

Creating virtual scenes with A-Frame

A-Frame Course I



Alberto Sanchez-Acedo

doi.org/XXX/zenodo.XXX

This work was supported by the Autonomous Community of Madrid (Spain) with a grant for industrial doctorates (IND2022/SOC-23503) with the collaboration agreement with Prodigioso Volcán S.L; Universidad Rey Juan Carlos (ID 501100007511).

Section 1

CREATING VIRTUAL SCENCES WITH A-FRAME | A-FRAME COURSE I

In this course you will learn about A-Frame, an HTML-based framework that allows you to create Virtual Reality scenes and immersive web environments using the tool's own tags and components.

Section 1

What is VR about? Theoretical introduction



SECTION OBJECTIVES

- Understanding the concept of Virtual Reality
- Learning to differentiate between different immersive technologies
- Introducing the applications of Virtual Reality in communication and other fields

Section points

1

2

3

4





Section points

Click on each of the points to find out what we will be studying in this module.

1. Virtual Reality definition

Virtual Reality is a concept popularised from the 1980s and 1990s (Rubio-Tamayo & Gertrudix, 2016) to refer to a real simulation in a virtual, immersive and interactive world in which the viewer can inspect and interact in an environment using devices specific to this technology, such as virtual reality glasses.

Today, and throughout history, Virtual Reality has been defined by many theorists and technology companies as:

- i (Weinbau, 1935)
- i (Levis, 2006)
- i (Elbert et al., 2023)
- i Microsoft
- i (Biocca & Levy, 1995)
- i (Rowell, 2009)
- i Adobe
- i Telefónica



(Biocca & Levy, 1995)

The aim of a Virtual Reality system is to achieve full immersion of the human sensorimotor channels in a computer-generated life experience.



(Rowell, 2009)

"Virtual Reality is an interactive computer simulation from the participant's point of view, in which the sensory information received is replaced or augmented"



**Click on the information points to
access the definitions of Virtual
Reality**



Telefónica (2023)

Immersive virtual reality seeks to create a full 360 experience by transporting users into digital three-dimensional environments. Through the use of devices such as virtual reality headsets and tracking controllers, we can interact and explore virtual worlds in a realistic way. The key to this technology lies in creating a sense of real life experience for the user.



(Adobe, 2023)

Virtual reality (VR) offers the possibility to move through a completely imaginary space, an artificial environment that exists in images but not in real life



(Weinbau, 1935)

The first known description of a virtual reality system can be found in the 1930s science fiction work *Pygmalion Spectacles*, by the writer Stanley Weinbaum (1935) (Rubio-Tamayo & Gértrudix, 2016, p.3). In this, the author describes it as follows:

"You find yourself inside the plot, you speak to the shadows (characters) and they respond to you, and, instead of being on a screen, the story is all around you" (Rubio-Tamayo & Rubio-Tamayo, 2016, p.3).



(Microsoft, 2023)

Virtual Reality are immersive experiences that help to isolate users from the real world, usually through a headset and headphones designed for such activities



(Levis, 2006)

A Virtual Reality system is an interactive database capable of creating a simulation involving all the senses, generated by a computer, explorable, viewable and manipulable in "real time" in the form of digital images and sounds, giving the sensation of presence in the computer environment.



(Elbert et al., 2023)

Virtual Reality is a more immersive experience involving manipulations and interactions with virtual objects within a completely virtual environment

2. Immersive Technologies

Virtual Reality is a technology that is included in a wider range of technologies known as immersive technologies. This concept of immersive technologies is the same as that of Extended Reality, which is explained as all types of technologies that immerse the user in a first-person environment, generating a sensation of presence.

Thus, immersive technologies or Extended Reality include, apart from Virtual Reality, other types of technologies such as Augmented Reality, 360° videos, WebXR or volumetric video, among others.

◉ BASIC FEATURES

3. Immersive technologies clasification. Virtual Continuum

In order to establish a classification of the immersive technologies seen above, there is a very useful concept known as the "Virtuality Continuum".

