
| **Open** |
| **Moderately a-contextual** |
| **Interactive** |
| **Low Opacity of contents (Max info)** |
| **Multimedia** |
| **Not handy and transportable** |

The worldwide emergence and spread of computers and networks (especially internet) has triggered a radical change in the way information is created and used. The remarkable features of these new devices enable a completely new way to communicate. First, unlike traditional media, new media embody a **bidirectional model** of communication. According to this model, the sender and the recipient build, by means of interaction, a consensual domain of meaning. The **active** role of participants together with **interactivity**, enhanced today by new "social features", is an essential characteristic of these kind of media. The contents are no longer static, they are **dynamic**. In addition to text and static images, today you can easily enjoy audio or video content together. With the help of computer graphics it is even possible to enjoy the reconstruction of remote or possible situations. The information is not necessarily closed, but, by virtue of its dependence on the contribution of the participants and thanks to the high and ever-changing connection with its sources, is **open** and connected to the contexts of reference (**moderately contextual**). Also, thanks to the wealth of content that can be accessed, thanks to the multiple connections between the content and sources, and also thanks to an intense social participation (such as blogs, forums and Social Networks) it is easier to trace the references and thereby reduce the degree of opacity of the contents (**less opacity and maximum information**). Another important feature is their **multimedia** character, i.e. the possibility to integrate different types of content (text, audio, video, 3D, etc..) in one medium. Even though they have these important features, enabling devices of new media (such as personal computers or laptops) are often poorly or not at all easy to handle and transport.

## Mobile Devices and Networks

With the advent and spread of new generation mobile devices, the necessary conditions for a real revolution in the media and publishing industry have been laid. These devices include smartphones such as iPhone and Android, and the more recent Tablets, such as Galaxy Tab and iPad2. In addition to their computer-like features,

these devices enjoy, on one hand, the benefits offered by the **maneuverability and portability** typical of paper and, on the other hand, of a **high level of contextualization** of information. It is no coincidence that in this context we speak of "**ubiquitous computing**" and "**wearable devices**" (wearable devices).

| |
|---|
| **Bidirectional/ Circular** |
| **Dinamic** |
| **Interactive** |
| **Open** |
| **Contextual** |
| **Active** |
| **Lower Opacity of Contents** |
| **Multimedia** |
| **Handy and Portable** |

## Enabling Devices

Augmented Reality relates to the access of context-sensitive information. In general, AR technology requires the use of devices equipped with appropriate sensors, which allow users to interact with their environment. One of the most common sensors in AR applications is the webcam. This is used as an "electronic eye" in combination with suitable computer vision algorithms that extract "features " from the video stream of information. Other types of sensors used increasingly to put digital content in context are GPS, accelerometers, compass and gyroscopes. These sensors are now standard equipment of the latest generation of mobile devices such as iPhone and Samsung Galaxy. In general, therefore, Augmented Reality applications are spreading increasingly because the types of devices that make them possible are becoming increasingly popular and accessible:

- Personal computers endowed with a webcam
- Laptops (with webcam)
- Mobile Devices (smartphones and Tabs).

## Key Factors for AR in Publishing and Print

As we stated above, Augmented Reality plays a key role in the transition from paper to digital. In support of this view we can mention a number of facts. These, in turn, can be interpreted as enabling factors for successful innovation in publishing. Among the factors that are intended to shape the future of the publishing sector we can mention at least the following:

- Growing Adoption worldwide of latest generation of smartphones (iPhone- more than 80 million and Android- 33mln units sold in the last quarter of 2010)
- Establishment of various “Apps Stores”, such as the Apple Apps Store or Android Market
- Increasing adoption of Internet on mobile devices
- The recognition by major international brands of the mobile sales channels
- Establishment of mobile Commerce (mCommerce).
- Growing adoption of Tablet mobile devices such as iPad and Samsung Galaxy Tab
- A tendency towards the creation of cross-media systems while the same content migrates on different technological platforms and distribution channels (Internet, ebook, print, mobile devices).

