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# Augmented and Virtual Reality: Towards the Enhancement of User Experience

Our world is increasingly virtual. Digitalization has been taking over every industry during the last few decades, and user experience and assistance is no exception. Reality and the virtual world were divided by a gap that seemed unbridgeable until recently. Augmented Reality (AR) and Virtual Reality (VR) allow users to go beyond previous limitations. Users can learn and practice without being held back by the limitations of the real world.

AR and VR are not brand-new inventions. The praise they received the last few years is related to recent technical innovations such as advances in computational power, storage, graphics, and high-definition displays. These progresses opened the way to immersive technologies that were previously burdened with wires, heavy headsets, and poor graphics. Today, light, wireless hardware, and beautiful graphics immerse the user in a virtual world better than before. But innovation won't stop there, as it is expected that \$20,4 billion will be invested in AR and VR, an 68% increase compared to the \$12,1 billion spent in 2018. This growing interest for AR and VR is shared by a wide range of industries such as engineering, medicine, and even softwares.

Each finds its own in immersive reality. How do companies use AR and VR? To what extent do they enhance the User Experience? Are they the future of the user assistance, or just trendy gadgets?

After considering what are AR and VR and their usages, we will discuss their influence on User Experience (UX), their values, and what their future may be in the technical communication industry.

## 1. What are AR and VR?

### a. Definition and comparison

Augmented Reality (AR) and Virtual Reality (VR) are different technologies that have to be distinguished from one another.

Name	AR	VR
<b>Definition</b>	A digital layer is superimposed on the world. The user's environment is integrated and virtual details are added to enhance the real-world experience.	The user experiences an entirely digital and interactive world. Visual and audio perceptions are entirely synthetic.
<b>Hardware</b>	Smartphones, tablets, smart glasses, headsets.	Headset or Head Mounted Device (HMD).
<b>Use cases</b>	<ul style="list-style-type: none"> <li>- During a manual task, AR provides step-by-step instructions.</li> <li>- Remote assistance for support and guidance.</li> </ul>	<ul style="list-style-type: none"> <li>- Cost-effective equipment design</li> <li>- Virtual training in a safe environment.</li> </ul>
<b>Examples</b>	Boeing technicians work with AR instructions for airplane wiring schematics in their field of view. This allows them to remain hands-free, thus reducing wiring production time by 25%, and error rates dropped to 0. <sup>1</sup>	Ford's workers' safety and productivity increased on the assembly line thanks to VR. Injuries dropped by 70%, while ergonomic issues were reduced by 90%. <sup>2</sup>

In other words, VR creates a new reality from scratch while AR is based on the real world. Because of the inherent differences between these two technologies, their usage and their effect on the user are set apart.

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<sup>1</sup> Capgemini 5

<sup>2</sup> Capgemini 3

## b. Implementation of AR/VR

Digital learning solutions that include AR and VR are popular because of the novelty excitement they produce. According to a digital learning engineer from a Parisian digital learning agency, VR and AR are part of a digital learning experience, but they cannot be implemented as standalone products. AR and VR are valuable, exciting fragments embedded in a larger learning experience that can offer companies unique benefits.

Because of their irreconcilable differences, AR and VR serve different purposes. They are implemented for different reasons and at different rates. According to an Irish VR and AR specialist, four reasons put off companies when implementing VR solutions:

- the required hardware is expensive and not always available,
- software equipment is expensive,
- the illusion created by VR is quickly spoiled and expensive, and
- safety issues may appear during a test. It is not possible to take into account the space in which the user will find himself or herself while using the VR product.

Moreover, companies are put off by the technical difficulties that come with a VR setup. Many share the specialist's opinions<sup>3</sup>: 66% of companies think that AR is easier to apply to use cases than VR. AR is implemented by 45%, while VR lags behind at 36%.

