Expansion of Immersive Experience in Society*

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Abstract. With the constantly evolving technology of immersive experience, this study ana-lyzed cases of various immersive user experiences. Characteristics of immersive user experience were classified into interactivity, virtuality, information processa-bility, presence and body ownership. When immersive user experiences are ap-plied to fields such as cultural content, advertising marketing, social VR, and connected car platform, innovative services and content for users are developed and meaningful insights into future immersive experience technology and social influences are derived. Lastly, problems to be solved were pointed out, such as the problem of human factors that cause visual fatigue, content copyright, and government regulations.

Keywords: Immersive Experience, User Experience, Interactivity, Virtuality Presence.

1 Evolution of Immersive User Experience

The technology of "Immersive Experience" is constantly evolving as the use of con-tent experienced in a virtual environment feels as if it is happening around me in the real world. Gartner told Immersive Experience as one of the top 10 strategic technology trends in 2019[3]. The way in which they recognized and interact is changing, which leads to a variety of immersive user experiences through technologies such as VR, AR and MR. User experience refers to the total experience of perception, reaction, and behavior that a user feels and thinks while using a specific system, product, or service.

True immersion technology must dazzle the five senses of the user. In addition to visual and auditory senses, the human senses such as touch, smell, and taste should

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[3] https://www.gartner.com/smarterwithgartner/gartner-top-10-strategic-technology-trends-for-2019/

be reproduced. ICT technology enables fast network processing speed to process high-definition content, 360-degree video camera technology that can move 4K or higher image quality freely, and technologies such as stereo sound, connect with multi-experience environments such as mobile, automobile, and wearable devices, there-by enabling the environment surrounding us to become a computing environment. In the future, artificial intelligence (AI) technology is expected to combine AR and VR to provide a more advanced immersive user experience. For example, a virtual chef helps me cook, or a health tracking device analyzes my heart rate changes or sleep patterns to help me manage my health.

When it comes to immersive technologies, devices, and content development, the challenge is for all companies to create new experiences for their users. The key to problem solving is to provide a natural environment in which users can immerse themselves and interact with virtual objects.

2 Characteristics of Immersive User Experience

The core characteristics that embody the immersive user experience are summarized as interactivity, virtuality, information processability, presence and body ownership.

2.1 Interactivity

When users are feeling “really involving” and “really using” going beyond simply “see”, they can have ‘realistic’ experience. Interactivity depends on how speedily, and naturally they can map and range content or services in the way as they want, within the virtual environment [3,4]. For example, when watching “black mirror” Netflix’s interactive content, people don’t unilaterally watch movies like they were used to doing in the past, but they actively choose stories and situations to get the results they want. In this way, interactive content are based on the participation of people, the content plot proceeds differently according to the user’s selection.

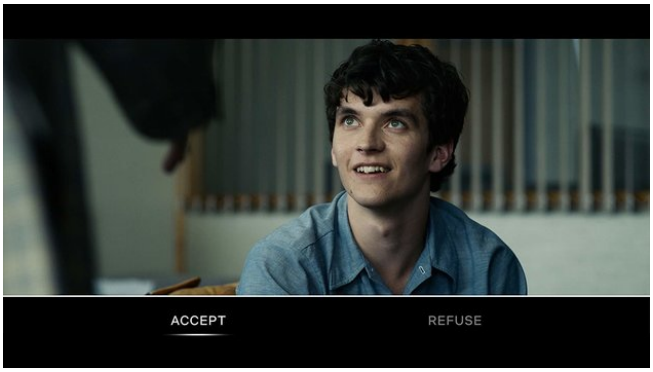

Fig. 1: “Black Mirror” distributed by Netflix[4].

2.2 Virtuality

Virtual reality is a space that embodies a specific world regardless of whether it exists or not: A world made of computer graphics such as text, images, and video. Milgram and Kishino described it as a 100% virtual world where users can immerse and interact in a perfect state [7]. Since it creates something imaginary, the user has a positive or negative experience depending on how similar the representation is to reality. Advances in technology make it possible not only to see the virtual world, but also to interact with what is embodied in virtual reality [10]. Social VR, for example, uses VR devices, enters virtual spaces as my avatar, and builds an environment where people can watch and talk with other participants.

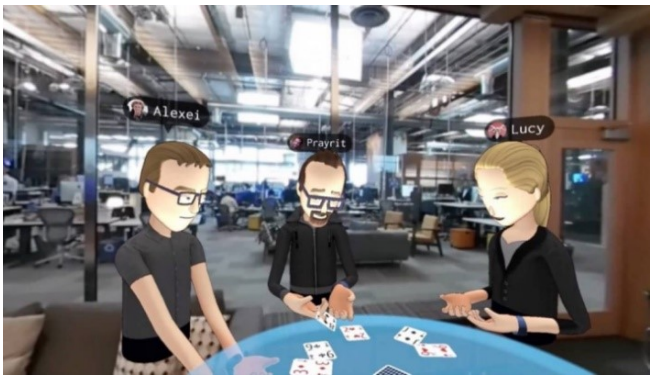

Fig. 2: Facebook's Social VR.

