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VIRTUAL REALITY - WHITE PAPER

Imagine you put on futuristic glasses and all of a sudden you control a spaceship[1], sit in the stadium of your favorite soccer team or dive into the underwater world: only three of the countless scenarios a user can experience in virtual reality or VR for short. The viewer becomes a participant and moves around in the virtual surroundings. A new experience that creates unusual closeness and maximum immersion.

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[1] YouTube link - Star Trek bridge commander:
https://www.youtube.com/watch?reload=9&v=romB8e5nMp8

1. Prologue and definition of term

1.1 Prologue

VR (virtual reality) promises its consumer an unexpected, creative range of possibilities and a completely unique experience (even for private consumers). VR came out of its niche in 2016 and has since then become a new and major opportunity - especially for the media and advertising industry. And the numbers speak for themselves: according to the International Data Corporation, eight million VR-headsets have been sold in 2016. Analysts predict a sale of 76 million headsets worldwide for 2020. VR is an innovation to compelling to simply turn a blind eye to.[2]

1.2 What is VR?

VR is a medium that consists of a computer generated, interactive world. It totally surrounds the user and by involving one or more senses through appropriate systems, they experience total immersion.[3]

VR represents a digital medium, and can be considered a technology as well. The technological origin finds can be considered due to the fact that the virtual world is computer-generated and involves multiple senses of the user through appropriate systems. **This virtual world totally surrounds the user and blends out the physical reality.** Interaction and immersion outline its core elements. They can create a strong sense of presence for the user and that in particular distinguishes VR from other information and communication media.[4]

1.3 The history of VR

The history of VR goes back many years. The first draft of a VR system originates in 1956 by Morton Heilig, who developed a machine called Sensorama. This development was supposed to be the “Cinema of the Future”.

In 1965, Ivan Sutherland (student at Harvard) developed the concept of the “Ultimate Display”, which is the foundation of today's VR technology. In 1968 he published a book called “A Head Mounted Three Dimensional Display” that laid the groundwork for the development of Head mounted displays. He achieved it through the so called “Sword of Damocles”, a head mounted visual output device that displayed computer-generated images on a monitor near the eyes and thereby created a window into a virtual world.

Figure 1: Sensorama Maschine

An alternative to the head mounted HMDs was developed in 1992 with the Visual Experience CAVE at the University of Illinois. Due to its substantial space requirements, high costs, costly computing times and restricted mobility of the user, they were only adopted by large corporations in product design industries.

[2] https://www.wuv.de/medien/die_zukunft_von_virtual_reality_liegt_im_kurzformat
[3] Definition: The word "immersive" derives from the English term "immersion", which in German means "immersion" or "deepening into one thing".
[4] https://omnia360.de/blog/was-ist-virtual-reality/

In 1995 Nintendo introduced the “Virtual Boy”, but limited processing capacity and inefficient graphic cards posed substantial difficulties. Eventually it failed due to poor image quality and resolution. With the release of the Oculus Rift and Oculus Go in 2012, the Startup Oculus VR rang in a new era in VR development.[5]

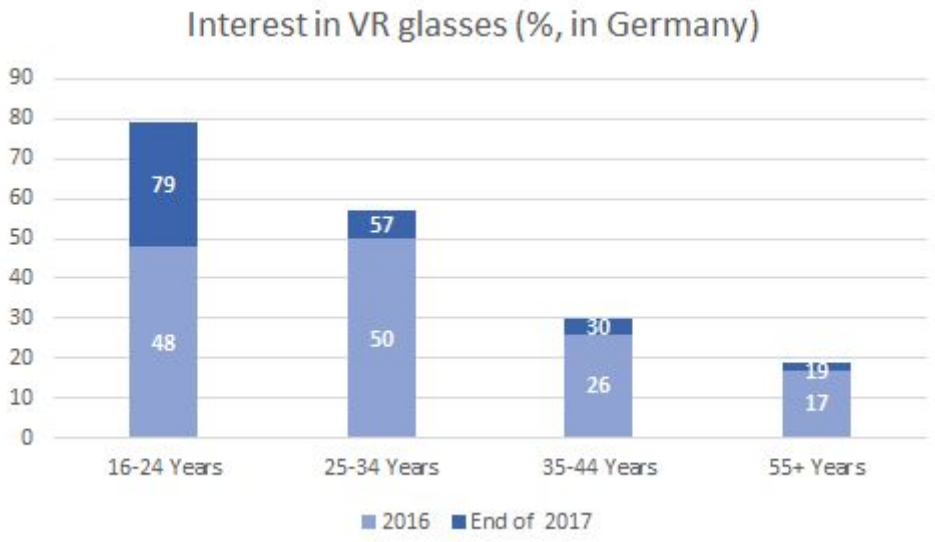

Figure 2: Interest in Virtual Reality glasses (End of 2017)

1.4 Difference between VR and AR (Augmented Reality)

Sensolligent explains the term AR on a separate White Paper.[6]
Here we would like to point out the differences between VR and AR.

VR	AR
The real surroundings are no longer perceived by the user.	The user sees the real world, but additional information is being displayed.
The user can only experience the 3-D world through accessories like VR glasses. Universal Studios has found a solution without the need of glasses.	To experience it, you require a smartphone, tablet, heads-up display, holographic system or AR glasses like the Microsoft Hololens.
A fast and more efficient computer will ensure an enhanced experience in the virtual reality.	Pokemon Go for example was a true AR hype – WOW-effect
The virtual world can be viewed, heard and felt.	There are AR games, installation guides,

[5] https://de.wikipedia.org/wiki/Virtuelle_Realit%C3%A4t
[6] See: www.sensolligent.com/ar

	navigation apps, workshop instructions and many more.[7]
VR is used in industrial applications, educational training courses, 3D games, media, entertainment, real estate marketing and many more.	Mobile devices, minimal performance
There are 360 degree images, 360 degree videos and fully rendered 3D worlds.	A tablet for example can hardly have the capability of a high end gaming computer.
The performance depends on the computers capabilities.	

