ADOPTING VIRTUAL REALITY: CAN WE ALL BENEFIT FROM SUPERPOWERS?

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INTRODUCTION

In the last decade, we have witnessed an exponential growth in the use and development of virtual reality (VR). In the next decade, according to Rosenblum's forecast (2000), we will witness changes in the VR ecosystem and increasing the use of media that will drastically affect all spheres of our lives (Muikku & Kalli 2017).

For many years VR was studied and various predictions were made about the many ways in which it influences users and their environments. The medium has now found a place of honour alongside influential media such as telephones, the Internet, and televisions and has now been given a significant boost in the digital world.

By Krueger's (1991) definition, the uniqueness of the VR medium is that it is a collection of many technologies in one medium that includes a computer, head-mounted display (HMD), headphones, motion sensors, and space detection cameras, among other components.

Eventually, companies in the market will compete for the term **immersion** which will come hand-in-hand with the user's sense of telepresence within the digital environment. It is the sense of **sustainability** in the virtual environment that will lead the authors in this article and will allow them to explain the phenomena of the adoption of technology and its positive effects in the learning environment (Flower, 2015). The focus of this research is the security field and the use of VR to train Law Enforcement Agencies (LEA) and other organisations; specifically suggesting empirical research based on real cases of VR implementation in the field to confirm the

benefits for companies and organisations in adopting VR technology to streamline processes and gain more value from the training processes.

The purpose of this report, VR is defined such as an environment that isolates the user from the real world, influencing their emotions through tools such as graphics, motions, sounds, among others.

As Martín-Gutiérrez, Mora, Añorbe-Díaz, & González-Marrero (2017, p. 473) define it, it is a "whole simulated reality, which is built with computer systems by using digital formats. Building and visualizing this alternative reality requires hardware and software powerful enough to create a realistic immersive experience".

Beyond this, VR can offer unique effects that include the use of methods borrowed from other research disciplines, like psychology, to influence and direct the user. Accessories can be an emotional upgrade to the user experience. In the VR world, such accessories tend to be called **haptics** and offer a variety of sensations such as smell, touch, vibration, and even sensory limitations such as movement limitations. In the field of VR, we can find a wide range of viewing devices, from smartphone-based devices to high-quality computer-based devices.

In this article, the authors do not discuss the differences between the devices, but rather the use of the medium as a learning tool, explaining the innovative advantages of it, due to its active immersion solutions. Lastly, the VR training solutions will be compared with "traditional" training solutions in order to examine the advantages and disadvantages VR passive and active immersive solutions have.

VR PASSIVE AND ACTIVE IMMERSIVE SOLUTIONS

Since innovative technologies such as VR have seen rapid growth in recent years, there is sometimes confusion in the common understanding of the differences between passive and active VR experiences, as well as in their use.

When talking about active VR the users are fully immersed within the computer-generated reality and they are therefore considered active users within the created environments. In fact, as soon as the users put on the headset, they sense (or their brain believes) things as if they were real: they can touch and grasp virtual objects, they can move around newly built environments, they can interact with each other at a distance by talking or passing objects to each other, and thus, they have the feeling of being in the same shared space, even if they are not. This is one of the most promising advantages of VR, and it is also an extremely important element for the **improvement** of training methods. In particular, the active role of the user allows the participant to **engage** in those learning environments as **operative participants**, allowing the development of exploration-based learning paradigms (James, Humphrey, Vilis, Corrie, Baddour & Goodale, 2002).

For the end-users (who, in the field of security, can be LEAs, companies, or private and public entities), it has become extremely important to **re-create** a realistic version of critical and dangerous **scenarios**, in order to test the safety of the real environment they are simulating and their staff and at the same time to test the preparedness of the employers and their compliance to different protocols – consider, for example, prison riots, bank robberies, a fire explosion in a workplace or work safety in a hazardous area (Kang,
Wright, Qin & Zhao, 2005).

Experiential learning in these kind of situations is the most effective way to learn how to **readily react** to critical situations, giving the opportunity to analyse the reactions, the mistakes, and the strengths and weaknesses of the system (Dorozhkin, Vance, Rehn & Lemessi, 2012).

At the same time users can actively experiment with the risks related to the critical situations in order to be more prepared and ready to prevent potential crises.

Studies show that experiential learning in which students expressed an interest in participating raised the level of commitment to learning. They also became active learners in VR which inevitably raised the effectiveness of learning (Martín-Gutiérrez et-al 2017). While passive learners are only expected to absorb data from the river of information, active learners need to collect and digest the data on the process before they are allowed tocontinue to the next piece of information and avoid being flooded with information.

Another method for carrying out training using innovative technologies, different from the active use of VR, is the use of passive immersive reality. This methodology of using VR passively is accomplished through **360° content**, which re-creates a given environment. The passive observers, who use the passive VR, are able to enter the virtual environments, see objects and people, listen to sounds and conversations, but they are not able to actively interact with the surroundings or affect the scene. They can passively watch, analyse, and observe things happening in the virtual world, but there is no interaction with other participants (Jang,Vitale, Jyung & Black, 2017). An important aspect of this is that an immersive solution has the potential to **create experiences** outside of one's own perspectives and to create empathy among the people who are watching and listening. In fact, the idea of placing an individual into another person's environment means also removing them in a certain way from themselves, making the **empathy effect** much more effective (Bujić, Salminen, Macey & Hamari, 2020).

