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摘掉VR眼鏡闖元宇宙：裸視3D沈浸體驗廣告初探研究

以士林小萌虎為例

Take off VR Goggles and Explore the Metaverse: A
Preliminary Study on Naked-eye 3D Immersive Experiences -
Taking Shilin Tiger Digital Advertising as an Example

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摘要

新媒體科技的繁榮及COVID疫情的衝擊帶領元宇宙興起，繼VR(虛擬實境)、AR (擴增實境)和MR (混合實境)後，裸視3D特效為新行銷型態掀起風潮。從士林夜市的3D立體小萌虎到東京街頭熱門景點新宿貓，紐約時報廣場的大鯨魚到首爾的巨浪，全球爭相投入這股元宇宙行銷熱。越來越多品牌試圖透過裸視3D行銷手法打造前所未有的感官衝擊，帶給觀眾除了眼鏡、手機科技設備的VR/AR體驗之外，另一種不需透過設備的裸眼沈浸式體驗。同時試圖替消費者排拒而日益式微的傳統廣告、公關、行銷策略甚至為觀光商機謀尋新生路。裸視3D竄起的背景為何？是否為受眾帶來有別傳統的廣告聚合效果？在下一波元宇宙世界觀風潮中扮演什麼角色？台灣的裸視3D是否能像日本新宿貓一樣成為觀光的推手？全球知名的台灣的科技及動畫業能否透過這些新媒體科技推動新一波軟實力？本文透過深入採訪(In-depth interview)台灣裸視3D動畫產製者及主題分析（Thematic analysis）個案策略，研究探討：

1.什麼是裸視3D？裸視3D的技術原理及行銷優勢。
2.元宇宙時代裸視3D士林萌虎沈浸式廣告案例分析及成效評估。
3.在新科技時代未來的應用及發展建議。

關鍵字

Abstract

The growth of new media technologies has resulted in the emergence of the metaverse. Following in the footsteps of VR (Virtual Reality), AR (Augmented Reality), and MR (Mixed Reality), naked-eye 3D effects have sparked a new wave of marketing approaches serving as the new solution to the dying advertising and tourism market. From the cute tigers of Shilin Night Market to the spotted cat on the world-famous attraction in streets of Shinjuku, Tokyo, and the giant whales in Times Square, New York, to the enormous waves in Seoul, the entire world is racing to engage in this metaverse marketing fad. More and more brands and businesses are delivering an unparalleled sensory effect by leveraging naked-eye 3D marketing methods to present viewers with another fresh immersive experience with/without using VR glasses. What is the background behind the rise of naked-eye 3D? Does it bring a different advertising aggregation effect or new tourism bussiness oppotunities to the audience? What part will it play in the upcoming metaverse worldview wave? Whether Taiwan's naked-view 3D can become a driving force for tourism like Japan's Shinjuku Cat. In addition, can Taiwan's world-renowned technology and animation industry promote a new wave of soft power through these new media technologies? This article explores the following through a case study, in-depth interviews with creators of naked-eye 3D animation displays, and a thematic analysis examination of marketing tactics:

RH1: What is naked-eye 3D? The technological underpinnings and marketing advantage of naked-eye 3D.

RH2: Case Study: naked-eye 3D immersive making and call-to-action conversion marketing effect evaluation in the metaverse era—Taking Shilin Tiger as an example.

RH3: Suggestions for future applications and developments in the age of new technologies.

keywords

Naked-eye 3D, Autostereoscopic 3D, 3D anamorphic Billboard, glasses-free 3D, immersive experience, metaverse, advertising

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Introduction

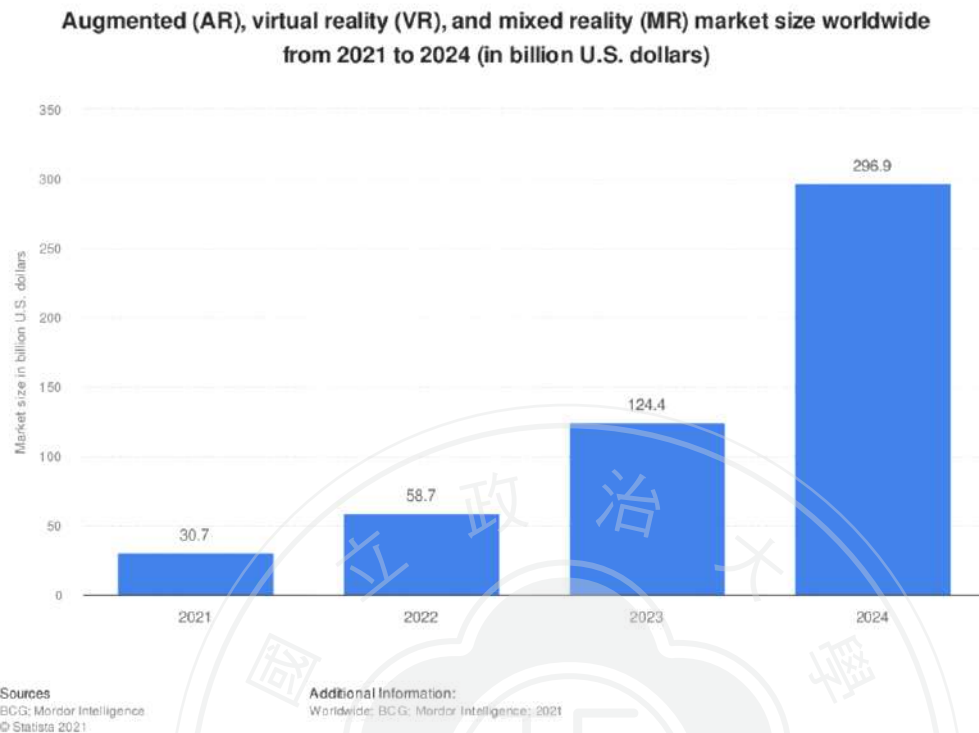Background: The Rise of Immersive Experiences

Under the blessing of the metaverse boom and the impact of the COVID epidemic, Verizon Media released the "Immersive Experience Survey" in 2021 and called it "The First Year of Immersive Experience." According to the survey, 58% of consumers are interested in immersive technology experiences, and the figure in Taiwan is as high as 82%, far exceeding Hong Kong, Japan, the United Kingdom, the United States, and other regions. Based on BCG and Mordor Intelligence survey, the current market value for AR/VR/MR is around $30.7 billion, and the market size worldwide is to rise to $300 billion by 2024.

