

PRESENT AND FUTURE ECONOMICS OF AUGMENTED REALITY

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ABSTRACT:

The present paper aims to address the 2015 realities of the Augmented Reality environment, from both technological and economical point of view. The paper introduces the issue of AR through a concise historical background, follows with a number of AR practical applications found in day to day business strategies, goes through the financial figures of the AR environment for the last couple of years and finishes with several predictions and considerations on the topics of AR use and monetization. As the main practical result, the paper will also present a fast and easy solution for digitization of real objects into 3D models, usable as definable object within an Augmented Reality application.

KEYWORDS: AR, 3D, digitization, augmented reality, monetization

1. INTRODUCTION

Augmented Reality is considered as “the major step forward” within the environment of the IT universe, with regard to public opinion at least. If we want to be a little more precise, in the same manner as it is the issue with other bright ideas or proposals, the concept of augmentation of reality is not hundred percent brand new, founded in the last one or two years. AR is an idea developed and implemented from quite a while ago, making the first appearance around 1960...during the previous century. Most researchers of the IT field think that the first AR implementation was the well-known device called “Sword of Damocles”, which was developed by professor Ivan Sutherland in the USA. He developed it by working together with a student of his, Bob Sproull. The device was developed and built as a first trial of some sort of head-up display (devices known as HUDs today). Unlike modern head-up displays we see today in a quite a lot of fields, the “Sword of Damocles” is a very big device that was actually hanged over the researcher’s head, stabilized by keeping it in place hung from the top of the room. Think about this size and compare it with the latest (even though already dead) Google Glass equipment. The miniaturization really took some huge steps ahead during the last decades ☺. The concept of Augmented Reality was first researched and later adopted by the military. As in the case of a lot of other advances humankind made during its history, the military fuels the need to know and develop advanced devices, which later come into everyday life of the rest of the population. The first large scale use of AR researches results is considered to be the fighter pilot combat helmet – the first HUDs to be used in real-life situations.

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Fig.1 The “Sword of Damocles” Augmented Reality device¹

The military appreciated the capability of bringing lots of information in minimal time, just in front of the fighter pilot's vision. Integration lots of data coming from different sensors (position, ammo, target identification, directions etc.) represented a big step forward in providing better fighting conditions for the airmen. For the last decade or so all the technological gains were spread among different army branches, making most modern army vehicles today capable of using HUDs, smart sensors, sophisticated location devices, smart weapons, identify friend or foes etc. During the last couple of years we have seen a new kind of weapon coming into focus – the drone. Besides tanks, fighter and bomber planes, rockets, bombs, helicopters, infantry fighting vehicles, submarines, carriers, destroyers and so on, the modern battlefield of today seems to converge to a new king, the drone. The today drones are in fact a result of advanced avionics, engineering and augmented reality. A fighter pilot can sit down in his chair in Nevada and live-control a fighter drone performing a scouting mission in north Afghanistan. Need be, the same pilot, or even the drone itself, can decide a new course of action depending on the situation at hand. And all these are accomplished with the use of AR, without putting the live of the pilot directly at risk.

¹ Image available from: <http://dazzleship.com/blog/oculus-damocleas/>

Some years after the army the rest of the world has also discovered the huge potential of the AR and started to push on that track again. Again, as in a lot of other situations, the fact that the civilian use of a certain technology is delayed has a direct relationship with its costs. In the beginning, the physical dimensions and the costs involved in running augmented reality devices was just too big for everyday usage. As time went on, the miniaturization process took its toll, the costs also decreased and as a result the AR came into the scrutiny of the large public again. Nowadays, the basic AR tools are found everywhere and can be very easily used through the smartphones that invaded our lives. The exact same thing happened to personal computers. During their first years, they were used mainly by large public organizations because of their size and costs but as time went the sizes shrunk, the prices became more affordable for everyone and any average household in the civilized world today has a computer which is a hundred times more powerful than the first ones, inside a case which can sometimes fit inside ones pocket! Going back to the augmented reality concept and its devices – besides the costs and sized involved in using such devices at the beginning, that was also another question that has been posed: are they really useful? When people started using AR devices, for day to day use, it was indeed difficult to find an actual 100% advantage in using such a device. One had to pay a lot of money and use a lot of time in learning how to operate such a device without having a very definite gain. Again, we can see a syllogism with the case of the moon journey. We can go to the moon today whenever we want (technologically speaking) but we are not sure we want too – there is no clear gain to be seen after spending all those amounts of money on a moon expedition. As different software houses began to develop more and more applications that can indeed bring something extra for the casual user, and as the cost decreased of course, the educated IT users begin to use more and more such AR devices. Even though we can't say that there is someone today, in the public stage at least, that actually relies on AR, more and more cases appear when people and professionals start to use AR in order to gain better information about different things.