2.3 Information Processability

This is how information is delivered to users through various sensors, which the media have described as media richness [2]. The process of interactive user experience is to utilize various human senses through specific input/output sensors. The provision of information through the use of the five senses raises the effect of interactions felt by users and brings about sensory immersion of information.

For example, a headset audio system that orients sound signals according to the user's viewing direction maximizes visual and audible sound effects to enhance user satisfaction and immersion. The real-time emotional response vehicle control system of the car, introduced at CES in 2019, optimizes the vehicle's interior space according to the driver's emotion and situation in real time by integrating and controlling the five senses elements in the vehicle in real time. In other words, based on AI, camera and various sensors, it automatically adjusts music, temperature, lighting and scent according to driver's emotion and condition.

[4] Source: Atlantic

Fig. 3: KIA's Real-time Emotion Adaptive Driving System in CES2019.

2.4 Presence

This refers to the feeling they are existing as being out of reality, feeling they are existing in the media. Some or all situations of an individual are created by technology, but are defined as a psychological state or subjective feeling that causes the individual to forget the role of this technology [5]. It is a concept that expresses the realistic three-dimensional feeling and vividness felt in the 3D movie Avatar. In order to maximize the immersive user experience, studies have been continuously conducted to find and apply factors that affect the realism when creating realistic content [8]. As people experience the 360-degree environment, they can have different experiences depending on the position of the movement in the video, the color, and the depth. TV technology is also introducing 8K displays to realize vivid ultra-high definition, or expanding 8K content by upscaling using AI.

2.5 Body Ownership

This refers to the state of 'feeling like my body' that the user feels. Body ownership is a concept that has been dealt with for a long time in cognitive neuroscience [6]. In the famous Rubber-Hand Illusion experiment[5], study participants were stimulated by rubber hands instead of their real hands, but experienced as if they were their own. In other words, the fake hand was taken as my hand. It is because our perception of my body is not just a feeling of seeing, but a total result of the combination of the recognition that we were in that position, the will to move, and the response of movement.

In another example, there is research that shows that virtual characters, even though they are white, are seen as black drummers. There is a mismatch between the environment the brain perceives and its own senses. Therefore, even if it is not real, when the feeling of body ownership, 'feeling like my body', increases when the content is experienced, it can lead to greater immersion and positive attitudes of users. This provides a starting point for character implementation when creating virtual reality content such as games.

In the implementation of virtual reality based on cognitive neuroscience, content and services are developed with a focus on the 'perceived experiences of people who believe that they are real even though not real.' Brain-computer interface (BCI) research [1] is also increasingly active, for example, the use of brain recognition headsets to control

[5] https://www.the-scientist.com/infographics/infographic-the-rubber-hand-illusion-31592

game characters, or the development of content that changes the flow of movie stories depending on the will of the viewer, and specific music using fMRI, wherein efforts are being made to arouse feelings and emotions as if listening to the music.

3 Case Studies of Immersive User Experience

With the development of AR/VR/MR technology, sensor technology of sensory stimulation such as tactile and motion recognition, CG, data analysis, artificial intelligence, and 5G network, con-tent and services of immersive user experience that stimulates the five senses, have been appearing continuously. These tangible content and services are driving innovation in a variety of areas, including games, movies and performances, as well as advertising marketing, education, healthcare and military.

3.1 Field of Cultural Content

Netflix's 'Stranger Things' 360 VR video starts with a dark night, a view of a first-person that walks to answer a ringing call in the living room. You can experience the horror of the protagonists indirectly, and become nervous as if you were left alone at home late at night. It can be linked with Facebook's stand alone. VR headset "Oculus Go" to provide a VR experience like a personal movie theater.

Fig. 4: Virtual Reality/360 Experience in "Stranger Things".

The Bunker of Light media art exhibition is a projection mapping-based, immersive media art that provides the audience with a unique artistic experience. Being surrounded by dozens of beam projectors and loudspeakers, the audience is completely immersed in the master's work and music.

AR Basketball, which has realistic content expanded into the sports areas, creates a basketball court space by augmenting virtual images on the walls and floors of the hologram theater. It is a way of raising scores by sensing the route of the ball through

[6] Source: `https://www.visitjeju.net/kr`

Fig. 5: “The Bunker of Light” Media Art[6].

the laser sensor when throwing a ball toward the basket. It is designed for the user to enjoy real basketball games, training and throwing in a virtual environment.

Fig. 6: AR Basketball game at K-live X VR PARK[7].