This concept, established by Milgram and Kishino (1994), facilitates the representation on a horizontal axis of a classification of immersive technologies according to their degree of immersion, with the technologies closest to the real world on the left side of the axis and the technologies closest to a complete virtual environment on the right side.





Virtual Continuum

This axis shows the most popular immersive technologies (360° format, Augmented Reality and Virtual Reality) classified in the Virtuality Continuum according to their degree of immersion.

Click on each of the technologies to learn more.



Virtual Reality

It allows the user to be immersed in a virtual environment through devices such as headsets or VR headset.

Characteristics:

- VR headset required
- Immersing the viewer in a virtual environment
- Possible use of more immersive devices



Augmented Reality

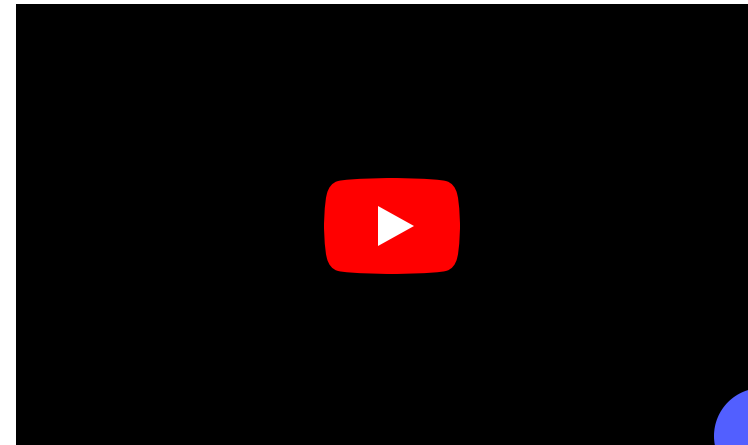
This technology combines elements of the real world with virtual elements to create scenes with interaction.

Characteristics:

- VR headset are not necessary
- Interactivity
- Use of digital audiovisual elements
- Real world



Social Media Filters





360 Technology

360° technology allows the creation of 360° photos and videos by means of its own cameras to generate this type of audiovisual content.

Characteristics:

- No external devices such as VR glasses are required.
- Less immersion.
- Monoscopic.
- Single point of view.

Among others, some of the devices that allow 360° content to be generated are:



Ricoh Theta



Insta One



Insta 360 Pro2



4. Virtual Reality applications

4. 1. Field of Communication

Virtual Reality is an excellent means of communication capable of realising innovative and unique projects. Within the field of communication, Virtual Reality is being used in different sub-areas:



Journalism



Data visualisation



Advertising



Film industry



Entertainment
and video games



Entertainment and video games

Virtual Reality is perhaps the field par excellence where it is applied, as video games are pioneers in the use of this technology. Large companies such as PlayStation and Meta have developed video games in Virtual Reality.



PlayStation VR



Meta



Film industry

With the appearance of Virtual Reality techniques, cinema found itself not only with a new technical tool to facilitate this recreation, but also a terrain on which to develop new productions (Sáez, 2007). Thus, there have been several audiovisual projects that have used Virtual Reality for their productions.

Several examples can be seen, mostly short films:



Carne y Arena



Advertising and marketing

Advertising and marketing have begun to explore Virtual Reality in order to generate a different relationship between the consumer and the brand (Sidorenko Bautista, 2018), and many large companies have used this technology to promote their products.



Data Visualisation

Related to the journalistic field, the 3D visualisation of interactive graphics allows for immersive and innovative interaction with data sets.

Some of the tools that allow the creation of this type of data are:



Flow immersive



Babia XR





Journalism

Immersive journalism is a branch of journalism that applies immersive technologies to the creation of content, including 360 technology or Virtual Reality. Immersive journalism is the production of news in such a way that people can witness first-hand the events or situations described (De la Peña et al., 2010). One of the first immersive reports was made by the Columbia University School of Journalism, when they covered the St. Patrick's Day celebration in New York City in 1997 in 360° format (Domínguez, 2015).