Three countries lead the way in AR and VR implementation, and France is among the frontrunners. According to a study, AR is mostly deployed in the United States, followed by China and France. Among those who deploy AR, 55% companies experiment with it, and 45% implement it. When it comes to VR, it is mostly deployed in China. France comes second, followed by the United States. Among those who deploy VR, 64% experiment with it, and 36% implement it. As use cases become more common, deployment will increase accordingly. An IT specialist for a German car company says that *"the impact will not only improve in the next one to three years, but it will also become standard in the automotive business."*

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<sup>3</sup> Capgemini 6

### c. Use Cases

During the first years of development, AR and VR were used hypothetically without ever being integrated fully. Companies could not see what improvement these technologies could bring. Since then, companies do not ask themselves how could AR and VR be beneficial, but how much could they benefit from them.

A study<sup>4</sup> shows that immersive technology delivers better efficiency, productivity, and safety:

- “*AR drives higher productivity and efficiency.*” Companies use AR to streamline workflows to technicians performing a manual task: their AR headset provides them with step-by-step instruction and a hands-free handling. An IT company uses AR to help employees to perform quality control for printed circuit boards and saw an increase of improvement in quality on the scale of 20-25%. A logistics company uses AR to help workers perform maintenance tasks. Workers increased their number of maintenance tasks per hour by 59%.
- “*VR drives increased efficiency and safety performance.*” Companies use VR to collaborate on projects remotely and boost efficiency. Experts can resolve problems by gathering together in a virtual space. Companies also use VR to train their employees when their work environment is difficult, risky, and leaves little error margin. In a virtual environment, employees learn to make the best decisions in a safe environment. For instance, a digital learning engineer created a learning module in VR to teach doctors how to operate on patients with a new machine.

With time, use cases multiply and get increasingly immersive.

## 2. Enhancement of User Experience

### a. Integration to already-existing UX

If we want to talk about the integration and the usefulness of AR/VR through user experience, we also need to know exactly what *user experience* is. Nowadays, this

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<sup>4</sup> Capgemini 8

word is more and more employed: we can hear it from almost every company selling any kind of product. We consider Donald Norman as the founder of this concept. This professor of cognitive science wrote *The Design of Everyday Things*, first published as *The Psychology of Everyday Things* in 1988. According to him, “*if there is any principle that is sacred to those in the field of user-interface design and human computer interaction, it is ‘know your user.’*”<sup>5</sup>

Getting to know the user for a corporation means that it is important to carry out a social study before. Who is more likely to buy the product? What age? Gender? Urban resident or not? And so on. Every detail is useful when it comes to targeting the right persons. The use of several tools, often borrowed from sociology, are required to create the perfect “ideal type”<sup>6</sup>: interviews, observations, qualitative and quantitative data, personas... Therefore, user experience is composed of many aspects. UX researchers, UX Designers, UX Assistance. These different fields are all linked to each other with the purpose of striking a balance between necessities, business and fluidness. As Fiona Yeung, UX Designer at Google, said : “*UX design stands for user experience design. It’s about finding the sweet spot where human needs and business goals meet, while giving users a delightful and seamless experience with a product or service. Good user experience design is often invisible because it’s not just about how something looks, but instead about how it works.*”<sup>7</sup>

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<sup>5</sup> citation <https://medium.com/@nickuxd/know-your-user-3ebac3524811>

<sup>6</sup> This concept belongs to Max Weber (1864-1920), one of the main founders of sociology. We consider an ideal type as a utopian construction intended to highlight real and empirical relations. It is not really sociologically correct to use this concept in this article: but the reader has to understand the usefulness of this word as a nod to the sociological roots of UX experience.

<sup>7</sup> <https://medium.com/google-design/faq-tips-and-tools-for-getting-started-in-user-experience-design-aka-ux-f46406729d4d>



With the improvement of technology, we can now use augmented reality and virtual reality (AR/VR) for user experience. This is a big step forward because it is now possible to get an immersive (and so more concrete) experience as a user.

## b. Immersive experiences

Methods are completely different to what we used to do before. We had e-learning (and we still have) but the user could only see, and not do anything. Now, the potential user can try the product before it actually exists. Or at least, before actually owning it. As we saw in the first part of this article, AR and VR are two different technologies (even though they are quite similar) and they are not used for the same needs.