Actual conversion figures demonstrate the advertising efficacy of immersive experiences. Consumers spend an average of more than one minute in AR experiences, according to Verizon Media's internal statistics, and the advertising interaction rate is 38%, which is greater than conventional display modes. "Traditional marketing methods are collapsing one by one," writes Mathew Sweezey, leader of Salesforce's market research group, in his book *The Context Marketing Revolution*. "Advertising, marketing, and PR are all meaningless in this day and age. Consumers want experiences rather than content."

According to the forecast of the research website Statista in 2022, US media advertising expenditures will reach US$322.1 billion by 2024, an increase of nearly US$100 billion compared to 2020. This number will only continue to rise. But instead, consumers are rejecting advertising. Every day, consumers will be exposed to 3,500 brand promotions, or 2.4 every minute on average. Too much information teaches customers to "filter" automatically, and no amount of advertising can compensate. They use ad blockers and pay to join the membership to refuse to view adverts. With an increased emphasis on privacy and the impending demise of cookies, brand companies want a new answer to a big portion of their advertising budget and marketing investment.

At this time, immersive technologies such as VR, AR, and XR have returned to the discussion with the development of the industry, and are regarded as the key to creating the "immersion" of the Metaverse. It has become a sharp tool for creating a marketing "experience". Being able to bring consumers an immersive experience has become a new

direction for brands to invest. The social platform Snpa said: "Let consumers enter the ZONE (similar to entering the flow), they will focus, be intoxicated, and invested in it."

Augmented (AR), virtual reality (VR), and mixed reality (MR) market size worldwide from 2021 to 2024 (in billion U.S. dollars)

The meta market size worldwide from 2021 to 2024. (BCG, Statista)

Immersive advertising is effective because it allows customers to participate in unique experiences that seem like entertainment rather than a sales pitch. Marketers must remain memorable when customers become overwhelmed by the lots volume of content available. Experiencing immersively helps naturally generate brand advocates, as participants share images from these events with friends and family even if they would never share an ad. A recent survey by Ericsson Emodo found that approximately 75% of consumers are more likely to pay attention to advertisements with immersive or augmented reality components, and 70% of consumers actually expressed interest in experiencing more advertisements with AR elements. These statistics are so incredible because it tells the market that consumers actually want more advertising - since immersive ads are like games; they go beyond traditional advertising and pull consumers from the moment to the unexpected.

At the same time, naked-eye 3D has also become a weapon to attract tourists. The Shinjuku cat video is played on billboards on the streets of Japan and attracts millions of people to watch it every day. It has become a new tourist attraction in the world, thereby driving business opportunities for surrounding stores. According to statistics, the cat is searched more

than 50 million times on Google and more than 26 billion times on YouTube every month. According to the latest statistics from the Japanese government, the tourism industry has picked up after the epidemic. Nearly 2 million foreign tourists visited Japan in April 2023, about two-thirds of the figure in April 2019 before the outbreak, and a 14-fold increase from last year.

Literature Review

Immersive experiences such as VR/AR and 3D Naked-Eye are used as a new form of technological advertising in the metaverse era to change the market. Mazuryk and Gervautz (1996) believe that such technologies allow consumers to view the world around them in different dimensions and experience things that cannot be obtained or even created in real life. Immersive advertising has changed the interaction between brands and consumers and is completely different from existing media attributes such as print, outdoor advertising, TV, and online audio-visual advertising.

Some defined immersion as a review of four general views: immersion as a property of the system used to display the virtual world, immersion as a perceptual response to that system, immersion as a response to narrative contents, and immersion as a response to challenges within the virtual world. (Nilsson, Nordahl & Serafin, 2016)

Witmer and Singer argued that immersion might be viewed as a "psychological state characterized by perceiving oneself to be enveloped by, included in, and interacting with an environment that provides a continuous stream of stimuli and experiences" (Witmer & Singer, 1998). Ryan(2006) provided an account of what causes individuals to become immersed in narratives. Narrative immersion may be described in terms of the three subcategories: temporal, spatial and emotional.

It resembles the idea of flow. A flow state is characterized by intense and concentrated attention as well as the fusion of activity and awareness. When proto, core, and extended awareness are all directed towards the same external event, maximum presence may also be felt. It appears plausible that challenge-based immersion, which in many ways resembles the experience of flow, would also be conducive to presence as it is defined by Riva et al. (2004).

Mariana Obrist (2020) believes that technology enables the creation of multisensory experiences that enrich and augment the way we interact with the world around us. Barnes (2017), when discussing the potential of virtual reality in marketing, mentioned that the combination of AI technology can provide hyper-personalized content for future experiences. This hyper-personalized content may be more subtle and persuasive when delivered to modern consumers in the market.

There is some evidence to suggest that 3D displays may have an "aggregation effect" on viewers, meaning that they may be more effective in capturing the viewer's attention and helping them remember details from an advertisement.

Stereoscopic 3D material encourages both more cortical areas and neural networks than 2D content, according to experimental evidence from EEG research comparing learning and long-term retrieval (Amin et al., 2021). In this study, subjective and objective data from cognitive psychology studies were analyzed to compare and assess the effects of two distinct modes, such as VR-2D and VR-3D, on emotional arousal. The findings demonstrated that people's perceptions of and presence in the virtual reality environment would be more significantly influenced by the emotional stimulation in the stereo-vision environment, leading to increased emotional arousal. The stereo effect mostly manifests in the 3 (21–30 Hz) band of high-frequency brain activity, which causes brain asymmetry with a left hemisphere that is more active.