RTVE



The Washington Post



El País



BBC

4. Virtual Reality applications

4. 2. Other applications



Real estate industry



Tourism



Museums and
Cultural Heritage



Education



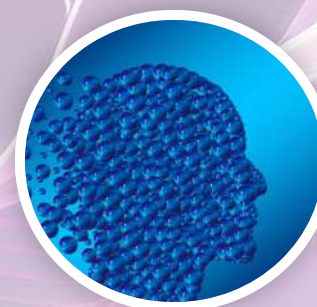
Health and Medicine



Arts



Sports



Psychology





Museums and Cultural Heritage

As in tourism, Virtual Reality can be applied in museums and in the visualisation of cultural heritage. Among the main advantages, VR makes it possible to "visualise and analyse objects, constructions or places without altering the original in the slightest, even encouraging the emergence of new hypotheses that, if dealt with in the real model, would not be investigated in depth in order to minimise the impact on the model. It allows, based on previous findings and studies, the recreation of objects and places that have disappeared or are in a very poor state of preservation" (Gutiérrez and Hernández, 2003).





Tourism Industry

In the last decade, the tourism industry has made use of Virtual Reality to create immersive experiences in relation to a given tourism resource (EU Mediterrani, 2021). Furthermore, "Virtual Reality represents a real opportunity to capitalise on the unique nature of travel and destinations in order to engage the customer in the travel experience from the first initial contact and enable them to build their own experience" (Alonso Almeida, 2019).





Virtual Reality can be applied to any professional field. This slide shows some of these areas.



Psychology

In addition to the use of Virtual Reality in health and medicine, this technology has been used in treatments or therapies for certain types of diseases such as phobias (Castañeda et al. 2011). Several studies demonstrate the effectiveness of Virtual Reality in the treatment of specific phobias and report preliminary and promising results in the treatment of more complex disorders such as panic disorder with agoraphobia, post-traumatic stress disorder or eating disorders (Arbona, García-Palacios and Baños, 2007).



Education

According to the web portal Deloitte (2017), in terms of education and learning, "Virtual Reality can be used to engage learners and develop their capabilities through immersion in highly realistic virtual work environments, which feature both educational information and interactive problem-solving challenges".

Otero and Flores (2011) highlight three main advantages of applying VR to education:

1. Facilitates constructivist learning.
2. It provides alternative ways of learning.
3. It enables collaboration between students beyond the physical space. To which we could add both the increase in motivation and interest in students (Vera, Ortega and Burgos, 2003; Cuesta and Mañas, 2016) and the development of digital competence (Aznar-Díaz, Romero-Rodríguez, and Rodríguez-García, 2018).



Real estate

The real estate industry has found in Virtual Reality an option to visit homes and interact with them in a virtual way offering benefits to the client (One Mallorca, 2023):

1

2

3

4

5





Arts

Several artists have created immersive works with Virtual Reality. In addition, there are several tools available to the user to create immersive art, so different apps and tools have been developed that allow users to paint in virtual reality, sculpt and model, and even animate (Rodriguez, 2020).





Health and Medicine

"Virtual Reality brings numerous possibilities and solutions in medicine: from training new doctors and practitioners with simulators and immersive encyclopaedias, programmes to sensitise patients before an operation to greater precision in surgical interventions thanks to robotics and virtual environments" (Ifema, 2022) Virtual Reality has been used for the design of prostheses and implants (Scharver, 2004) or for surgical training (Pohlenz et al. 2010).



Sports

Virtual Reality has been directly introduced in recent years in the field of journalism for the production of news pieces. Similarly, the characteristics of this technology have not gone unnoticed in the sports field (Paíno-Ambrosio and Rodríguez-Fidalgo, 2020), and virtual reality can become a useful complement for both professional athletes and those who do it as a hobby or for health (Syncro VR, 2020).



