

THEME 4

Culture in the cloud

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Let's begin at the end, anticipating in an idea where this article is going to end: the future of the Web, or the Web of the future, can be glimpsed today in the so-called *Internet of Things* (IoT).

Internet technology has become much more tangible, it is beginning to infiltrate every space, and for several years it has been slipping in through the cracks in our houses, it is adhering to our bodies and soon it will adhere to our minds.

The time is still some way off when sensors embedded in our brains send signals to the pianist in the room about the emotional effect his art is having on the public who are listening, or so that the pedals of his piano are adjusted automatically to set different rhythms, the result of ultra-fast decisions based on the real-time analysis of the mountains of data received from the brains of other audiences in other countries and at other times, but in fact the questions we should be asking ourselves are: How long will it be? What will pianists of the future be like? Will they study solfa or mathematics?

According to mobile Internet analysts, 2013 was the year of responsive design and the boom of wearable devices, that is, ones you wear on your wrist, on your head or even in your skin, and which connect you and let you interact with other things, always using Internet technology to achieve this.

A highly relevant datum from the latest study by [Google Research](#) on consumption at Christmas 2013–2014 is that searches for the term *wearable* underwent a 100% increase since January the

previous year, particularly on the West Coast of the United States and the technology Meccas of New York and California.

But before describing these technologies, it is worth examining the concept of augmented reality, since many of the new mobile devices use it. "Wearables" are part of a broader equation that is already having a great impact on industries in the cultural sector and will probably have much more.

AUGMENTED REALITY, MIXED REALITY

Augmented reality (AR) technologies are a key factor in the success of wearables. But what do they consist of? Of the many definitions, I like the one that described AR as "an improved view of the real world". But watch out! Augmented reality must not be confused with virtual reality.

Virtual reality creates worlds that are completely different from the real one and its maximum exponent was [Second Life](#). Although this platform aroused great expectations, even possible benefits for companies and institutions, the fact is that so far it has demonstrated its applicability to gaming, the film industry and leisure, with the failure of many of the business ventures that set out to exploit it. It may be recalled that at one time banks, shops and embassies set out to create their own spaces, but the fact is that at the moment it has not met expectations.

Augmented reality, on the other hand, is a much more recent phenomenon that mixes experience of the real world with the virtual one, enabling a different sort of interaction with the exterior. The term was coined in 1992 by the Boeing researcher [Tom Caudell](#).

This is one of the cases in which literature and film have been ahead of reality. In his 1993 novel *Virtual Light*, William Gibson described some glasses that are quite similar to what we now understand as augmented reality. "Whoever wore them could see notes and additional details that were attached to each object in the physical reality before them. They were often used by artists and neurosurgeons. In the frame and lenses there were electromagnetic contacts that acted directly on the optic nerve." In another passage from the book, in an empty room one of the characters (Rydell) puts on some virtual light glasses that have been lent to him by a policeman, after which he can see in the same room a three-dimensional image of the scene of a crime that had happened some time before. Also, in [Minority Report](#), a film by Steven Spielberg starring Tom Cruise, there are a number of gestural interfaces to

plan the future that are not too different from some of the products that are already on the market.

Augmented reality technologies (AR) introduce the virtual into the real world in order to improve it

A wearable AR device always requires some form of display that can be located on the head or on the retina, for example; there are no limits. To mix in the images of the real world a camera is required. The device usually offers Internet browsing, GPS services, address search, photography, videocalls and ticket sales, to mention some services. Smartphones have many of the elements needed for augmented reality applications, making them potential augmented reality devices.

It is calculated that by 2014 there will be 864 million AR telephones and that approximately 103 million

cars will use AR by 2020, enabling users for example to receive traffic statistics via their glasses while they wait anxiously in a traffic jam, as described in this article in the online digital technology site Digital Trends on [AR applications for iPhone](#):

Expectations of its impact in coming years have been raised in all sectors and have taken a firm grip in medicine, architecture, tourism and the automobile industry, to mention a few, and the cultural sector could also become an area for application, as for instance in digital television, educational content and virtual exhibitions. One example that can be mentioned is an attempt by the British Museum to improve visitors' experience through an educational project based on AR launched in 2011.