It has been experimentally demonstrated that the human brain processes S3D information differently than typical 2D information by using additional cortical areas and neural networks. This alters participant behavior by causing them to recall the LTM more quickly during a recall test (Slobounov, et al., 2015). Additionally, studies have demonstrated that 3D displays can elevate physiological arousal in viewers, which is considered to improve memory and focus. This is due to the fact that people are more likely to profoundly digest information and keep it in their long-term memory when they are in a state of heightened arousal.

"VR manipulates the interactive sense of time and space, providing new possibilities for content communication. " (Szymczak, 2019). The advantage of this form of advertising lies in the innovation of technology, which creates new experiences in the visual, auditory, and tactile senses. media. When the existing media cannot achieve the expected benefits, more

interesting and attractive media forms, and content not only meet the preferences of the audience but also can realize the value of advertising. In recent years, it is common to use eye trackers to track and capture facial expressions, emotional responses, etc. to collect big data responses to warm up for the subsequent intervention of VR/AR technology, experience the situation, and real-time response and feedback to break the existing framework of the public's impression of advertising.

Chen Ruiwu (2020) pointed out that according to psychological research, VR/AR content can improve the audience's ability to retell key facts, interact with the content for a longer period of time, and have a greater impact on their thoughts. Using VR/AR to experience the charm of products can greatly reduce consumers' defense against advertisements, and increase the exposure rate of advertisements in a cost-effective manner. The role of advertising today is not only to reach consumers but also to immerse consumers in the advertising situation.

Although VR/AR can create a realistic space and give consumers a real feeling of experiencing their own environment, there are still limitations in operation. Mangles (2018) argued that although the augmented reality is simple, fast, and interactive, providing a niche and attractive way to attract the target audience, virtual reality still needs to wear head-worn displays and other accessories, which makes it difficult to reach potential customers.

Consumers are not only tired of the existing advertising forms but also want to gain different visual experiences from the past and create more rich and diverse experience situations. How to use the integrated new technology, use the simplest equipment, and the least devices to achieve the immersion experience effect has become the key to 3D Naked-Eye's emergence in brand marketing in recent years.

The key to immersion is in the users' perceptions of quality, interaction with the service, and the qualities of technological features that users perceive and with which they interact. Overall, these observations imply that much of the immersion is related to the users' subjectivity as well as the objectivity of technology. (Shin, 2017)
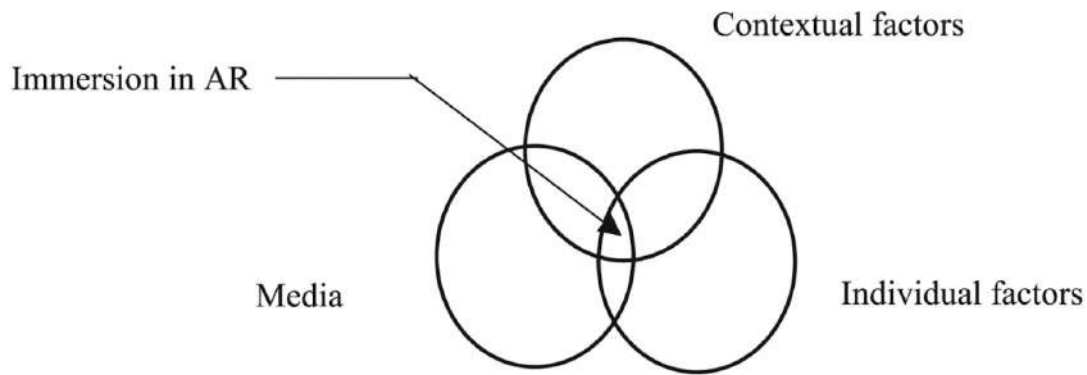
A user-centric view of immersion and engagement. Immersion in AR. (Donghee Shin)

Immersive technology is a technology that blurs the boundary between the physical and virtual worlds and enables users to experience a sense of immersion (Lee, Chung et al., 2013, Lee, Shan et al., 2013). Immersive technology, including augmented reality (AR) and virtual reality (VR), is increasingly pervasive in our daily lives. Different researchers have provided various definitions of immersive technology. One perspective focuses on the sensory information it provides.

Slater (2009) defines immersive technology as technology that offers users a substantial amount or high quality of sensory input. On the other hand, some researchers emphasize the immersive experiences users have while using the technology. Or defining immersive technology as technology that blurs the boundaries between the physical and virtual worlds, resulting in a sense of immersion and heightened realism in virtual experiences (Soliman, Peetz, & Davydenko, 2017).

Immersive technology refers to a digital environment that engages multiple senses, primarily sight and sound, to either extend or completely replace the user's real surroundings with digital content. This technology blurs the line between the physical and simulated worlds, resulting in a feeling of immersion (Lee, Shan, & Chen, 2013). Two prominent types of immersive technology are augmented reality (AR) and virtual reality (VR), each differing in their proximity to the real world (Javornik, 2016). AR overlays digital content onto the real world, while VR creates a virtual world that may resemble the real world (Flavián, Ibáñez-Sánchez, & Orús, 2018).
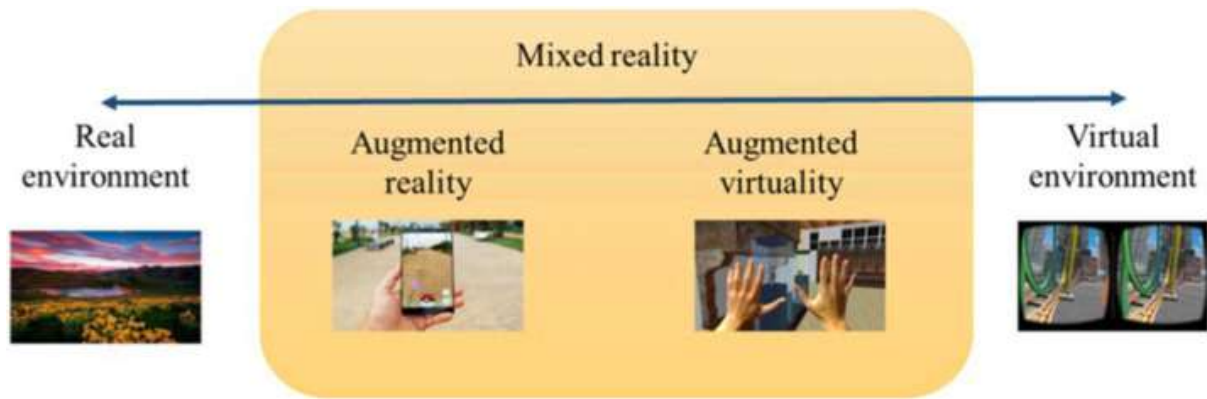
Reality-virtuality continuum (Milgram & Kishino, 1994).