Bibliography

and useful resources

360 Horizons (2023). 360° VR Titanic - The tragic timeline - Virtual Reality Experience. Disponible en: <https://www.youtube.com/watch?v=ap6JLZPq0r8&t=2s>

Adobe (2023). ¿Qué es la realidad virtual? Realidad virtual: explicación. Disponible en: <https://www.adobe.com/es/products/substance3d/discover/what-is-vr.html>

AirPano VR (2020). Antigua ciudad de Petra, Jordania. Video aéreo 360 en 8K. Viaje virtual. Disponible en: <https://www.youtube.com/watch?v=xSiv4TkfSOE>

Alonso Almeida, M. del M. (2019). Robots, inteligencia artificial y realidad virtual: una aproximación en el sector del turismo. *Cuadernos de Turismo*, 1(44), 13–26. <https://doi.org/10.6018/turismo.44.404711>

Alttilo DIRCOM (2017). Museos con Realidad Virtual. Disponible en: <https://www.youtube.com/watch?v=1YeihImadRE>

Ambrosio, A. P., & Fidalgo, M. R. (2020). Del espectador pasivo al experiencial: la realidad virtual en la información deportiva. *Index. comunicación: Revista científica en el ámbito de la Comunicación Aplicada*, 10(1), 219-240. <https://doi.org/10.33732/ixc/10/01Delesp>

Anna dream bush (2018). Underwater magic (Virtual Reality Painting). Disponible en: <https://www.youtube.com/watch?v=diB9DaIMmEc&t=1s>

Arbona, C. B., García-Palacios, A., & Baños, R. M. (2007). Realidad virtual y tratamientos psicológicos. *Editorial Médica*.

Archstone Latam (2019). Realidad Virtual Inmobiliaria. Disponible en: <https://www.youtube.com/watch?v=Xrrsq7rafKU&t=113s>

Arqavia (2017). Realidad Virtual para el Mercado Inmobiliario. Disponible en: <https://www.youtube.com/watch?v=K3xCYXbKIBY&t=18s>

Aznar-Díaz. I., Romero-Rodríguez, J.M., y Rodríguez-García, A.M. (2018). La tecnología móvil de Realidad Virtual en educación: una revisión del estado de la literatura científica en España. *EDMETIC, Revista de Educación Mediática y TIC*, 7(1), 256-274, doi: <https://doi.org/10.21071/edmetic.v7i1.10139>

BabiaXR (2023). BabiaXR, a toolset for 3D/VR data visualization in the browser. Disponible en: <https://babiaxr.gitlab.io/>

Bautista, P. S., Rubio, L. M. C., & de Julián, J. I. C. (2018). Marketing y publicidad inmersiva: el formato 360º y la realidad virtual en estrategias transmedia. *Miguel Hernández Communication Journal*, (9), 19-47.

BBC News Mundo (2017). Video 360: La batalla por Mosul contra Estado Islámico desde el aire y en 360 grados. Disponible en: <https://www.youtube.com/watch?v=fXnARV00lm8>

Biocca, F., Kim, T., & Levy, M. R. (1995). The vision of virtual reality. In F. Biocca & M. R. Levy (Eds.), *Communication in the age of virtual reality* 3–14)

Castañeda Roldán C. Y. & Vázquez García F. E. (2011). Realidad Virtual, un apoyo en la Terapia de Acrofobia, Claustrofobia y Agorafobia. *Memorias del VIII Congreso Internacional sobre Innovación y Desarrollo Tecnológico (CIINDET 2011)*, Cuernavaca Morelos, México.

Cidade da Cultura (2017). Carne y Arena (Virtualmente presente, Físicamente invisible). Disponible en: <https://www.cidadedacultura.gal/es/evento/carne-y-arena-virtualmente-presente-fisicamente-invisible>

Cuesta, U., y Mañas, L. (2016). Integración de la realidad virtual inmersiva en los Grados de Comunicación. *Icono 14. Revista de Comunicación Audiovisual y Nuevas Tecnologías*, 14(2), 1-21. <https://doi.org/10.7195/ri14.v14i2.953>

De La Peña, N., Weil, P., Llobera, J., Giannopoulos, E., Pomés, A., Spanlang, B., Friedman, D., Sanches-Vives, M. & Slater, M. (2010). Immersive Journalism: Immersive Virtual Reality for the First-Person Experience of News. *Presence* 19, 291–301.