A number of museums such as the Streetmuseum and the London Museum have created an AR application based on the use of historic photographs combined with localisation, allowing visitors to see what the city looked like at some time in the past. The Centro Nacional de Arte of Mexico was a pioneer in using them within the museum, placing children in front of a mirror with digital augmentation. The children could wear various simple clothes and hats as AR markers. Depending on the markers they wore, they would see a projected image of themselves wearing historic garments over their own.

In the 2011 British Museum project [Passport to the Afterlife](#), children used mobile phones provided by the Museum to scan markers that showed 3D images of objects from ancient Egypt. Augmented reality markers must not be confused with QR markers. The basic use of QR is to send the user to a Web site, while an AR marker makes it possible to show three-dimensional objects. In her excellent article, Shelley Mannion, the Museum's director for digital education, also explains how artists, aware of the potential of the technology, are using it to produce virtual exhibitions, where and how they like, anywhere in the city or in its artistic spaces. For example, on 9 October 2010, [Sander Veenhof and Mark Skwarek invaded the MoMA](#) creating an AR

application that projected their works inside the galleries.

Although most of the instances of the use of this technology have so far been in museums, it has also been suggested that augmented reality could replace the manuals used by technicians in many sectors of industry, such as car repair, and so the same might happen in the field of education in general, with a consequent impact on the book industry.

CULTURE SEEN WITH OTHER EYES

Google Glass was the star launch from Google in 2012, the first commercial augmented reality product, which inaugurated a new generation of wearable devices. Its promotional video shows a modern version of Leonardo's bird man and it transports us to a land where its users control their experience in the world while barely grazing it, with the utmost lightness and freedom.

The glasses show significant information on a little screen located in the corner of your eyes, making it possible, among other things, to take photos and shoot videos. They are voice-sensitive. The user orders *Glass take a picture!* and the glasses obediently snap your sky-diving experience. The world seen from above, at your feet, without needing your hands to press any button. *Glass record a video!*, you could go on, or *Glass share this!*, and the device, that is, the pair of glasses you are wearing, records and shares the unique, interactive experience you are having with the world around you. The glasses elegantly superimpose all manner of useful or commercial information on the images of the real world, and as though that were not enough, last month [Google announced that it would add the possibility of controlling music with the glasses](#).

The experiments by museums to develop AR applications for mobile devices will soon be

improved by equivalent applications for *Glasses* so that there will be no need to use your hands. The mobile devices we are used to are beginning to turn into rather old-fashioned devices. The media are also pioneers in using the glasses, for example the [Google Glass application for the New York Times](#) or for CNN News.

The tourist industry has been amongst the first to see the potential of Google's new invention and the Glasses are spoken of as being the tourist guides of the future. The use of augmented reality, which enables users of the glasses to magnify what they are seeing down to the tiniest detail and to see real-time indications based on maps, will make future applications for cultural tourism extremely valuable, both for the tourist and for museums, libraries, theatres or exhibition galleries or cinemas who wish to reach a localised, more attractive public. Probably one of the most interesting uses of this technology will be the ability to record and share one's personal experiences. By way of example we might cite this experience of a visit to the [Metropolitan Museum](#) using it. Who would not like to repeat the experience of Vargas Llosa on a visit to the Prado?

Although still very expensive—they will cost about €1,500—they will not be on sale until 2014 and probably we will see more applications for Google's invention as the price goes down, driven by amongst other things the competition of new suppliers such as Apple, who have already announced their version of augmented reality glasses, presumably in white to give continuity to the company's trade-mark colour.

**Wearable devices
are clothes and
accessories that
incorporate electronic
or computerised
technology**

WEARABLE DEVICES IN ALL SIZES

As well as the glasses, which have rapidly become popular, closely followed by the SmartWatch launched by Sony, other tactile devices also exist or are under development, smart wigs, tattoos and bracelets, while sensors are being embedded in sports shoes and even in underwear.

i-Air Touch (iAT) technology, for example, offers projectors of virtual images that can be “touched” and seen through special glasses. The camera is activated when it detects the user’s fingers a certain distance away, although unlike the Glasses it does not respond to voice commands. Devices of this kind are better classified amongst the tactiles. In the meantime, Disney is developing facilities that will not need any physical contact to achieve a [Feel it in the Air](#) effect. “A time will come,” says a Disney researcher, “when we will use telephones not just for seeing and hearing, but also for feeling”.