2. AUGMENTED REALITY IN ACTUAL USE

For the last three or four years, the AR potential has begun to be seen by a lot of actors in the IT field, with a lot of consumer applications being developed and launched, although the largest majority of these applications can be considered as “beta versions” of what Augmented Reality could really provide. In most cases today, AR is not quite science fiction feats capable. We do not yet have AR environments like we saw on the iconic TV shows StarTrek, StarGate or Minority Report. The realities of today are in fact collages of different applications and electronic online apps built and composed in order to help us learn or to entertain us by means of different interactive scenarios.

The Augmented Reality environment that we actually have around us today is in fact a technology that combines computer generated images with real ones (either static or dynamic, online or published on paper, available through a camera of a smartphone or online). We should see the AR of today as just a phase in the process of filling the space between real world and computer-generated universe. In fact, Augmented Reality was described as the application of inserting and mixing digital information into the real environment, in real time.

3. AUGMENTED REALITY – EXAMPLES OF PUBLIC WIDE-SCALE USE

The most hyped AR device for the last years was without a doubt the famous Google Glass. Fortunately or not, subject to one's liking and opinion on the topic, the Google Glass project failed to deliver up to the end. Even though the technology potential was obvious and above doubt, the final result was a failure, mainly because the society does not seem very happy to accept its widespread use.

One other AR software application that saw quite a large audience and it is considered really useful is Star Walk. This AR software application was first developed for Apple environments but was later ported to other operating systems and is now considered comparable with the famous Angry Birds game, as per number of downloads. This AR application is simple and easy to use and it really does something useful – it helps a lot in order to let one become an astronomer without need of special equipment or advanced professional knowledge. You just have to point the camera of the smartphone, having previously installed the app, to any point of the sky and you will get information on virtually every star that is out there. It is a perfect example of AR capability, of what AR can actually help with today – simple things that really make a difference, are free and provide something that is very complicated to attain by other means... if you do not actually own a rocket and a magic spell to go visit those planets.



Fig.2 Star Walk captured screen¹

One other AR software that was in the beginning a huge success was a game that captured millions of gamers and became a true life for some – Second Life. The game was

¹ Image available from: <http://vitotechnology.com/star-walk.html>

considered the AR software that holds the record for largest number of users at one moment.



Fig.3 Second Life captured screen¹

Actually, Second Life is trying to make a spectacular comeback to the top and started a cooperation with another project that might become a very important one on the AR playing field – the Oculus Rift.

A very educational example of public AR is seen at the world famous Smithsonian Museum. Visitors here can make use of their smart devices to re-live the age of the dinosaurs.



Fig.4 Smithsonian Museum of Natural History, “Walk Among the Dinosaurs” Exhibition¹

¹ Image available from: <http://ludercy.com/old-blog/final-thoughts-on-second-life/>

Also a very suitable field for AR is the historical recreation of various landscapes. Of course, many of those historical backgrounds have been destroyed over centuries and AR is the best tool to provide an accurate re-enactment of a certain location millennia ago. We could go to Rome, visit the forum and see through the smartphone's display the legions of Augustus marching over the stone paved roads. In Rome we can also find AR software applications that help tourists by providing them a holistic image of the still standing Roman Colosseum.



Fig.5 Rome's Colosseum seen through an AR application that can reconstruct various parts²

AR has another perfect playing field in regard to design and engineering. Instead of having to wait for a complex process of building stuff, researching them, modifying and building again – the modern industrial designers can use the AR for development and testing purposes. They can design a certain component, place it inside an AR reconstructed environment and see exactly how it would act and react depending on various parameters. Electrical engineering and microelectronics are other perfect situations for applying the AR. Instead of having to build a costly and time consuming motherboard and check every microcontroller on it, the engineers can now design an AR application that recreates the entire board of circuits, simulates different flaws of electricity or data and then calculates what would happen in different scenarios, when would the board over heat or go into a short-circuit.