Deloitte (2017). Tech Trends 2017. Disponible en: <https://9di.es/yzjo2djt>

Domínguez-Martín, E. (2015). Periodismo inmersivo o cómo la realidad virtual y el videojuego influyen en la interfaz e interactividad del relato de actualidad. *Profesional De La información Information Professional*, 24(4), 413–423. <https://doi.org/10.3145/epi.2015.jul.08>

El País (2019). Vídeos 360º de El País. Disponible en: <https://www.youtube.com/playlist?list=PLeEzCJHXCIX1sC0IPqOCqj1AF-Rj7Sr3A>

Elbert, M. J. P., Mendoza, B. M. Z., Aguirre, K. A. M., & Cárdenas, M. V. (2023). Realidad virtual, realidad aumentada y realidad extendida en la educación. *RECIMUNDO: Revista Científica de la Investigación y el Conocimiento*, 7(2), 74-88.

EU Mediterrani (2021). ¿Qué es el Turismo Virtual? La realidad virtual en el sector turístico. Disponible en: <https://mediterrani.com/turismo-virtual-realidad/>

Flow Immersive (2023). Flow Immersive 3D AR Data Visualization. Disponible en: <https://flowimmersive.com/>

Fundación Telefónica (2019). 'Intangibles. Una exposición digital de la colección Telefónica'. Disponible en: <https://espacio.fundaciontelefonica.com/evento/intangibles-una-experiencia-digital-de-la-coleccion-telefonica/>

Gutiérrez, D., & Hernández, L. A. (2003). Potencial de la Realidad Virtual en el ámbito del Patrimonio. *Revista PH*, 46, 1-9. <https://doi.org/10.33349/2003.46.1629>

Ifema (2022). Realidad Virtual y Aumentada en la medicina. Disponible en: <https://www.ifema.es/noticias/salud/realidad-virtual-y-aumentada-usos-en-medicina>

Levis, D. (2006). ¿Qué es la Realidad Virtual? Disponible en: https://www.academia.edu/2449000/_Qu%C3%A9_es_la_realidad_virtual_

Man City (2017). Man City Matchday in 360 VR! Disponible en: <https://www.youtube.com/watch?v=FcSnHBZcC4w>

Meta (2023). Reinventamos las reglas del juego con Meta Quest. Disponible en: <https://www.meta.com/es/quest/gaming/>

Microsoft (2023). ¿Qué es la realidad aumentada o AR? Disponible en: <https://dynamics.microsoft.com/es-es/mixed-reality/guides/what-is-augmented-reality-ar/>

Milgram, P. & Kishino, F. (1994). A taxonomy of mixed reality visual displays. *IEICE Trans. Inform. Syst.* 77, 1321–1329.

National Geographic (2017). Lions 360° | National Geographic. Disponible en: <http://bit.ly/30BiUBS>

One Mallorca Real Estate Agency (2023). La Revolución de la Realidad Virtual en el Sector Inmobiliario. Disponible en: <https://www.linkedin.com/pulse/la-revoluci%C3%B3n-de-realidad-virtual-en-el-a6wwf/?originalSubdomain=es>

Otero, A., y Flores, J. (2011). Realidad virtual: Un medio de comunicación de contenidos. Aplicación como herramienta educativa y factores de diseño e implantación en museos y espacios públicos. *Icono 14. Revista de Comunicación Audiovisual y Nuevas Tecnologías*, 9 (2), 185-211. <https://doi.org/10.7195/ri14.v9i2.28>

Play Station VR (2023). Play Station VR. Disponible en: <https://www.playstation.com/es-es/ps-vr/>

Pohlenz Philipp, G. B. A., Petersik A., Von Sternberg N., Pflesser B., Pommert A., Ho¨ Hne K-H., Tiede U., Springer I., Heiland M. (2010). Virtual Dental Surgery as a New Educational Tool in Dental School. *Journal of Cranio- Maxillo-Facial Surgery*, 38, 560-564.