The smart watches from Sony, Samsung and Qualcomm represent another new type of device to which we must accustom ourselves. Apple is not being left behind: it has announced that it will soon launch the Apple iWatch on the market and it has patented a new type of flexible display, the [iCuff](#). We do not know whether this is intended to be used with the iWatch or in a new type of iPhone. Also, in November 2013 another maker of smart watches, Pebble, had already sold more than 250,000 units of a model able to receive calls and messages and to control music. Pebble has already announced that it will soon be capable of supporting popular applications such as Foursquare.

Motorola Mobility has announced a [tattoo](#) that acts as a microphone, which achieves perfect clarity of sound, and not only enables wireless communication with a mobile device but also acts as a lie-detector.

Finally, [Sony](#) has patented a new, radical type of wearable that consists of a wig with a laser pointer

and GPS able to control other gadgets. The patent states that the wig is built to connect wirelessly to other devices and will be controlled entirely by head movements. Sony asserts that in comparison with the Glasses or smart watches the wig will have the advantage of being more discrete. While not denying that the patent is highly innovative, I confess I have my doubts as to this latter point!

OPTIMISATION OF MOBILE CONTENT, MOBILE APPLICATIONS AND MOBILITY TECHNOLOGIES

I stated at the beginning of this article that 2013 had also been the year of Responsive Design—and not by chance, but because of the proliferation of devices. We do not know how people are accessing, in our case, culture on the Internet, which may be from a browser, a mobile phone, a tablet, a watch or a pair of glasses, making the management of the content that is to be presented to the user a very complex matter. The so-called adaptive mobility technologies are a response to this problem.

New demands have been generated for the storage, transformation and presentation of content, particularly when it comes to designing experiences that will work well both from a desk-top browser and from a mobile device. Should I make a specific version of my site for mobiles? Or would it be better to develop a mobile app? These are the questions that publishers, museums and online music companies are asking themselves every day. Another question it seems logical to ask is, “How is this new generation of devices going to affect existing technology?” and, what is more important, “In what form will it be used every day by the specialists who produce, manage and exploit digital content?”.

There are, as usual, many answers: it may be that the best thing is for the website accessed from a mobile to be different from the one accessed from a

browser running on a desktop machine, not just because the screen size is different, but because the visitor's mindset and context are different. For example, on a website selling books, one consideration is to determine at which point in the sale cycle the user is accessing the site from a mobile device—something that usually happens once or twice, particularly at the start of the purchase process—and offer only the necessary information on the mobile version of the website. In general, mobile-friendly browsing requires a simpler design than a desktop website, avoiding, for example, the use of scrollbars or making the user enter text.

Consequently, the technological problem arising from having to develop applications different from the website for different mobile operating systems must not be confused with what is really intended and what is good for business. The fact that the new responsive design technologies make it possible to resolve this problem by developing a single version of the website that can be seen well on all devices does not necessarily mean that we have to develop the same version of the website for all of them. This is probably not what we want. Mobility is a question of options that implies understanding the cycle of the user, in our case the consumer of cultural products, in order to choose the best option at any given moment.

One of the advantages of responsive design is that it makes it possible to optimise the design for several devices without the need to create different versions of the website, and indeed use the same URL, by detecting the device which is being used for access. On the other hand, one of the main drawbacks of using native mobile applications is the need to develop multiple versions of the software to be compatible with the operating system of the device in each case. Today's trend is towards hybrid applications of which a single version is developed. That is, applications that run on the device but which use the same mobile web technology as the website.

In 2009 a specialist in mobile technologies called [Luke Wroblewski](#) summarised his ideas on good practice for design for mobiles in an article that created a great impact. The title of the article, which was followed by a book, was "Mobile First", and the underlying idea, the "call to action", if you prefer, was the need to simplify designs for mobiles and focus on the important things in view of the limitations of their displays. In the same article he called for the abandonment of desk-top browser design mentality in order to take best advantage of the features that smart phones of the period offered: localisation, multi-touch, tactile interface, accelerometer, camera, etc.