Tech and Application – A Closer Look at Naked-Eye 3D

Have you ever seen a billboard or an LED display that seemed to leap off the page as if it was three-dimensional? This is a technology called naked-eye 3D (also known as "glasses-free 3D" and "autostereoscopy"), and it has become increasingly popular in recent years. It allows viewers to see three-dimensional images without needing to wear any special glasses. It works by creating multiple perspectives of an image or object displayed on a screen. To the viewer's eyes, these different perspectives appear to be in three dimensions.

Naked-eye 3D displays leverage sophisticated algorithms that allow viewers to feel as if they are actually inside the image or video being projected. The technology works by creating multiple layers of images projected onto a single screen or canvas with slight variations in each layer—just enough variation so that when viewed from different angles, it appears as if objects are popping out from the screen or canvas. This creates a much more realistic and immersive experience than traditional AR or VR can provide without requiring any additional equipment like glasses or headsets.

This type of display has become increasingly popular in the past years due to its eye-catching visuals and immersive feeling. As brands and companies look for new ways to engage consumers with their products or services. With its ability to simulate real-life visuals and objects, naked-eye 3D can provide a truly immersive experience that other forms of advertising cannot replicate. The most noticeable difference between naked Eye 3D and traditional billboards or LED displays is the sense of depth it provides. When viewers look at

a naked Eye 3D display, they feel like they are "in" the advertisement rather than just viewing it from afar.

Various naked-view 3D billboard presentations in well-known locations around the world. (Pinterest)

In 2017, Coca-Cola played a 3D animation ad featuring naked-eye 3D on a large LED display billboard in Times Square, USA. It utilized 1760 independent moving cubes, using programming and animation to interweave 2D and 3D images, creating a flowing effect like waves. Together with the shape of Coca-Cola's iconic curved bottle and droplets of water, the ad enhanced the product's appeal.

Coca-Cola played a naked-eye 3D simulating ad on a large LED display billboard in Times Square in 2017. (tech. co)

In March 2020, a large outdoor billboard in the COEX shopping center in Seoul's Gangnam District, South Korea, had the theme of "WAVE." The stunning visual effect of waves surging inside the building was simulated using a gigantic LED curved screen that was up to 20 meters long and 80 meters wide. This not only attracted the attention of the public but also brought new creative ideas to LED advertising companies, inspiring them to produce various visual and sensory experiences.

"Wave" was shown on Coex K-pop Square in Seoul, in 2020. (d'strict and CJ Powercast)

In July 2021, a hyper-realistic giant 3D cat appeared on an advertising billboard in front of the east exit of Shinjuku Station in Tokyo, Japan. The cat, named "Shinjuku East Exit Cat," interacted and played with pedestrians, providing a therapeutic and heartwarming experience. This large interactive advertisement board was created using a 4K ultra-large LED curved screen located across from the east exit, which is currently the only 150 square meters 4K large-screen street view display in Japan. "Shinjuku East Exit Cat" is the first advertising billboard project launched by Cross Shinjuku Vision, which is a new commercial and office building in Shinjuku. The cat even has its own Twitter account and a 24-hour live broadcast of the billboard's screen on YouTube. It soon became a world-famous attraction spot bringing foreign tourists and business opportunities nearby.

The Shinjuku East Exit Cat launched in July 2021, becoming one of the famous landmarks in Tokyo. (クロス新宿ビジョン)

A collaborative media artist unit formed by d'strict, showcased public media artwork titled "Whale #2" in New York City's Times Square in July 2021. "Whale #2'" occupies a 1,400㎡ -large screen, Illuminating the pedestrian plaza at the center of the iconic Times Square, transforming the electronic display board into a hyperrealistic three-dimensional space where waves are crashing down on a majestic blue whale.

The showcased public media artwork titled "Whale #2" in New York City's Times Square in July 2021. (d'strict)

In October 2022, almost one million people attended the "2022 Nuit Blanche Taipei" event hosted at Shilin in Taipei City. One of the most impressive features is Shilin Night Market's

"Curved Surface 3D Large-Scale Advertising Wall," which displays a lifelike "Shilin cute tiger" video. This adorable 3D naked-eye tiger cub not only drew onlookers but also sparked discussions on social media and received numerous comments, piquing the interest of many netizens. The driving force behind this naked-view 3D charming tiger is Taiwanese technology business Samoi Tech x Active Animation LTD. Successfully made a name for Taiwan's "digital transformation of traditional business circles" and "new outdoor advertising technology".