Even more, instead of having to send an engineer from Germany to Romania for a training on different components installation procedures, a special AR training can be arranged and the German specialist can provide a sort of a holographic enactment of a real component installation procedure from thousands of miles away and without having to

¹ Image available from: <http://www.mnh.si.edu/exhibits/walk-among-dinosaurs/>

² Image available from: <https://www.youtube.com/watch?v=WOVjISxlhpU>

carry or even actually have neither the components nor the mechanism they are supposed to join to.



Fig.6 Augmented Reality used inside a car factory assembly line¹

In the very crowded field of advertising AR managed to get a high degree of attention from preeminent names on the market. Among the most important furniture providers today, at worldwide level, the Swedish company IKEA, had developed a software application based on AR. Their application is several years old, the first version, and is now considered as one of the veterans of the field. The software let a customer try different locations for a piece of furniture by placing it exactly in the real environment of their home and see if it really fits, if the size is right, if the colors fit in, if the position of other things might be altered etc.



Fig.7 Augmented Reality application from IKEA catalogue¹

¹ Image available from: <http://www.designboom.com/cars/bmw-augmented-reality-to-help-with-car-repairs/>

Going to the more “scientific” fields, the so called “exact sciences” - like physics, chemistry or mathematics - we have different AR software applications that support a teacher in explaining phenomena or reactions not only by telling an audio story but also a visual one.

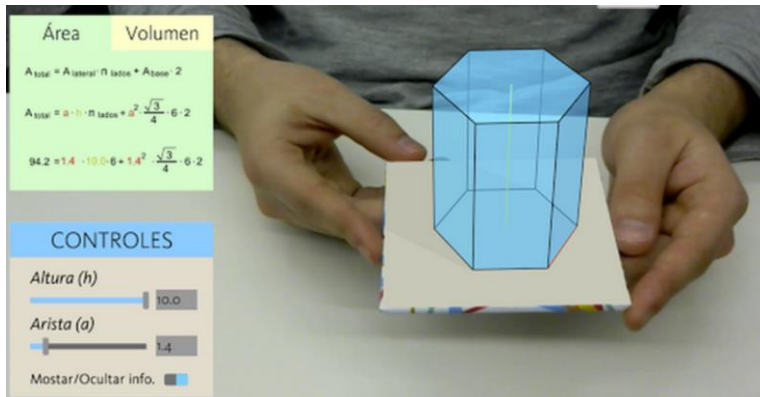


Fig.8 Augmented Reality application for geometry calculations²

Probably the highest expectations of a future AR device are now standing behind Microsoft HoloLens. The revolutionary Microsoft project promises to be able to bring “real” holograms into our lives [1]. For example, the teaching of anatomy is more or less the same for hundreds of years – and yet, Microsoft has shown a demonstration, in the first half of 2015, of a new future system of teaching anatomy. All the inside of a human body would be available as a hologram, resizable, focusable, moveable and completely customizable.

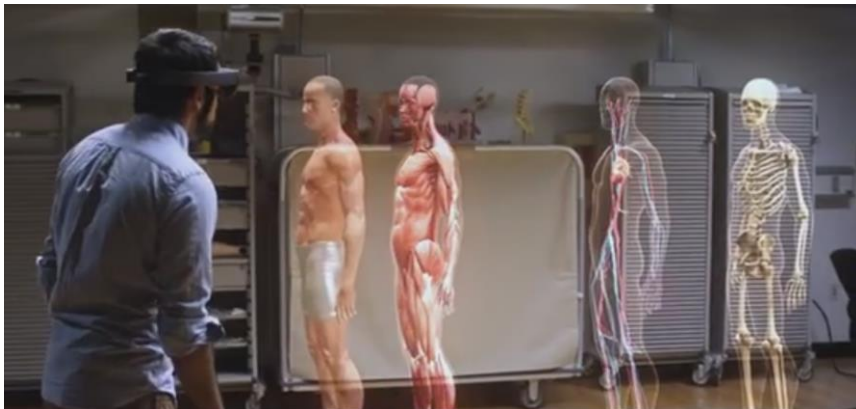


Fig.9 Microsoft HoloLens for teaching anatomy³

¹ Image available from: <http://www.businessinsider.com/ikeas-2014-augmented-reality-catalog-2013-8>