Adaptive mobility technologies make it possible for a single version of a Web site to be viewed well on all devices

Luke Wroblewski's ideas made a huge impact, and even though very soon afterwards new Internet browsers began to incorporate many of the features of mobile devices, reducing the distance between them, as a consequence of the popularisation of mobile web technologies in comparison with the mobile applications that Wroblewski had originally called for, the central idea that it is necessary to design for the mobile first still holds sway and is very important, to the point where it is common to speak of "mobile first responsive design".

HTML5 is one of the technologies incorporated into new browsers and has made possible the old technological dream of a single version of a site for all devices. So how does HTML5 differ from HTML4 or HTML3? Firstly, HTML5's new labels make it possible to do many more elegant, interactive things than the previous versions of the standard. One example is the famous page that emerged as one of the demonstrations of its functionality that reproduces [the credits for Star Wars](#); for example, with HTML5 it is possible to render 3-D objects.

Another difference with respect to earlier versions of the standard are the new semantic labels it

incorporates and which could have such a major impact on issues that are highly relevant to the cultural sector, such as the protection of digital rights, although this leads us away from the subject of this article. But what makes HTML5 particularly suited for managing mobility are its new application programming interfaces (APIs) which make it possible to provide a functionality equivalent to what could before only be achieved by direct calls to the various mobile operating systems.

Other technologies that underlie responsive design are the so-called media queries, that are able to recognise the device on which the browser is running, and the CSS3 standard for cascading style sheets, which makes it possible to define shared styles and create specific styles for big displays using relative units that make "fluid design" possible, both in terms of column width (fluid grids) and image size (fluid images).

At the moment there are very few websites that could be regarded as fully responsive, but the Web world is rushing to achieve this. For example, the website dconstruct.org, which describes itself as a meeting point for people at the intersection of culture and technology, applies this sort of technology. If you access it in a desktop browser and reduce or increase the window size you will see how different objects on the page are resized in consequence, and similarly the site will adapt to whatever device is being used for access. Another example is the website www.omusicawards.com. A responsive website to which a visit is recommended is [Smashing Magazine](#), specialised in the "user experience", a new sort of specialisation that proves to be essential to properly analyse and design the user's navigation through various interfaces. In the words of MIT researcher Don Norman, one of the fathers and driving forces behind the concept, "It's not complexity that's the problem, it's bad design. Bad

**Responsive Web
sites resize and adapt
to all of the devices
used to access them**

design complicates things unnecessarily and confuses us. Good design can tame complexity"¹.

By way of a summary, if one makes a comparative analysis of mobile web technologies and the development of mobile applications, it can be said in favour of the former that the service can be found through a search-engine or link, but with the disadvantages of having to be connected to the Internet and the limited use made of some of the devices' most advanced features. Until recently it was said in favour of mobile apps that they would make better use of the features of the device (push notifications, GPS localisation, camera, NFC payments, biometric security), and that they would work without a network connection, but as already mentioned this distance is becoming shorter and shorter thanks to the evolution of browsers.

The good news in the face of this dilemma is that mobile applications may not only be native, that is, run exclusively by means of calls on the mobile operating system, but also hybrid, and these are reusable on different types of mobiles. Applications of this type do not need a network connection and achieve the goal of "build once, run everywhere" through the use of standard Web development technologies (Java, HTML5...) and a specific "container" for the device. For the user this is transparent, since they have the same look and feel and functionality as those available in the App Store. In April 2012, the Gartner consultancy predicted that by 2015, 80% of all applications developed will be hybrid, or "mobile web". It seems then that mobile applications come quite close to being the best of both worlds.

All mobile applications, be they hybrid or native, have the peculiarity that they can be downloaded from big distributors such as Apple's App Store, Google Play, Win Phone Marketplace or BlackBerry World. Although it is difficult and costly to assess what proportion of mobile apps on these sites are related to digital culture, the book industry, games and education clearly have the largest presence. For example, in the Apple App Store alone one can count 26% games and entertainment, 11%

education and 10% books, amongst the more than eight hundred thousand apps available for download.

CULTURAL SENTIMENT ANALYSIS

With all the digital devices we are carrying or wearing, the quantity of data we produce is enormous. To this has been added the flood of data from social networks, and it is estimated that a further flood will come from the connected devices we shall discuss below. Furthermore, all this data is collected and analysed. There can be no doubt as to the existence of what has been called Big Data, nor can there any longer be any doubt as to the usefulness for our lives of exploiting it in real time, although there were some doubts at the beginning. The highly respected scientist [László Barabási](#), for example, author of the influential book *Linked*, which describes the functioning of the networks with reference to the [irreversibility of Big Data](#), predicts that its impact on our lives will be equivalent to that of connection to the Internet.