These factors certainly point out a situation that is favorable to the adoption of AR solutions in the publishing and print sector.

## Goals of AR in the Publishing Sector

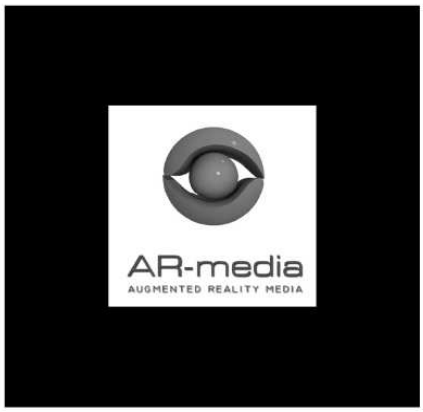
Augmented Reality can meet a broad spectrum of goals linked to the promotion of value in the editorial domain.

*Marketing Goals*:

- Increase the number of copies sold or the output of current volumes
- Address the offer to new or larger users' basins
- Create new revenue streams from advertising
- Improve readers' loyalty with converging publishing products that are more in line with current trends and readers' needs.

*Functional Goals*:

- Reduce cognitive overload on the reader
- Increase quantity and types of information available in the same act of enjoyment
- Increase the level of "presence" and engagement experienced by readers
- Improve the performance of readers in learning and retaining information.






### POSSIBLE "REVENUE STREAMS" FROM AR IN PUBLISHING

Some of the possible sources of revenue from AR for publishers of content include (Perey 2011b):

- Charging users for the accompanying AR application, on a one-time fee basis or by subscription (monthly, yearly, etc..), as it is now in use with eBooks
- Content supported by Advertising, or in print media or directly through the digital content received by the user of the AR application/service
- Transactions within the AR application for goods or services, or for additional "value added content" which is not included in the base (possibly free) application.

## Applicative Scenarios for Publishers

Thanks to Augmented Reality we can imagine completely new ways of adding value to traditional print media. Indeed we think of a new generation of publishing products and services that may be able to generate independent "revenue streams". Essentially, Augmented Reality technology cuts across the various segments of the publishing market. In fact it may be used to convey additional interactive and multimedia content in all areas of traditional publishing, including books, magazines, newspapers, posters, educational and multimedia products, entertainment and advertising. Based on the flexible and cross-media nature of AR, we examine a number of reference applicative scenarios just to provide an idea of how AR can be better employed in the publishing sector.

**NEWSPAPERS AND MAGAZINES**

*"Augmented" Advertising*

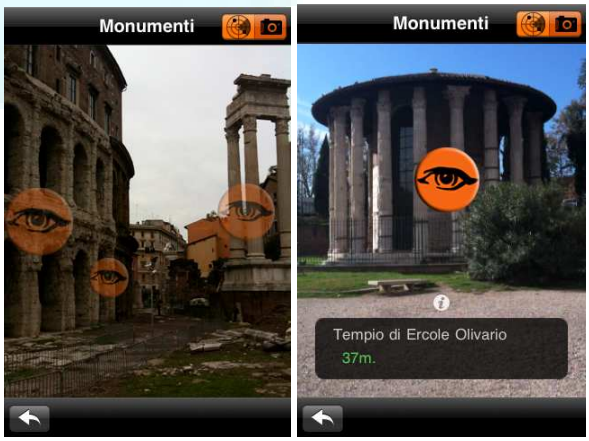
It is possible to create special content areas especially targeted to advertisers directly inside magazines and newspapers. These content areas can trigger, in a given physical context and by means of a suitable AR tag, the visualization of digital content - video, audio, interactive 3D animations - in addition to the text, thanks to suitable devices such as mobile phones, Tablets, and PCs. This possibility adds a new dimension to the reading experience and brings multimedia content where it previously could not be. Moreover, it can generate new "revenue streams". This scenario requires the inclusion in the printed editorial product of appropriate AR tags (similar to the QR codes) or use a generic image recognition technology (Natural Feature Tracking).