WHY IS NOW THE RIGHT TIME FOR VR IN TRAINING AND EDUCATION?

The VR market is expected to grow by an average of 28% per year over the next 5 years (2020-2025). While in 2020 is estimated to be worth approximately $6.1 billion and is expected to reach around $21 billion in 2025. According to Markets & Markets (n.d.), the **impact of COVID-19** has created a **significant demand** for VR solutions in the medical field, as well as solutions in the social and educational field.

Similarly, Fortune Business Insights (2020) indicates a significant **increase** in the adoption of technology as a solution for meetings and exhibitions and, of course, the expectation of an immersive solution for lectures and distance learning.

In a competitive environment joined by most of the major technology companies, this **stable market growth** can be expected with a competitive supply that will increase the rate of adoption in organisations and households. Among the big companies that have joined the race in the last decade there are Facebook, Sony, Samsung, Google, and Lenovo. All of these companies invest most of their budget in hardware development, although most of the market share is actually in the content (ITprotaday,2019).

According to Goldman Sachs's data (2016, 7), the market share of education alone is around $1 billion but does not include data on training in medicine ($5.1 billion), engineering ($4.7 billion), military ($1.4 billion), and other sectors that use training in VR.

Why then is this the right time to embrace the medium and assimilate it into companies and organisations?

Firstly, VR training and simulations had been used to improve surgical skills even before the pandemic as a result of a **shortage** of physical operating rooms, time and budget. considerations, and concerns for patient safety.

Furthermore the pandemic is accelerating the use of VR because it can offer the best solution for the aforementioned limitations (Kogan et al, 2020).

Amitabh (2020) explains that the COVID-19 set new rules and **changed** the learning methodology and standards. He added that students reported that distance learning and new technologies that accelerated their penetration to the market are effective in fitting the actual needs of the 21st century way of learning. It is then no surprise that COVID-19 is heavily contributing to that demand for VR and Artificial Intelligence (AI), alongside many other new technologies.

In addition, VR is **affordable** and **easy to use**. On the one hand, the price of the hardware has dropped significantly and now purchasing basic VR glasses stands at the same price and even lower than that of a home game console. On the other hand, giant tech companies have made an effort to make the product accessible to the home user, so setup and use is simple and does not require advanced technological knowledge.

Furthremore, it gets media attention. Since the Oculus Goggles Kickstarter project in 2012, VR has received extremely positive **media attention**, which has encouraged many organisations and end-users to try and purchase the technology. By 2018 the number of VR users was already estimated at 171 million (Shanhong, 2019).

Also, it is an **immersive** technology. Many technology companies have emerged in the last decade and encouraged the purchasing of accessories for VR glasses. These companies have created accessories that have enhanced the potential of VR, further heightening the level of immersion. This has greatly contributed to increasing use of the medium.

Last but not least, it provides **endless possibilities**. In the last decades, it has been registered a process of optimisation of these technologies, which has led to its beneficial application in training activities, while also contributing to saving financial resources and strengthening the market. The content is extremely valuable and can offer a world of endless possible training solutions.

ADVANTAGES OF VR IN TRAINING AND EDUCATION

There are **four reasons** why VR is beneficial for training and education purposes. Firstly, it enhances the **performance** and the **focus**. In Oculus (2019), Connect Isabel Tewes presented an experiment, involving two participants, asking them to perform the exact same task (performing the same medical surgery) . The first participant was trained to perform the task with traditional manual guides and use of VR simulation, while the second one was instructed with traditional manual guides only. The virtually-guided participant took 50% less time to perform the task and, crucially, did not require the assistance of a professional, while the traditionally-trained participant frequently required assistance, and performed the task with lower results than the first participant. In the same presentation, Tewes (Oculus,2019) demonstrates how VR can enhance learning and collaboration, explaining how performing a collaborative activity within virtual reality centralises most activity in the shared space without distractions. Tewes described car designers who were able to complete an assigned task in 20 hours of activity, which would otherwise usually take many months.

Secondly, with VR **mistakes become opportunities**. Making mistakes can be a fear of any trainee but VR allows each trainee to attempt tasks and fail and, by doing so, to explore different ways of solving a problem without having to overcome the consequences as in the physical world. In the digital world, it is possible to make mistakes that otherwise may cost injury, damage, and even death in the real world (Wang et al,2018). This way of learning offers relief for the trainees and strengthens their creative side. At the same time, the use of VR is a strength for the trainees as they feel committed to reality, and as such, they make decisions in real-time, which makes them experience the situation as if it were real (Kahn et-al 2018).

Furthermore, it allows a **customisable experience**. Among the advantages that VR brings to trainees, Masie (2017) emphasises the ability to personalise the learning experience - in VR the trainee controls and changes the environment from their own perspective.

This allows the trainee to choose the speed with which he or she acquires the knowledge and adapts to course to his or her own preferences and needs.