From a technological point of view, Big Data involves the use of specific hardware for the storage and recovery of large volumes of information: modern No-SQL databases; real-time event processing systems and a new generation of advanced tools for statistical analysis.

The problem is that as human beings our capacity to understand and consume Big Data is limited, so we need new solutions to resolve the problem and take advantage of the opportunity. Sentiment Analysis systems can analyse and exploit the enormous volumes of data generated by users of the social media and can support different business decisions on the basis of trends in consumption or intention to purchase, for example.

The real-time use and exploitation of large volumes of data for the taking of major decisions is a factor affecting competitiveness in any industry, including

the cultural industry. For example, Big Data technologies are often used to segment marketing offers and this also applies to the marketing of books, exhibitions, films, photography, music, etc.—something which is becoming more and more necessary in view of the hyperabundance of data that afflicts us.

The value of this type of analysis in public health, global warming problems or financial turbulence is plainly

accepted; nonetheless, analysis of its impact in the cultural arena is advancing only lackadaisically. At least at first sight it seems that the IoT and the Big Data phenomenon have not left much mark on the statistics for the cultural sector, although one of the hypotheses of this article is that data on creativity industries lie hidden under headings such as distribution or entertainment, while detailed analysis and case studies do reveal a greater impact than the statistics would suggest at first sight. It must be said, nonetheless, that according to an analysis by McKensey these technologies will affect all sectors, but some more than others. According to this report, in 2009 there were already 269 petabytes of education data stored in the United States and 717 petabytes of communications and media, facts which lead the consultancy to conclude that in the cultural industry, those that can most benefit are the education and entertainment sectors.

An ever greater impact is expected from the use and real time exploitation of Big Data with advanced tools

DIGITAL IDENTITY OF CULTURAL OBJECTS

Another major trend to come that has the Cloud at its epicentre is the "Internet of Things". This phrase refers to a level of the Net in which a series of intelligent things are connected together, using IP to facilitate interoperability. Furthermore, it calls for



the use of the lightweight communications protocols that are popular in social networking, such as REST, to control devices in view precisely of its nature as a stateless protocol, that is, asynchronous and not awaiting a response. This makes it very useful in these scenarios.

A sensor is a device that detects a certain physical quantity and returns a mechanical or electrical response. They are found in every field, including electronics, mechanics and industry. The sensor picks up the signal produced by the device. Machine To Machine (M2M) technologies are part of the Internet of Things concept and the term refers to communication between two remote machines. The device or sensor connected to the machine being monitored normally possesses some degree of processing capacity and sends the information to a remote server where it is intelligently stored and analysed.

M2M has been successfully applied in such diverse fields as safety in the home and monitoring the health of dairy herds. If a cow becomes ill, the information is sent immediately to the farmer, who no longer has to spend nights awake. Modern photocopiers fitted with an M2M module can automatically request more toner or paper or alert

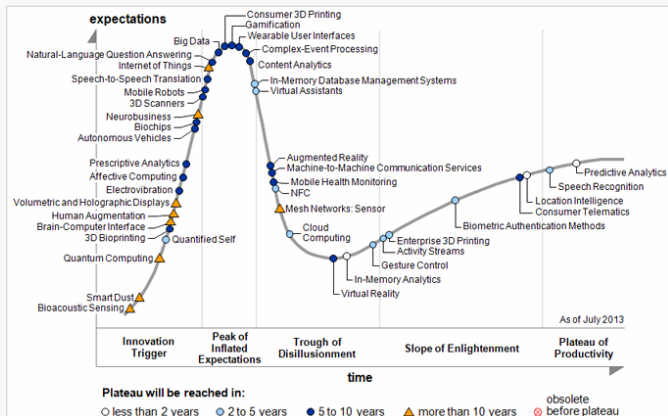
the maintenance company of parts that have gone wrong. Nor do its applications end there.

Deutsche Telekom's M2M Competence Center estimates that there are more than 100 million vehicles, fire alarm systems and dispensing machines connected. According to Cisco, connected cars too are already a reality, and the European Union has mandated that beginning in 2015 all the new cars that are registered must have an [automatic emergency call system](#).