The "2022 Nuit Blanche Taipei" event was hosted at Shilin in Taipei City, which displayed a lifelike "Shilin Tiger" naked-eye 3D video. (Active Animation)

The principle and technology of naked-eye 3D

Because people's eyes are looking at objects from different angles, there will be slight differences in the images they receive. This difference is called "parallax". The brain will determine the distance of objects according to the angle of parallax, establish the relative distance of each object, and generate the so-called "stereo vision". 3D technology is to use the principle of binocular parallax and various optical technologies to make the left and right eyes receive different angles of view so that the viewer can have a stereo vision of the picture. In the early stage, glasses were worn, such as red-blue filter glasses and polarized glasses. Through the filter of glasses, the two eyes can see different pictures respectively,

producing a stereoscopic effect. It can be generally divided into three types: parallax barriers, lenticular lenses, and directional backlight.

The 3D naked-eye technology also uses the principle of binocular parallax to reconstruct the 3D model through the optical technology of the screen itself, input the 3D image into the viewer's eyes, and form the left and right eye parallax to achieve the best-naked vision effect that allows the eyes to receive different pictures.

The brain will determine the distance of objects according to the angle of parallax generating the so-called "stereo vision". (Active Animation)

How the 3D naked-eye digital billboard is formed:

1. Create illusions using reference objects: For instance, by using white lines to divide a regular image and allowing the subject of the image to extend past the white line, binocular parallax can be used to create the illusion of three dimensions. Through the use of color depth, it is possible to create the three-dimensional illusion of human eye parallax on a screen. The protruding portion of the 3D three-dimensional edge is highlighted, and the concave portion is displayed in a dark color due to light blocking, just like the shadow effect that appears in the 3D painting. The white lines and shadows are the reference objects at this point, which aid in creating a more accurate mental image of three dimensions.

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Create illusions using reference objects. (Internet)

2. Use the curved LED screen to strengthen the illusion: The human eye sees objects in three dimensions. There will be a small difference between the images seen by the two eyes due to their separation. The brain is able to calculate space thanks to this tiny difference. The brain has a 3D sense of space because the sense of distance is used to distinguish between the size and distance of objects. When viewers stand in front of the screen, they will simultaneously see the front and side of the object thanks to the use of perspective-aware visual content. The 3D sense of space is improved by the brain's processing of this parallax.
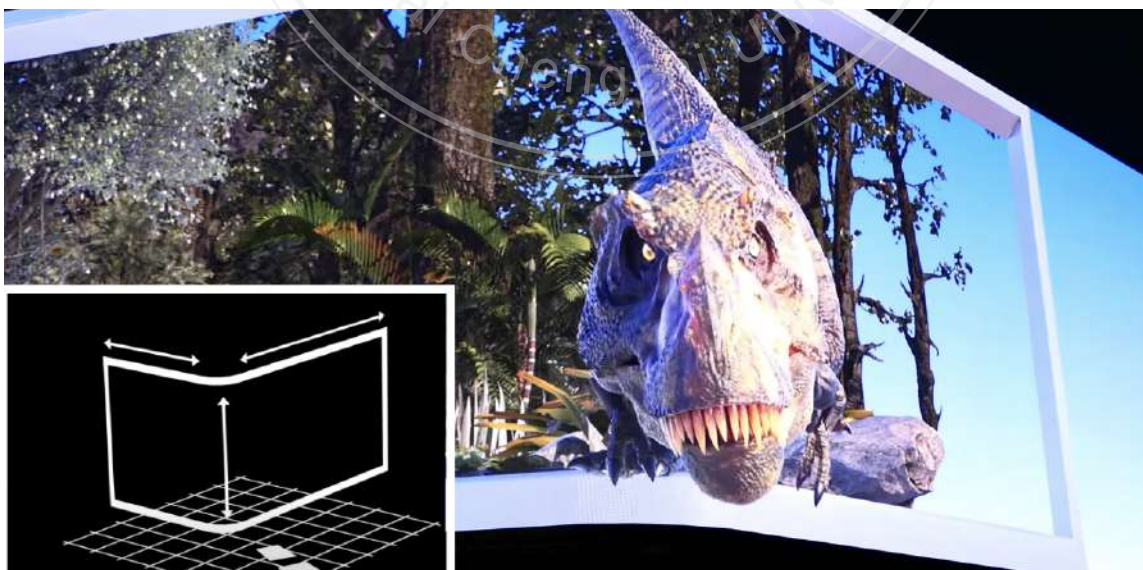
When viewers stand in front of the screen, they will simultaneously see the front and side of the object via perspective-aware visual content. (YouTube)

3. Use specially designed 3D image content to create scenes: By using 3D special effects images, it is possible to create the illusion of a three-dimensional effect on a flat LED screen. Instead of the video appearing flat and two-dimensional, it can have depth and dimensionality that makes it seem more lifelike and immersive. This technique involves crafting the 3D images to create the effect and then integrating them into the video content in a way that makes them appear seamless and natural.

Use specially designed 3D image content to create scenes. (Pinterest)

4. Create effects by utilizing the surrounding environment: The most flawless 3D naked-eye video can incorporate into the surrounding space. The wall, the building, and the area around the advertising billboard are the main components of the physical environment. These elements blur the line between the screen and the building, making it difficult for viewers to tell where the edge actually is, which makes it simpler for them to believe the image is coming from the building. The interior space has been expanded to make the content viewing experience more immersive. Each 3D naked-eye digital billboard must be uniquely tailored, and the content must adjust to factors like screen size, shape, and viewing angle. The effect will be entirely different depending on where the 3D naked-eye content is shown.

Create seamless effects by utilizing the surrounding environment .(Pinterest)

Research Method

The author of this article used to be a news media worker, in order to answer research questions, we got in touch with the production team of "Active Animation" through a friend's introduction. "Active Animation" created the naked-eye 3D advertisement for Shilin Tiger, and it is one of Taiwan's internationally renowned and experienced animation production companies. It has won awards for animated films such as World Film Carnival Singapore, Black Swan International Film Festival, and The Monthly Film Festival. Animation representative works include NETFLIX's Resident Evil: Infinite Darkness, Dragon Quest X Thorn Priestess and God of Construction Online, Getter Robot Arc, Sony Music Zone, BRAVELY DEFAULT BRILLIANT LIGHT, A-Ha's Egg Cake, and more. Naked-eye 3D works include Shilin Night Market Little Tiger, the world's most giant naked-eye 3D tung tree located on Ximen, Taipei, the naked-eye 3D advertisement for Joy Light LED headquarters in Taichung, Ming Yao Department Store rocket launch advertisement, Benz BAM 2022 Festival, Porsche Taipei Xinyi Business District Street Action Naked Eye 3D Advertisement, etc.