*"Augmented" Informative Contents*

Augmented Reality can also be used to give publishers the opportunity to convey, in addition to traditional content (text and static images), a wide variety of digital content within the context of news, columns and articles all kinds. Information and cultural content can then be brought to life thanks to triggering tags that allow, through a smart phone, a computer or a Tab, to view a video stream of an interview, a Film trailer, an event, or any relevant fact. The benefit of a newspaper of this kind is the ability to reach, thanks to a cross-media tool, an audience already familiarized with technology, no matter if they are or are not accustomed to reading.

*Geo-located "Augmented" Contents*

Thanks to latest generation mobile devices, that are equipped with GPS, accelerometers and gyroscopes, it is now possible to revolutionize the concept itself of "newspaper" or "magazine". From our point of view, in fact, augmented reality allows to implement the metaphor that " **reality is the newspaper**". In addition to digital content that may be associated with the AR tag printed in the newspaper, in fact, this content can also be made available directly from the screen of a smartphone in the shape of geo-located contextual tags overlaid directly on the live video stream of the mobile camera. In this way, the user may have a direct access to immersive and informative content that is relevant in the neighborhood, he can select the items of greatest interest and access information in an interactive manner. This option may be useful in different circumstances, such as when a user wants to be informed of important events and happenings in the proximity. Thanks to the AR application the user can be guided towards the event /happening or, if necessary, helped to avoid it.



*"Augmented" Special Inserts*

Often newspapers and magazines come with special inserts aimed to offer additional content and insights as well as attract the interest of specific categories of users. Special inserts take the shape of "thematic topics" and are sold as "extras" in connection with the purchase of the newspaper. Augmented Reality can be used, in this case, to design and create new types of immersive and interactive thematic special inserts. In fact, traditional content can be "augmented" with digital content in order to make the product more informative and appealing, possibly increasing its commercial potential. "Augmented" thematic inserts are another ingredient of product innovation that can help to generate important revenue streams for publishers.

**BOOKS**

*"Augmented Reality" Books*

Books are another important type of publishing product that Augmented Reality can help to innovate. In an even more innovative manner than newspapers, AR technology inside the books can help to create immersive reading experiences as well as high impact content structures. Possible applications include:

- Books and Encyclopedies for children
- Cross-media Products for Edutainment
- Text Books for K-12 Education
- University Books
- Technical and Professionals Books
- User's and Maintenance Manuals
- Touristic Guides.

The possibility of conveying digital content in the context of traditional text-based media is particularly relevant not only for its cultural added value, but also for the fact that, as shown by many studies, augmented reality improves in many ways the performance in learning tasks (Shelton & Hedley 2002; Schwald & de Laval 2003; Goldiez 2004, Kaufmann 2004). For this reason, AR technology not only makes the book a new and more attractive product from a commercial point of view, but it also improves its functional features with respect to its older cousin, the printed book. Some topics for AR books include: archaeology, boats, cars, models, architecture, games, crafts, fairy tales, film, geography, history, science and technology.


**COLLECTIBLES**

*Collectibles endowed with "Augmented" Contents*

The category of collectibles includes all of the editorial products that can be collected and are typically offered in multiple issues during the year. In this area you can imagine many AR applications, from assembly manuals, to the instructions for decoupage, cards games, up to really innovative products that only imagination can conceive. Some topics include: archeology, boats, cars, models, architecture, games, crafts, fairy tales, film, geography, history, science and technology.

## Conclusions

Besides the challenges that unavoidably need to be addressed, the potential for Augmented Reality applications in publishing, and in particular in connection with the press, are enormous. What emerges from our analysis is that AR provides significant added value, both on the cultural and on the commercial levels, to paper-based publishing products, without the need to completely replace them. This enhancement will then correspond to new market opportunities that are yet to be explored. The advent of next-generation mobile devices anticipates an horizon of adoption for AR as a mainstream technology that is now close and inevitable.

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