But while in the fields of health and industrial products its utility is obvious, exploitation of it in the creativity industries seems to have been much more timid. Nonetheless, pictures, books and sculptures can also be identified and tracked using the smart tagging technologies. QR codes have become essential in museums, but there are many more possibilities for using labels and sensors on the artwork that can add value for the institution or company that conserves it and/or markets it, for the artist and for the person who enjoys it.

Each cultural object could be uniquely identified in the future through these technologies, a fact that opens up interesting perspectives for marketing, loaning and above all artistic and trans-media co-creation, themes which are dealt with in other articles in this Annual. We can approach an object to obtain more information by reading a QR label, but beyond this the IoT technologies combined with third-generation mobile devices can offer us new ways to experience art, helping us to have more visual and more tactile experiences.

The future of the technology points to the combination of data emitted in real time by the artistic and/or cultural objects with the information residing in business databases or in the Cloud, about me and about the tastes of others whom I might resemble, linked to new solutions for high-speed data analysis (Fast Data). Its use or exploitation is transversal across the processes of marketing, sales, loans, storage and exhibition. This could be really interesting, from my point of view, in the



GARTNER HYPE GRAPH

transformation of the artistic experience itself, as the figure tries to show in a very simplified way.

HORIZON 2020

The technology consultants Gartner annually publish their famous [Gartner Hype](#) graph of technology evolution. To understand it, it is important to pay attention to the horizontal axis, which represents a very well-known model developed by this consultancy to explain the curve of technology adoption. According to Gartner, in the most optimistic scenario technologies begin with a “technology trigger”, reach a “peak of inflated expectations”, pass through the “trough of disillusionment”, progress to a stage of “recognition of utility” and finally some of them are consolidated and “stabilised”, while others are left by the wayside and slide into the abyss as they descend into the trough of disillusionment.

With the modesty that any prediction demands, and in reverse order of appearance, probably those that will have the greatest impact on the cultural sector have already been mentioned in this article, and they are virtual and augmented reality, the NFC technologies used in mobile payments, the new wearable user interfaces, Big Data, gamification and the Internet of things we have just discussed.

According to a report by [Jupiter Research](#), today only 60 million people use augmented reality

applications regularly, although it is calculated that there will be 333% growth by 2018 in the use of smart phones and smart glasses that involve augmented reality. It is also expected that by then they will have slipped out of their gaming stronghold and invaded daily life. By 2018 the same consultancy estimates that there will be 200 million users of augmented reality mobile applications. Regarding the evolution of the IoT, analysts disagree; [Morgan Stanley](#) predicts there will be 75 billion devices connected to the Internet of Things by 2020 and a market analysis by Berg Insight predicts a growth of 360 million by 2016.

CONCLUSION: DIGITAL CULTURE AT THE FRONTIER BETWEEN ART AND TECHNOLOGY

The study *Digital Culture*² by Aleksandra Uzelac and Biserka Cvjetanin, published by UNESCO, begins with the following idea:

Digital culture is a new and complex notion [...] The new possibilities created by communication and information technologies—global connectivity and network growth—challenge our traditional way of understanding culture, extending it towards digital culture too. So that culture today must be understood as an open, dynamic process based on communication and interactivity, and we must not think of it as a closed system that turns us into a cultural mosaic in comparison with other, similar or different, cultures.

The benefit for society of the new technological possibilities, in terms of the elimination of cultural frontiers and the cultural inclusion of the most disadvantaged societies, is clear. But not everything is positive: there is also the risk of a growth of the digital divide as the new technologies involve more complex and costly technologies³. Although access to the first Internet has been cheap, the world that is emerging around it is already not so cheap. Concerns over the use of Big Data to avoid our entering a truly hellish technological empire are not trivial. In this regard, in his article “[Reinventing](#)

[society in the wake of big data](#)", MIT professor Alex Pentland poses the question, "For whom is this new data-ruled world and what will it be like? [...] it is true that this new world might make George Orwell seem like a third-rate player with little imagination and that we need to think about serious issues such as privacy and the property of data". Cultural institutions and companies are the repositories of a large amount of data of enormous value from the point of view of heritage and of business and they must investigate how the new technologies can help them with their task while not ignoring the problems their use poses for society.