Augmented reality is about productivity and efficacy. It is possible to solve a problem collectively, with the help of experts. Whereas virtual reality is more about security and safety. We can handle dangerous situations in a safe zone.

They are both very important concerning user experience because it is now easier to get “into” the (fake) experience. The immersive aspect of these technologies makes it more visual, and therefore more real. Learning becomes easier and faster than it used to be. But most importantly, it is safer. From one firm to another the environment can be different, and, depending on the field of work it can be more or less dangerous.

A digital learning engineer at a French car company tells us about how “restrictive” some environment can be. He gives some very relevant examples: nuclear engineers

and/or automobile sector. Anyone risks being hurt anytime, according to the dangerousness of a new material. The main idea behind the immersive experience is to practice as much as possible to control it perfectly in the end. Even through the medical domain: VR will help a surgeon to use a new material, and be prepared and effective with real patients.

Space is also one of the main fields using the AR and VR technologies. For example, Thales Alenia Space uses it especially in Belgium, Spain, France and Italy. Creating and building a satellite requires a lot of information. This information has to go from one person to another (from one machine operator to another) very quickly if we want to be productive. Operators and experts can work at the same time, on the same object, even if they are not physically gathered. With augmented reality, the corporation won 50% of time because all the information is now available on one condensed interface usable by every employee. According to the corporation, AR and VR are doubtless helping to reduce of a fabrication of a satellite.

### c. AR/VR as a game

Beyond the fact that it is faster and safer, AR and VR are also used as games. That is what we called “gamification” which means that we tend to transform the work as a fun activity. It supports participation, and it’s also easier to learn with a modern immersive technology. This is what the A digital learning engineer at a French car company named the “wouah” effect of virtual reality : it’s fashion and impressive, and it put the operators as the main actors of the process. As the philosophy professor said, VR is engaging, it goes beyond text, images and videos.

## 3. The values of immersive tech

Immersive technology is more and more common in companies nowadays. However, is it always a relevant choice? Indeed, even if a VR or an AR solution might seem a profitable and efficient choice for companies and users, technical communicators need to spend time and effort into it before it is useful. According to an AR/VR consultant for companies, it is always the first question to ask. Now, professionals tend to think

that AR and VR are used because it is trending, and not especially for the usefulness of the technology.

### a. An undeniable efficiency?

In an e-learning context, virtual and augmented realities show a huge advantage: the learner is immersed directly into the learning environment and cannot be distracted.