2. Areas of application for VR

So far, VR was actually only linked to the gaming and entertainment industry. However, VR has far more potential. For example, it can help a user shed their fear of heights or transport users to places and cities they have never seen before.[8]

Figure: 3 Flight simulation

"VR can be utilized in numerous fields of interest. A very common area of application is training pilots in flight simulators. Even the industries increasingly use this technology, primarily for the construction of virtual prototypes, production scheduling, virtual training, ergonomic evaluations and spatial/layout studies in geology. They use both "Powerwall" as a stereoscopic 3D-wall and multi side projections for total immersion in the graphic simulation."[9]

Additional areas of application are the visualization in architecture, chemical industry and energy. VR is also applied in medical therapy, where we classify it as virtual rehabilitation.

A specific example of an application is the planning of infrastructural measures that change the appearance of a landscape. The surroundings can be replicated very accurately, so that the user can not only see, but rather envision the actual transformation through such a project. The users themselves determine which point of view to take, navigating either by gamepad or the arrow keys on the internet version.

VR can replicate natural operating procedures. In a virtual work environment, employees get the chance to take a realistic approach in dealing with simulated facilities, machinery and working materials. The virtual work environment appears in actual size and technical processes run continuously in real time. Any movement in this environment can be controlled directly by the machinery and/or individuals. Perspective and acoustic change depending on where the individual stands and how he moves.[10]

[7] https://magic-holo.com/unterschied-virtual-reality-vr-und-augmented-reality-ar/
[8] https://www.drei.at/de/planet3/3blog/gadgets/vr-hype-oder-zukunft.html
[9] Quote: Michael Gruber, CEO, Sensolligent
[10] https://de.wikipedia.org/wiki/Virtuelle_Realit%C3%A4t

Summarized you can find VR in the following fields:

- Training of employees
- Training simulations
- Fault diagnostics and repair
- Virtual butler
- Assistance in the design of new products
- Sales assistance[11]

Figure 4: Virtual Reality

3. Advantages and disadvantages of VR

PRO	CONTRA
Immersion enables improved understanding of the product	Willingness to wear quite bulky and heavy glasses for an extended period of time
Development-, decision making and purchasing processes are clearly curtailed through the use of VR	No long term studies exist to show how immersion into virtual worlds affects the mind
Capabilities for modelling complex task performances – behavioral patterns	Social isolation: escape into an artificial life
Sales support for diverse products – a space saving way to present a product portfolio	Expenses for high end hardware
Increased transparency through AR-apps	Sensation of dizziness during rapid movements

[11] https://www.goldorange.com/Virtual-Reality-Spielerei-oder-Chance

Cutback on errors	
Cost reduction in product development	
Increase of product quality / design optimization	
Creative product development process	
VR hardware is not performance related. High end devices resolve nearly all issues. VR hardware is merely an end medium IO device, whereas AR or wireless are entire computers.	
Minimal purchase costs, i. e. VR glasses	
Processing power	

4 Problem solving approach / Examples of application

Sensolligents problem solving approach and examples of application will be outlined in the following points.

4.1 Problem solving approach by Sensolligent

Sensolligent converts all original CAD files of their clients into 3D models for all their simulators. therefore the VR decoupling of such models is a logical move for a digitally savvy clientbase. Their own models can be presented to them in a 3D space. A popular showcase area for the end customer are exhibitions (key advantage: saving space by utilizing the infinite space in VR) and sales activities with wow effect.

4.2 Use cases & examples by Sensolligent

Through the VR decoupling Sensolligent serves a variety of clients and their requests. Initially, there is always a base product that can be enhanced or personalized according to the clients requests.

Some examples of VR decoupling by Sensolligent:

- Modular assembly system – simulation additionally available in VR display – drone flight – the client experiences a downright wow effect during presentation. Through VR simulation the product becomes tangible and perceptible to the clients.
- Aerial image of a digital twin: spares the huge hardware expense
- Controlling machinery through VR: Navigation is entirely location independent. A great advantage, avoiding long travel distances and resulting in reduced working hours and decreased costs.

5. Conclusion

It's safe to say that VR is going to revolutionize and enrich our world in many areas. VR offers completely new possibilities to comprehend and experience products, work processes and surroundings. Particularly in the field of marketing & PR there are countless amazing VR solutions that are going to impress your client base. Thanks to VR, the sales and trade industry gains trendiness and space reductions. It's safe to say that virtual reality will not only assert itself in the gaming industry but positively affect all aspects of life.

6. References and footnotes

Internet resources (page view 08/18):

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Virtual Reality - Hype or future?

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Difference VR / AR

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YouTube link - Star Trek bridge commander:
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Figures:

Figure 1: Sensorama Machine:

https://en.wikipedia.org/wiki/Sensorama

Figure 2: Interest in Virtual Reality glasses (Rank 2016)
Source: Representative YouGov Online study (16+, n=2023)

Figure 3: flight simulation:

https://de.wikipedia.org/wiki/Virtuelle_Realit%C3%A4t

Figure 4: Virtual Reality:

Source: Sensolligent

7. Copyright and contact details

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