On the other hand, although the benefits of investment in technology in the cultural industry are clear, there must also be

Investment in technology in the cultural industries also entails the adaptation of management processes in order to generate profits

awareness that investment in technology does not have an immediate impact on development until management processes are adapted to the new changes. In the study [Big Data: The Next Frontier for Innovation, Competition, and Productivity](#), by the McKinsey Global Institute, the consultancy clearly relates investment in technology with economic development through the various stages of the technological revolution, but warns that "there is a delay between investment in technology and the management innovation needed to accelerate productive growth".

IoT and Big Data technologies may help towards better conservation of works of art and enable better use to be made of exhibition spaces, and may also contribute to achieving better exploitation and marketing of cultural products (books, photographs, music, etc.) based on the analysis of the new, valuable data available about the public's preferences and behaviour. The new wearable devices and augmented reality may help generate experiences that imply greater involvement of the senses—touch, sight and hearing—with the art object. Equally motivating, the possibility of communicating remotely with different art objects thanks to IoT technologies could catapult artistic production into places we have yet to imagine, so that cultural spaces are transcended and become new, entirely digital spaces, where the artist can generate new artistic experiences beyond a specific physical space or object.

Something like this must have passed through the mind of André Malraux when, at the height of the Second World War he described his imaginary museum as a place without bounds nor special restrictions nor temporal limits, made to measure for each person, where what one has seen there and elsewhere, what one is and what others are, are all mixed and are transformed into a world where, as he says at the beginning of the work, "a Romanesque crucifix was not originally a sculpture, the *Madonna* by Cimabue was not a painting, neither was *Palas Atenea* by Fidias a statue". Do not be led astray: no matter that a work of art is digitalised and completely at our disposition through the Net, Malraux's dream has still not been fulfilled.

NOTES

- 1 Donald A. Norman (2010). *Living with Complexity*. Cambridge, MA: The MIT Press.
- 2 Aleksandra Uzelac y Biserka Cvjeticanin (2008). *Digital Culture: The Changing Dynamics*. Unesco.
- 3 Google Glass Exclusion Problem. Artículo de Lauren Hockenson en GigaOM.

REFERENCES

- Malraux, André (1951). *Le musée imaginaire*. Paris: Gallimard.
- Uzelac, Aleksandra y Cvjeticanin, Biserka (eds.) (2008). *Digital Culture: The Changing Dynamics*. Unesco.
- Wroblewski, Luke (2011). *Mobile First*. A Book Apart.

RECOMMENDED READING

- Bruner, J. (2013). *Industrial Internet: The Machines Are Talking*. O'Reilly Media.
- Domingo, C. (2013). *El viaje de la innovación*. PlanetaLibros.
- Marcotte, E. (2011). *Responsive Web Design*. A Book Apart.
- Norman, D. y Nielsen, J. (2010). *Gestural interfaces: a step backward in usability*. The MIT Press.
- Steimle, J. & al (2013). "Displays Take New Shape: An Agenda for Future Interactive Surfaces". *CHI'13 Extended Abstracts on Human Factors in Computing*. ACM Press.
- Swan Jones, L. (1999). *Art information and the internet*, Arizona: Oryx Press
- Weyl, E. (2013). *Mobile HTML5*. O'Reilly Media.

LINKS

- [Google Research: 2013 Holiday Shopper Intentions](#)
- [Google Glass will expand its features into music](#)
- [Seeing the Metropolitan Museum Through Glass](#)
- [British Museum - Augmented Reality: Beyond the Hype](#)
- [Creating a Mobile-First Responsive Web Design Museum becomes fully accessible to deaf people](#)
- [La irreversibilidad del Big Data - László Barabási Reinventing Society in the Wake of Big Data Gartner Hype 2013](#)
- [The Next Frontier for Innovation, Competition, and Productivity by the McKinsey Global Institute](#)
- [Smart Phones, Smart Glasses and Augmented Reality to Jump 333% by 2018](#)
- [Google Glass Exclusion Problem](#)
- [The Language of Content Strategy](#)
- [Tedxmoncloa 2012: La evolución de las interfaces - J. Freire](#)
- [The Role of IoT in China 12 years plan](#)
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SITES OF INTEREST

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