Road to VR (2016). Quill - VR Art with Oculus Rift and Oculus Touch. Disponible en: <https://www.youtube.com/watch?v=wf5l97Yu7ho&t=1s>

Rodríguez, V. (2020). 10 Herramientas para crear arte en Realidad Virtual. Disponible en: <https://i-amvr.com/10-herramientas-para-crear-arte-en-realidad-virtual/>

RTVE (2020). Ciudades vacías por el Coronavirus | Video 360 | Lab. Disponible en: <https://www.rtve.es/lab/ciudades-vacias-coronavirus-covid19-360/>

Rubio Tamayo, J. L. & Gértrudix M. (2016). Realidad Virtual (HMD) E Interacción Desde La Perspectiva De La Construcción Narrativa Y La Comunicación: Propuesta Taxonómica. *Revista ICONO 14. Revista Científica De Comunicación Y Tecnologías Emergentes* 14 (2), 1-24. <https://doi.org/10.7195/ri14.v14i2.965>.

Sáez, E. (2007). La realidad virtual como objeto y contexto cinematográfico. 1. *Dimensiones histórica, económica e industrial y tecnológica* 9, 293.

Scharver Chris, E. R., Johnson Andrew, L. J. (2004). Designing cranial implants in a haptic augmented reality environment. *Communications of the ACM*, 47 (8), 33-38.

Shangri-La Hotels and Resort (2015). Shangri-La Hotels Virtual Reality Tour. Disponible en: https://www.youtube.com/watch?v=wjmlX_dc3Y8&t=1s

Syncro VR (2020). Deportes y Realidad Virtual. Disponible en: <https://syncrovr.com/deportes-y-realidad-virtual/>

Telefónica (2023). ¿Qué es la realidad virtual inmersiva y cómo funciona? Disponible en: <https://www.telefonica.com/es/sala-comunicacion/blog/realidad-virtual-inmersiva-como-funciona/>

The Met (2017). The Met 360° Project: Arms and Armor Galleries. Disponible en: <https://www.youtube.com/watch?v=JydrKFwSFkE&t=2s>

The New York Times (2015). Walking New York | 360 VR Video | The New York Times. Disponible en: <https://www.youtube.com/watch?v=f0-89v4Fk-M>

TimeOut (2023). Llega a Barcelona una exposición inmersiva sobre Tutankamon. Disponible en: <https://www.timeout.es/barcelona/es/noticias/llega-a-barcelona-una-exposicion-inmersiva-sobre-tutankamon-090323>

Travel Alberta (2018). 360 Video of The Royal Tyrrell Museum in Alberta. Disponible en: <https://www.youtube.com/watch?v=3RPQwCxu5po>

Vera, G., Ortega, J.A., y Burgos, M.A. (2003). La realidad virtual y sus posibilidades didácticas. *Etic@net, Revista científica electrónica de Educación y Comunicación en la Sociedad del Conocimiento*, (2), 1-17.

Videoreport Canarias (2022). Realidad Virtual | ¿Cómo llegaron los primeros pobladores a Canarias sin saber navegar? Disponible en: <https://www.youtube.com/watch?v=XANV2UtzoLI>

VirtualWorld (2016). The VR Museum of Fine Art para HTC Vive. Disponible en: <https://www.youtube.com/watch?v=6WAC38aZ-hk>

Weinbaum (1935). Pygmalion's Spectacles.

Zhilyaeva, A. (2019). Virtual reality painting performance WorldSkills 2019 opening, Kazan. Disponible en:
<https://www.annadreambrush.com/>

Creating virtual scenes with A-Frame | A-Frame Course I



ALMA MATER STUDIORUM
UNIVERSITÀ DI BOLOGNA



Audiovisual and multimedia production: **CIBERIMAGINARIO**
GRUPO DE INVESTIGACIÓN