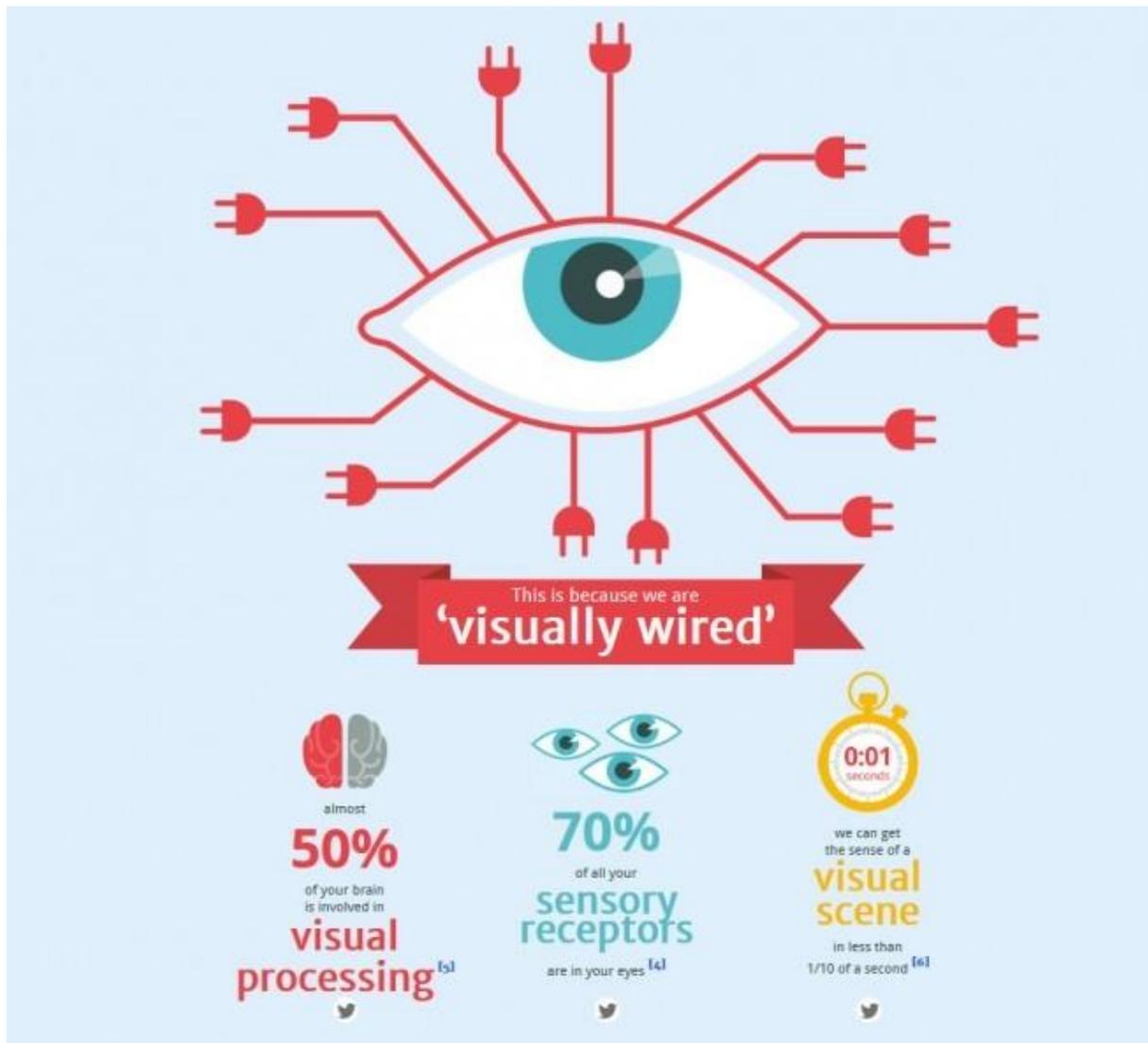
An Innovation Manager in a big German automotive group says users keep sending positive feedback for that kind of training since it is more entertaining than textbooks and they are even eager to do them again to get better performance. The gamification of the learning process, along with the virtual environment, is also a good motivation: users want to get better overall and do not mind repeating the same process in order to do so.

A study of the University of Maryland even showed that students/users remember information better when they learned via VR, compared to a more common way of learning with computers or tablets. The participants said the immersion helped them focus better, and the results reflected that: “40 percent of the participants scored at least 10 percent higher in recall ability using VR over the desktop display.”<sup>8</sup>

Of course, studies are not abundant yet as that technology is slowly rising, but it is a well-known fact that our brain retains a lot more information when it comes to images.

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<sup>8</sup> Ventsias Tom, "People Recall Information Better Through Virtual Reality, Says New UMD Study", *University of Maryland*, June 15 2018, <https://umdrighnow.umd.edu/news/people-recall-information-better-through-virtual-reality-says-new-umd-study>, accessed June 10 2019



9

As shown in this infographic above by Neomam, a creative content studio, images come first, especially today in an increasingly virtual world. Users must operate more quickly and they don't have time to get lost in written documentation, which is why video tutorials are more and more common, but they don't have the immersion feeling that immersive technologies offer.

### b. Time-saving and more secure alternatives?

Among the many fields of application for VR/AR, risky processes are among the most logical that come to mind. With these solutions, trainees in the nuclear field, for

<sup>9</sup> Neomam Studios, "13 Reasons Why Your Brain Craves Infographics", <https://neomam.com/interactive/13reasons/>, accessed June 10 2019

example, may try a new procedure as many times as they like without risking their lives or damaging the equipment. Less risky example: in the automotive industry, logistics department employees can follow trainings in a dedicated room where they can move around<sup>10</sup>.