3.2 Field of Advertising Marketing

Companies are reinforcing their brand experience marketing by utilizing content and services that provide various immersive user experiences based on the new media space. This is sometimes referred to as a digital installation. We look at examples of successful marketing campaigns based on five types of experiential marketing, such as sense, feel, think, act, and relate classified by Bernd Schmitt [9].

[7] Source: `http://www.klive.co.kr/`

The Lush Spa Experiment It visualizes the impact of the rush spa experience on the mind and body by measuring changes in the heart rate, brain activity, muscle movement and touch, and breathing. Being designed to capture human biometric data, the rush product massages the user's body, and the user's body sends out body data that was different from the previous data, expressed by visualization. It is designed to make users recognize Rush as a special brand that sets it apart from other spa brands.

Fig. 7: The Lush Spa Experiment[8].

Unbelievable Bus Shelter by Pepsi Max It is a tedious experience for public transporters to be waiting for the bus to arrive. With this in mind, Pepsi installed an AR project at the London bus stop that will surprise users. By using the AR, he replaced the walls of the bus stop with fake windows so that the flying saucers, robots, and tigers seemed to go down the street. The key is to make the virtual world feel as if it is real.

Theater Of Experience at Singapore Changi Airport Travelers are surrounded by immersive media walls to experience fun and diverse content, while passing through the security check zone. The beautiful landscape of reality alternates with the subtle and lively virtual world. Eventually, Changi Airport's digital signage transformed travelers' moments from optical illusions to movie storytelling to joy and discovery.

Adidas Broadcast AR Interactive It is a project that creates a situation that seems to be showing football tricks with a soccer star using augmented reality technology. As the

[8] Source: `https://techtrends.tech/`
[9] Source: `https://www.theverge.com/`
[10] Source: `https://www.frameawards.com/`

Fig. 8: “Unbelievable Bus Shelter” project in London[9].

Fig. 9: Theater of Experience at Singapore Changi Airport[10].

user stands in front of the huge augmented reality screen, Brazilian soccer star Marcelo on the screen talks and shows the movement of the football. The user then takes the action given and takes a commemorative photo with Marcelo when finished. The video of the entire experience is automatically captured by the augmented reality system and easily shared online with a single click.

Sony’s A Multisensory Food Fantasy It is a project for users to experience traditional Japanese cooking process. It is an action marketing case where the user experiences cooking through a digital installation and the cooking process forms tactile interaction at the same time. The content is created in small particles as soon as the user’s hand touches the digital installation. This visual movement causes the desire to act directly

[11] Source: `https://www.indestry.com/`

Fig. 10: Adidas's AR Interactive Campaign[11].

on the user to create small particles. When small particles are produced, the cooking process is visualized in a metaphorical process.

Fig. 11: Sony's A Multisensory Food Fantasy[12].

Etude House's Color Factory A participation project allows users to create and select their own lipstick to match their skin tone. Utilizing the digital kiosk, a digital installation, users upload their photo and find out the recommended color for them. The users select a favorite color among the recommended colors, and then customize the case to create their own cosmetics.

3.3 Social VR

'Wanna One's virtual space' is immersive content using social VR platform, and users connect to the VR world that reproduces the space in Wanna One music video as realistically as possible, and find the cheering rods of Wanna One members within a

[12] Source: Sony Music Communications
[13] Source: `https://www.etude.com/kr/ko/main`

Fig. 12: Etude House's Color Factory[13].

limited time wherein if you find all the 10 rods, you will get the prize. The challenge remains to activate the social VR platform and validate the feasibility of the platform business through the inflow of fandom.

3.4 Connected Car Platform

Audi developed the technology to experience movies and video games from the rear seats of the car, using VR glasses to make the car space a mobile amusement park and theater. In essence, the vehicle's movements and VR content are linked in real time, and Audi demonstrated a VR content, "Marvel Avengers: Rocket Rescue Run", which was collaborated with Disney.

Fig. 13: Audi's Car Content Platform[14].

[13] Source: `https://variety.com/`

4 Challenges to be solved in immersive experience

Since immersive virtual reality is a principle that the brain recognizes the virtual stereoscopic space through the display in front of the eyes, the human factor problem of visual fatigue caused by the depth of the image remains a problem. In particular, there is no solution for digital motion sickness caused by the parallax between display response and head movement. There are individual differences, but within a few minutes of actually running the roller coaster content, the experiences felt very sick. There is an urgent need for technical complements of displays, software, and efforts to find content methods that are suitable for ultra-contiguous eye display.

In addition, there are challenges to secure core competencies and copyrights for immersive con-tent production and solve national regulations and deliberation issues. In order to expand the immersive content market such as virtual reality, it is most important for research and technology development to grasp the user's reaction from the user's point of view beyond the views of manufacturers and providers.

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