² Image available from: <https://www.smores.com/h3pdg-augmented-reality>

³ Image available from: <https://www.microsoft.com/microsoft-hololens/en-us/commercial>

4. FINANCIAL CONSIDERATIONS OF AR ENVIRONMENT

As is the case with every other technological advancement, the AR has risen to a point where the money become really relevant. Huge amounts of money are invested in this field, with the leading IT “monsters” in the lead. Google spent billions for Google Glass and then abandoned it, last year (in 2014) Facebook paid 2 billion dollars for Oculus VR and let them operate independently and build their much expected Oculus Rift, Google invested together with other high-profile investors another over 500 million dollars in the Magic Leap project, Microsoft bets billion dollars into HoloLens. These amounts of money are mind blowing for most of the future common AR users.

The virtual reality devices are now considered as being part of one of the two categories: AR or VR. AR (augmented reality) is closer to the roots, being open and only partially immersive – the user can see the actual live environment and has computer generated information added to this scene. VR (virtual reality) is a more futuristic approach, being closed and fully immersive – the user is engulfed in a completely computer-generated environment.

While VR might seem somehow more advanced, in truth the VR is also much more restrictive and restricted. It is a good solution for future projects related to gaming or 3D movies but it has one distinct disadvantage – it is actually a “stand-still” solution. Being fully immersed into the computer generated environment, the user has to stay in one place and he cannot actually move, being in danger of bumping into things he does not see ☺. I consider this technology to be best suited for games, movies and educational purposes – let us say suitable for more “scientific” usage.

AR I consider to be the next public-wide hype. The AR is great for gaming too, but probably not as good as VR in providing a new and complete atmosphere for gamers. Nevertheless, the fact the AR is usable while moving around and even doing something else is its greatest advantage.

I think AR has the potential to bring the user-experience to a level that was attained when the first smartphones appeared. Just think of it: AR is like using a transparent Google Glass (or the future HoloLens probably) that you could have taken anywhere, while VR is like having a completely opaque helmet on your face like Oculus Rift.

The VR economics are similar to the PC/console gaming and 3D movies industries. The VR could harness tens of millions of users that are technology savvy and able to pay hardware prices similar (in the future) to those of the best gaming consoles today.

The AR economics are much more similar to the mobile phone market, at least with the smartphone market. Actually, AR can have billions of users (in the future) that make a step forward from their smartphones or phablets.

The researchers from Digi-Capital estimate that the combined AR and VR market can reach no less than 150 billion dollars in just five years, in 2020. They also agree with my assessment that the largest share of this market would go to the AR devices and not to the VR part. Their estimations go to 120 billion market for AR and 30 billion market for VR.

The similarity of AR to the present day smartphone use will undoubtedly bring the largest social-media networks to AR as soon as it becomes truly meaningful on the market. There will probably be an avalanche of software AR applications for Facebook, LinkedIn, Tweeter or WhatsUp. The easiness of the transition from nowadays use of smartphones to the AR one would also bring a new type of online commerce – besides the old e-commerce and the newer m-commerce we will probably talk about the new a-commerce.