As a pioneer in Taiwan's naked-eye 3D-related advertising practice, Active Animation has rich experience in animation production and a complete model database. In addition to works covering large-scale animated films, TV cartoons, game-opening animations, visual effects, original IP and model database sales. It has clients all over the United States, Japan, China, etc., and produces various types of animated short films and series of films in Chinese, English, and Japanese. It is a professional production company with international management and artistic creation capabilities. At the same time, their creative team includes animators, illustrators, art creators, engineers, and professional R&D technicians. They have in-depth and professional insights into Taiwan's animation innovation technology, metaverse creativity, immersive experience, and industry market trends.

After contacting Active Animation and obtaining the consent of the CEO of the company, the author conducted an "in-depth interview" of qualitative research on relevant animators, script designers, art designers, and other personnel involved in the production of Shilin Tiger. In addition to discussing the characteristics of naked-eye 3D, understanding the production process of individual cases, and considering the relationship between immersive experience

and marketing indicators, interview questions focused on how the current industry produces naked-eye 3D advertisements, and the relationship between animation designers and business marketing developers, to the overall organizational culture's acceptance of naked-eye 3D.

The "in-depth interview method" allows researchers to truly touch and establish intimacy with the interviewee, as well as understand their self-feelings, personal experience, choice values, and personal choices, as well as their professional ideology, cultural knowledge, and viewpoints. (Johnson & Rowland, 2012). At the same time, according to the answers of the interviewees, through the method of "thematic analysis", the interview data are summarized, organized and classified for some specific issues with similar concepts, and several themes are identified.

This thesis investigates the role of several roles in the overall phenomenon through case studies. Understanding the interacting meaning of human experience and the social reality in which it exists is feasible through the symbolic interaction process mentioned in the in-depth interview (Miller & Glassner, 1997). Simultaneously, within the flexible framework, this study will concentrate on Taiwan's well-known creators, consumers, and proponents of naked-eye 3D marketing.

Interviewees included animators, producers, script writers, technicians, and 3D model art designers who personally participated in the production of naked-eye 3D Shilin tiger digital advertisements. The interview method is a one-on-one and face-to-face interview, and the interview time is about 30-40 minutes per person. At the same time, in order to discuss advertising strategies and commercial marketing effectiveness, we also interviewed business leaders, marketing strategy managers, and the CEO of the animation studio. Explore the current development status and future prospects of naked-eye 3D through their practical case sharing.

The following is an outline of this thesis visit:
1. What is naked-eye 3D? The technology and principle of naked-eye 3D.
2. Why has this technology gained such traction in recent years? What technological advances have resulted in breakthroughs?
3. Why is naked-eye 3D on the rise: Market demand? Immersive interactive surge? Or new technology development?

4. How do you create naked-eye 3D billboards advertisement? The production process of the Shihlin Tiger.

5. What is the most significant difference or appealing feature of naked-eye 3D over traditional advertising or LED billboards?

6. Who are the best customers for naked-eye 3D business applications? Cases sharing via Harajuku Cat and Shihlin Tiger.

7. What is the effect and conversion of naked-eye 3D on the application's subsequent call-to-action? Important indicators include the relationship between immersive advertising and the consumer experience.

8. What are the technical constraints or disadvantages in terms of development?

9. Other suggestions for future marketing applications in the metaverse's new era.

Interview Object Table

Job Title	Job Description	Code	Sex
Senior Technical Artist	Hardware and LED screen equipment specifications control.	**A**	Male
CG Supervisor	Supervise multiple technologies such as animation, special effects, and synthesis of 3D models.	**B**	Male
Art Team Manager	Develop scripts, draw storyboards.	**C**	Female

Animation Designer	Use 3ds Max, MAYA animation software to design 3D characters and scenes.	**D**	Male
Business Development Manager	Contact Naked-eye 3D business cooperation cases.	**E**	Male
Animation Studio CEO	Head of animation company.	**F**	Male
Animation Producer	Responsible for the planning and execution of naked-eye 3D commercial projects	**G**	Male
Marketing Strategies Planner	Formulate network, advertising, public relations strategy and promotion budget, creative and marketing implementation	**H**	Female

Case Study: Naked-eye 3D Advertising Shilin Tiger

The intention of creating the Shihlin Tiger

Seeing the success of the Shinjuku Cat in Japan and it's becoming a well-known local landmark, It occurs to us that Taiwan can also create a similar cute city image representative IP. In Taiwan in 2021, E-DA Visual Effects Corp. once designed a naked-view 3D Cyclops

animation film. Because 2022 is exactly the Year of the Tiger, we quoted the concept of the traditional Chinese zodiac Tiger when creating Shihlin Tiger. We referred to the Shinjuku cat as a realistic design in terms of designing the Shihlin Tiger elements. So in the beginning, we hope that the little cute tiger the more realistic the better. But after the design sketches came out, considering the acceptance of the market audience, the tiger was too real and might not be pleasing, so we switched to it. And create a cute version of the tiger. (Interviewee G, Animation Producer)

The sketches showed different ideas for designing the Shihlin Tiger, from the realistic version to the cute version. (Active Animation)

Interviewee B, who has taken part in the planning and production of the Shilin tiger, said that he faced several difficult challenges in the actual design of the 3D naked-eye tiger. First of all, in order to achieve the best viewing effect, you must set the best viewing point before performing animation design. In the early stage, the team used self-developed software to put the camera in an accurate position, so that the colleagues who designed the script could grasp the audience's perspective to create a better three-dimensional effect.

