# 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, in short VR. The viewer becomes a participant and moves around the virtual surroundings. A new experience that creates unusual closeness and maximum compassion.

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[1] YouTube link - Star Treck 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 (also from the private sector) an unexpected, creative range of possibilities and a completely unique experience. VR came out of its niche in 2016 and has become a new and major opportunity especially for the media and advertising industry ever since. 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. Too compelling to simply turn a blind eye from such an innovation.[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]

Therefor VR represents a digital medium, which can be considered as technology as well as a medium. The technological origin finds consideration in the aspect, that the virtual world is computer generated and through appropriate systems involves multiple senses of the user. **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 defines 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 should have been the "Cinema of the Future".

In 1965, Ivan Sutherland (Harvard student) developed the concept of the "Ultimate Display", which is the foundation of todays 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 with 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 conjectured 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 merely applied by large corporations in the product design industries.

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[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 to succeed due to poor image quality and resolution. With the release of Oculus Rift and Oculus Go in 2012, the Startup Oculus VR rang in a new era in the VR development.[5]
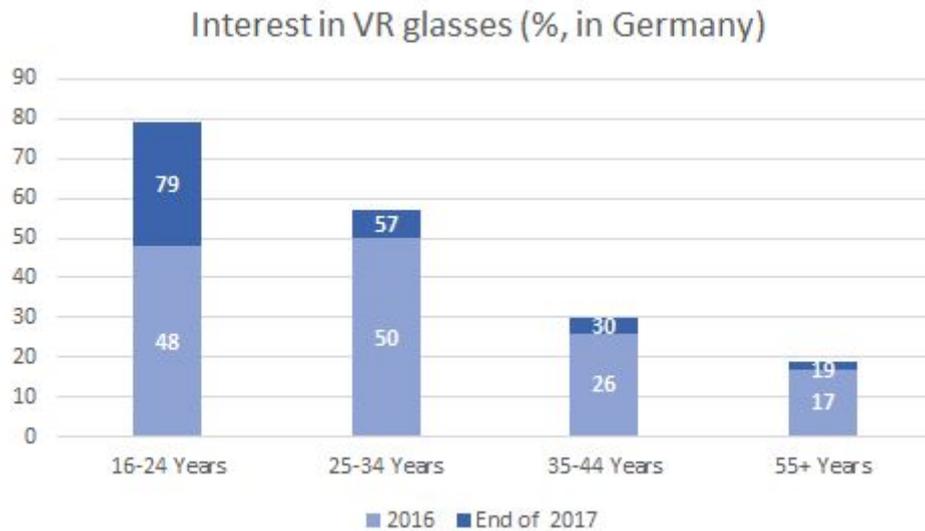


Figure 2: Interest in Virtual Reality glasses (End of 2017)

## 1.4 Difference between VR and AR (Augmented Reality)

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

| VR | AR |
|---|---|
| Here the real surroundings are no longer perceived by the user. | Here the user views 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 already found a solution without the need of glasses. | To experience it, you require a smartphone, tablet, headup display, holographic system or AR glasses like the Microsoft hololens. |
| A fast and more efficient computer will insure 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, |

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

| | navigation apps, work shop 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 entirely 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. But VR has far more potential. It can help a user shed his fear of height for example or it can transfer users to places and cities they have never seen before.[8]



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

Figure: 3 Flight simulation

Additional areas of application are the visualization in architecture, chemical industry and energy. VR is also applied in medical therapy, we are then talking about virtual rehabilitation.

A specific example of 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. They determine for themselves which point of view to take, either by gamepad or with arrow keys navigation 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 alter depending on where the individual stands and how he moves.[10]

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[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
- Simulation trainings
- Fault diagnostics and repair
- Virtual butler
- Assistance in the design of new products
- Sales assistance[11]



Figure 4: Virtual Reality

## 3. Advantage 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 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 |

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[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. Therefor the VR decoupling of such models is a logical move for digital savvy clientele. Their own model can be presented to them in a 3D space. A popular showcase area for the end customer are exhibitions (key advantage: space saving through infinite VR space) 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 however 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 – end 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.
- Areal shot of a digital twin: spares the huge hardware expense
- Machinery control through VR: Controlling is entirely location independent. A great advantage, since long travel distances are omitted and thus 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 the clientele. Thanks to VR the sales and trade industry gains trendiness and space reductions. Therefor 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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Wikipedia: Virtual Reality:

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Difference VR / AR

https://magic-holo.com/unterschied-virtual-reality-vr-und-augmented-reality-ar/

YouTube link - Star Treck 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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