From the point of view of technical communicators, writing a classical PDF technical documentation and developing a VR/AR training obviously involves different skills, some of them being more time-consuming than the others.

For PDF documentation, the communicator basically needs to know what should be treated (subject) and how it should be treated (audience) with additional hard skills (DITA, XML software, etc.).

As described in *Virtual Reality as a Comprehensive Training Tool*<sup>11</sup>, the process of a VR training is quite different:

- Information gathering
- 3D modeling
- Scene creation
- Animation
- Script elaboration
- Interaction and audio
- Interface development

It is safe to say that today, technical communicators rarely have all these skills and such trainings require several persons, which eventually takes more time than involving a single person.

In the long-term, since learning is much more efficient when virtually immersed, potential incidents would be minimized (which means financial savings), there would be less questions asked from trainees and the training team would only need to edit minor details in the case of updates or they could reuse models for new products.

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<sup>10</sup> Volkswagen News, "Virtual Reality at Volkswagen", <https://www.youtube.com/watch?v=bW-wDz0sBrk>, Youtube, March 31 2017, accessed June 10 2019

<sup>11</sup> Pérez-Ramírez Miguel, Ontiveros-Hernández Norma J., "Virtual Reality as a Comprehensive Training Tool", 2009, Mexican International Conference on Artificial Intelligence, <http://www.micai.org/2009/proceedings/complementary/cd/ws-wile/WILE09-07.pdf>

Moreover, outside of the e-learning context, for someone looking for a specific piece of information, we may wonder whether finding it would not be slower since they would have to wear a headset, activate it and search in a menu that was not designed to be searched since virtual environment trainings are usually linear.

### c. Cost-efficient or cost-intensive solutions?

According to a Doctor of Philosophy (Ph.D.) in Technical Communication and Usability, the main cause that would prevent more companies to implement such solutions would be the cost. It is nonetheless impossible to deny a trend that yielded a record \$2.3 billion in VR/AR investments in 2016 (compared to +\$700 million in 2015)<sup>12</sup> as stated by Digi-Capital, a Silicon Valley based AR/VR/XR adviser.

First, let's not forget the price such a documentation type would cost: it seems that more hiring is required (technical communicator, developer, animator...) and the software/material needed is non-negligible. Prices for VR headsets vary greatly, but the more professional models cost about \$1.200<sup>13</sup>. The training would, at least at the beginning, cost several hundred thousand dollars.

Is it worth replacing physical trainers, PDF or video documentation?

Hiring trainers for specific sessions during the year might end up costing less than hiring a whole team full-time dedicated only to VR/AR documentation all year long. A training session costs between \$1.900-\$3.200/day<sup>14</sup>, and several employees may attend that session. With 20 employees attending a one-day \$1.900 session, each one of them would cost as much as \$95. This is fairly cheap, especially compared to the price of a brand new headset, as mentioned before.

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<sup>12</sup> Digi-Capital, "Record \$2.3 billion VR/AR investment in 2016", Digi-Capital, February 2 2017, <https://www.digi-capital.com/news/2017/02/record-2-3-billion-vrar-investment-in-2016/>, accessed June 12 2019

<sup>13</sup> Vanian Jonathan, "Volkswagen Pushes Further Into Virtual Reality", *Fortune*, July 5 2017, <https://fortune.com/2017/07/05/volkswagen-virtual-reality-app-htc/>, accessed June 14 2019

<sup>14</sup> Sellitto Johan, "Coût horaire d'un formateur : combien coûte une formation ?", *Cadres en mission*, February 13 2019, <https://www.cadresenmission.com/blog/cout-formation-entreprise/>, accessed June 12 2019

At the same time, even if several dozen headsets obviously cost a lot more than a few sessions with a qualified trainer, this cost is only a one-time event which will be profitable over the years. According to AVRspot, a creative agency, here are the prices for different VR/AR environment:

*Manufacturing — hyper-realistic 3D models, environment and different scenarios creation usually required – starting at \$11000*