Indusgeeks (2019), who specialises in game-based training, explains that a gamification is a **key training tool**, while from an employer perspective, VR training is praised for saving a significant amount of money per employee, saving time, and streamlining the organisation. Undoubtedly, VR training brings real value as an educational tool and offers a comprehensive solution for the entire training chain. In the learning process, the organisation has lower costs both in terms of infrastructure and in the cost of training time, as well as requiring fewer staff members to implement and support it. The trainers are free to assess and facilitate the actual training process since the process is run automatically in VR and thus the trainee can lead himself with the help of guidance in the virtual world. The quality and efficiency of the process improves the trainee's level of enjoyment and shortens the learning time, enabling more information to be transferred in a shorter time. Crucially, these benefits raise client satisfaction with the whole process and offers a more accurate and often faster service.

Finally, it allows to **extract beneficial data.** One of the greatest advantages of VR is that beyond qualitative analysis we can use plenty of tools to produce reliable and numerical information. Tools such as eye-tracking, biofeedback accessories for measuring sweating, blood pressure, and heart rate, and even EEG (Electroencephalography) devices provide data that can be extracted from the process and create feedback to improve the products. Eye-tracking systems make it possible to objectively examine game times and sources of fear in VR (Reichenberger, 2020).

Further research offers methods of handling and adjusting content according to the biofeedback provided by the user and

thus the content changes automatically and repeatedly. It is possible to determine a range in which the content changes according to the operator's decision and thus also makes the situation in the learning process more difficult or easier (Donga et al 2020).

In conclusion, these capabilities are endless and, in many respects, grant users certain super-powers. Using the data, we can even control the level of immersion of the participants and influence their performance while monitoring objective metrics and changing content in order to influence these metrics. We can also allowplayers certain abilities in the experience if they succeed to control their physiological metrics. These are interactions that cannot be controlled in most of the existing media which places virtual reality as a unique medium with the highest monitoring and control capabilities (Houzangbe et al,2020).

THE EXPLOITATION OF VR IN SECURITY

The advantages of VR are slowing entering into the field of security, opening **new frontiers** for the Law and Enforcement agencies (LEAs) in approaching threats and risks, but also supporting prison administrations, civil society and security-related experts in dealing with phenomena such as rehabilitation programs, forensic extractions, or violent extremism.

As previously mentioned in this article, VR is majorly effective when used as alternative for situations which may be considered **dangerous** or critical or even impossible, in the real life (Strickland, 2010). If we think about fire emergency trainings done in a "traditional" way, compared to those done using of VR, we suddenly understand the huge impact this innovation technology may have. In fact, traditional trainings do not consider that people react very differently if under stress or facing dangerous and unstable situations. VR trainings, on the other side, let the user train in a real-situation environment, where trainees are able to sense fear, fire, and disorder, and therefore, they react as they would react in a real situation of emergency (Macedonia,2002). while avoiding the complications, the costs, and the danger linked to a real simulation.

From one side, the virtual simulation allows the trainer to understand what to avoid and how to better address the **risks** related to the specific crisis and, on the other side, it allows the trainees to deeply understand their reaction and the "dos" and "don'ts", in order to be more prepared in case of real emergency. Similarly, it is possible to re-create riots in virtual environments, for example, which can be used by LEAs to better address their reactions in conflict situations of social unrest. Again, a virtual simulation of a riot lets the

agent sense the dangers around him/her and therefore, to train on how to immediately and correctly respond to it.

One of the major benefits of such training was the increased user **involvement**, thanks to the aid of tools such as motion detectors, virtual reality, controllers, and interactive multiplayer platforms (Baur, Schättin, de Bruin, Riener, Duarte, & Wolf, 2018).

It should be additionally considered that, sometimes, trainings in the field are not possible due to the high risks associated to them. The recreation of the scenario through a virtual simulation supports LEAs in familiarising themselves with hostile environments, without putting themselves in danger. The use of VR in the security sector should be seen as highly beneficial, but it is still in an initial phase and empirical research must be further developed in order to see the results. The security world is moving in this direction and it is upgrading and adapting its technologies in order to be competitive and ready to a new horizon.

CONCLUSION

VR has existed as a medium for many years, but in the last decade, it has been slowly entering a wider range of areas of life and improving a range of processes in diverse types of organisations and learning methods. In order to get the most out of the technology, we must first know its capabilities and examine its implementation in the best way within a given sector or organisation in order to maintain the chain of success: value for the organisation - easing the training process - satisfied trainees - satisfied customers - successful organisation.

Through this article, there have been examined many values that are reflected in the training process with different methods to influence and shape the trainee in the process. Both objective and subjective measurement abilities have been analyse, capable to form the basis for improving the training process.

Also, it has been demonstrated that saw that we can mix multiple values and create multiplayer VR experiences for a learning process that could shorten unnecessarily long training times and even bridge the distance and accessibility gaps created due to the COVID-19 virus, which have accelerated the implementation of virtual reality training into companies and organisations.

Based on this article, the authors will present further concrete research based on security forces training and improving the efficiency and effectiveness of the learning process.

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