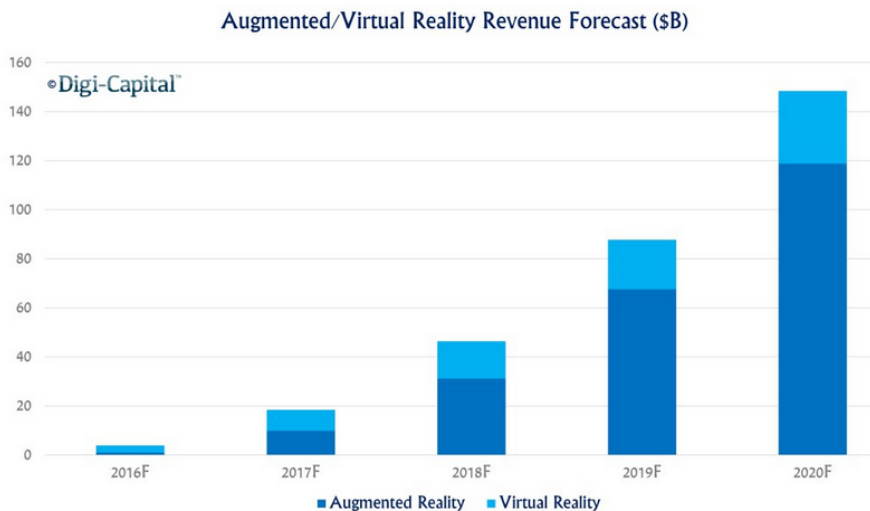


Fig.10 Digi-Capital forecast of AR/VR revenues for the next five years¹

The Digi-Capital research goes even deeper in the field and divides the AR and VR prospective revenues into different sources of income.

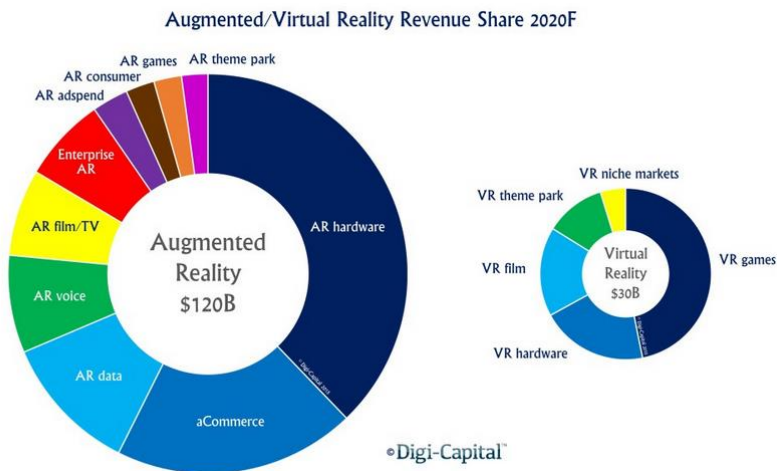


Fig.11 Digi-Capital forecast of AR/VR individual revenue streams for the next five years¹

¹ Image available from: <http://www.digi-capital.com/reports/>

5. CONCLUSION

The universe of augmented reality is not entirely pink, without any shade of grey. The path is set and I am sure that the augmented reality will win the bet, but the way might still hold some surprises. We have just to remember that the excellent technical feat of the Google Glass project was in the end a failure from the economic and commercial point of view. There still are several issues with different people showing dizziness signs from AR/VR devices, there still are privacy issues like those that plagued the Google Glass, there are still both technical and social problems that have to be addressed before the augmented reality really takes off.

The internet is now everywhere in the modern world. The civilized society of the 21st century rely on electronic networks for everything and even started to consider the access to internet a distinct right that has to be upheld by the law. Finland was the first country that issued a law to state the right of every citizen to have an internet connection of at least one megabit/second, in 2010 [2]. The Finnish legislators have also upgraded the specifications for 2015, when every citizen has to have a connection of at least one hundred megabits/second.

The present day big players of the IT field have all started to get an interest in this topic of augmented reality, with the only one exception of Apple. Google has been the first pioneer in revolutionary AR, it had developed the Google Glass, it learned a lot from this experience and moved on to bet on the Magic Leap project. Facebook bets on Oculus Rift as a VR solution of the future. Microsoft developed its own HoloLens which, if all available details are true, can be another revolutionary result from that company. The only great one missing is Apple... or isn't it? Let us not forget the Apple is known for its secretive ways. Apple managed to revolutionize the smartphone industry and shape it into what it is today with the first iPhone. Who knows, maybe iA(pple)R is the next secret to come out from the Cupertino research wizards...

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2. [Tabusca, Silvia Maria - "The Internet Access as a Fundamental Right"; published in "Journal of Information Systems and Operations Management", Vol.4. No.2 / 2010, pp 206-212, ISSN 1843-4711.](#)

¹ Image available from: <http://www.digi-capital.com/reports/>