*Energy — 3D laser scan/photogrammetry reconstruction for the precise environment and objects creation usually required – starting at \$24000*

*Healthcare — human body/body parts hyper-realistic modeling and quiz/decisions tree scenarios development usually required — starting at \$12000*

*Retail — retail floor realistic 3D modeling and different scenarios programming usually required — starting at \$9000*

*Aviation — the cockpit model creation and different interactions creation usually required – starting at \$18000*

*Education — classroom environment and virtual lesson(s), including interactions, VFX effects, quiz creation usually required – starting at \$8000<sup>15</sup>*

## 4. The Future of VR/AR

As said before, companies are slowly realizing the benefits of the VR/AR solutions. Even if they are currently expensive, we know their prices will start reducing in a few years with the democratization of their mainstream and corporate use.

What does that mean for technical communicators?<sup>16</sup>

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<sup>15</sup> AVRspot, “How much does VR application development cost in 2018?”, *AVRspot*, May 29 2018, <https://www.avrspot.com/much-vr-application-development-cost-2018/>, accessed June 12 2019

<sup>16</sup> Lumera Juergen, “Is Augmented Reality the future of technical documentation”, *TCWorld*, March 2013, <http://www.tcworld.info/e-magazine/technical-communication/article/is-augmented-reality-the-future-of-technical-documentation/>, accessed June 7 2019

### a. A soon-to-be mainstream technology

Mainly big companies start adopting *en masse* VR/AR solutions nowadays because of their cost. But since this is a more and more competitive market, with growing investments each year, we can already say that cheaper equipment will appear soon enough.

Among companies that use VR/AR, 46% estimate that the technology will become mainstream within the next three years, and 53% after three years.

A developer in a Virtual Engineering Lab for an automotive group said: “The impact will not only improve in the next one to three years, but it will also become standard in the automotive business”

However, 66% think that AR would be more applicable to their operational field since trainees are still in the “real world” with only virtual additions to help them learn. This is true: people learning in completely virtual environments just learn and do not actually do anything, while people learning in an AR environment learn while doing. Automotive technicians may repair cars while using AR glasses showing them what to do with specific tools.

### b. Are technical communicators developers in the making?

The first documentation of this kind actually in place are designed and deployed by IT-profile employees since they are the only ones mastering the IT skills required to develop that kind of training.

Today, most skilled technical communicators are asked to know how to use a series of different software and IT languages or models such as FrameMaker, MadCap Flare, DITA, HTML... With the rise of VR/AR solutions, especially in training, those skills are bound to change drastically. Communicators will have to learn how to use new authoring tools, how to work with 3D data. The mere principle of documentation will change, since the concept will change from simply explaining a task to show a task.

## Conclusion

“User experience” is not only a concept, but it also became a field of research for several years now. From the smallest to the biggest company, everybody tries to know their user perfectly to set up a real trustful relationship. It starts with UX research, continues with UX design, and ends with UX assistance. What tools do UX experts usually use? Website sites, training, e-learning, etc. We always have had a distance between the product (whatever this is) and the person. Except from training where the products are introduced to users, and they can try it a little bit, they never had the possibility to practice beforehand.

Nowadays, more and more corporations around the world uses the AR and VR technology. Through this article, we thought about why and how it is useful and/or important. Depending on the field of work it's more or less relevant. On one hand, some environments can be dangerous and it's important to practice on a virtual design, to avoid any kind of accident: nuclear, military, weapons, medical, space, etc.

On the other hand, the use of this technology is related to the “fashion” aspect of it. This is new, modern, immersive and playful, that's why it is so attractive. Sometimes, AR and VR are not relevant, but it strengthens the good relationship with the user. Consider the “gamification” for example: isn't it the best way to attract people? It shows how any kind of products/objects/tools can be useful and entertaining at the same time.

Here's another point of view concerning immersive technologies. For some people, technology is hard to understand, and it's not made for everybody. Instead of being stuck on these understanding issues, AR and VR give the possibility to make the user experience concrete.

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