In order to create a vivid dynamic of the cute tiger, animators need to build it layer by layer through bones, muscles, and fur and add lighting and shadow to create a three-dimensional effect. The more manipulators you have for an animated character's expression, the finer the expressions. Animators first draw sketches by hand and then use 3D software for production.

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The relevant 3D software mainly uses Autodesk series, including Maya and 3ds Max. The team will also use Blender or Unreal Engine and other software as required. He said: "The dynamic capture technology we are good at will also use Maya and 3ds Max modeling, and will be handled by the animation department after completion. But if the project requires live motion capture, it will be handed over to the exclusive motion compensation department 'Animo' in charge, and continue the lighting, rendering, and compositing behind."
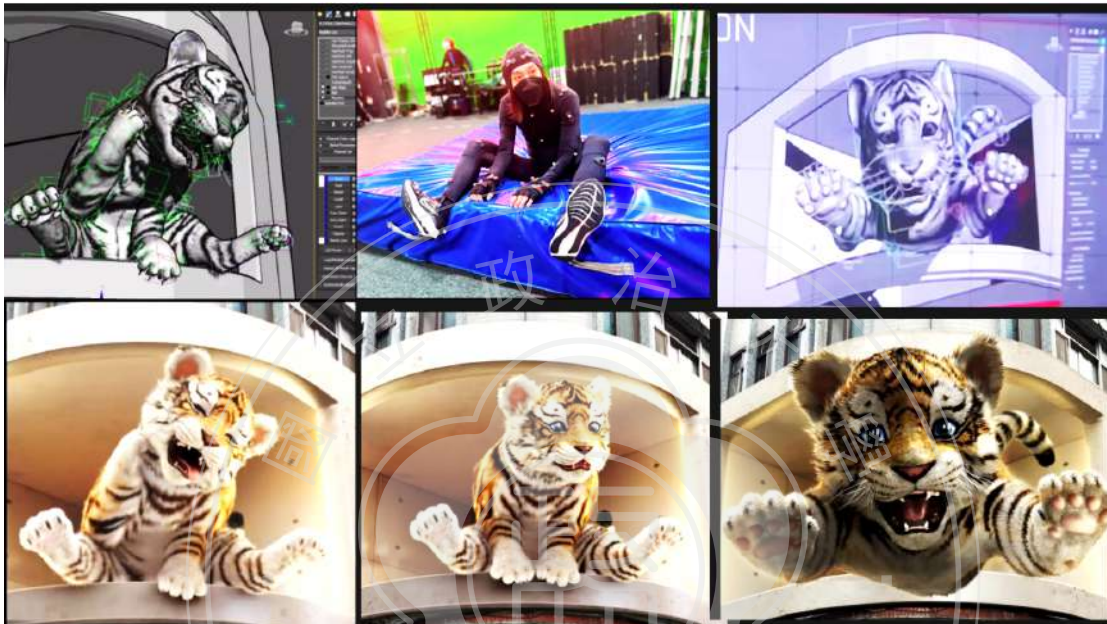
Animators first draw sketches by hand and then use 3D software for production. To build up the live motion captures for the tiger. (Active Animation)

Generally speaking, the design of a curved screen is more difficult, but the effect is good, so the designer has to pay attention to the limitation of the view angle. Like 3D cards, the best viewing angle is 45 degrees. However, it can also be seen when the angle is shifted to 30 degrees, while the positive angle of 90 degrees cannot show the viewing effect.

He said: "During post-production, the team has already constructed the simulated scene materials. With the above-mentioned software, the production staff will not have to worry about technical mathematical calculation problems. For example, presenting the correct three-dimensional effect on different curved screens and so on. Usually, it is mainly calculated manually, but these complex problems will affect the presentation of the final results, so the A Lab department has specially developed software to connect the entire process in series to present works with a high three-dimensional effect."

The team constructed the simulated scene materials with the software to solve technical mathematical calculation problems. (Active Animation)

In addition to the location, it is also necessary to consider the differences in design when viewing day and night. DOOH advertising (Digital Out-of-Home) is usually designed in the daytime so that there will be some contrast at night. Because of the relationship between the light source and reflection, the design in the daytime can generally be used at night, but not necessarily vice versa. However, there are also exceptions. For example, Shilin Tiger is mainly set at night in the beginning because it considers that the displaying place is the Shilin night market.

In addition to the location, DOOH advertising is also necessary to consider the differences in design when viewing day and night. (Active Animation)

Does the effect and quality of LED have a direct impact? He said yes, but the resolution is only detail, the most important thing is creativity. When designing the animation picture, the actual production effect is greater than the presentation effect. For example, the cute tiger setting is a 2K effect, but the actual image needs to be 4K. Generally speaking, the most precise resolution for household use is P1, and the LED wall is about P16, according to the visual effect of the wall size.

The LED wall does not have to be the most delicate but can be reinforced through design and creativity. For example, Shilin Tiger uses a P5 wall surface. If the main character of the animation is cute and eye-catching, the design emphasizes delicacy and nudity. If the protagonist is a commodity, it is necessary to consider how to create a naked visual texture of the space. These designs must compromise between seeking the best performance and visual effects. (Interviewee B, CG Supervisor)
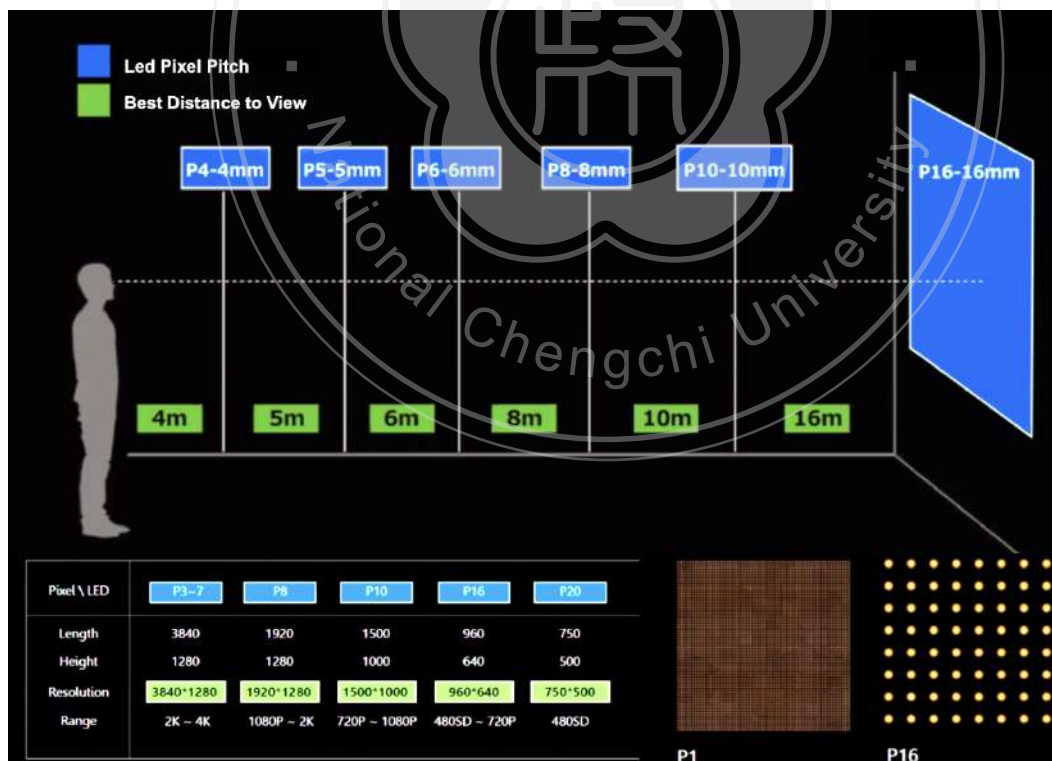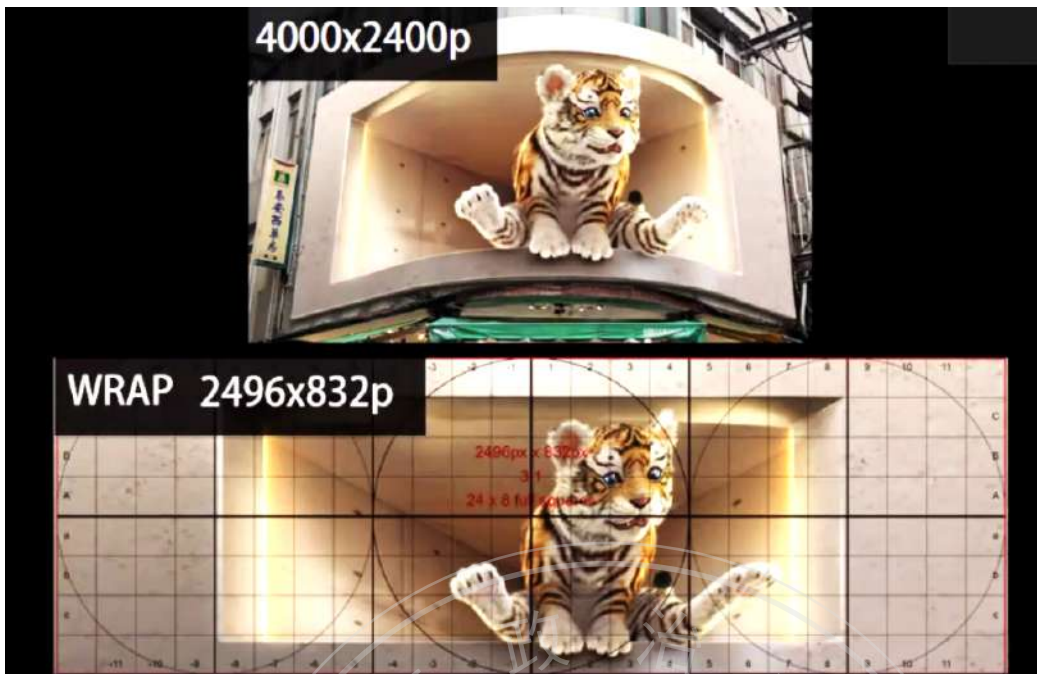
Pixel \ LED	P3~7	P8	P10	P16	P20
Length	3840	1920	1500	960	750
Height	1280	1280	1000	640	500
Resolution	3840*1280	1920*1280	1500*1000	960*640	750*500
Range	2K ~ 4K	1080P ~ 2K	720P ~ 1080P	480SD ~ 720P	480SD

The most precise resolution for household use is P1, and the LED wall is about P16, according to the visual effect of the wall size. The cute tiger setting is a 2K effect, but the actual image needs to be 4K. (Active Animation)

The production cost of naked-view 3D audio-visual content

LED billboards with varying positions, angles, and shapes are required due to the development of naked-view 3D content. Using Shihlin Tiger as an example, the production cost of 30-second to 1-minute 4K resolution audio-visual material is approximately NT$1-1.3 million. The rental of LED electronic signage is not included. Because the 3D animation characters and environment models have already been produced, the true production cost will not increase exponentially as the length of the animation increases.

Why has naked-eye 3D technology flourished in recent years?

The rise of 3D sensory stimulation： With the rise of the digital age, listeners are no longer satisfied with the traditional 2D presentation method. 3D stereoscopic paintings and 3D parallax museums are popular, and everyone starts to think about how to play new tricks in advertisements and animations, and also bring more 3D stereoscopic sensory stimulation to the audience in terms of marketing.

The growth of high-standard LED billboards： In the past, the mainstream demand for large-scale outdoor LED billboards in the market was to be large enough and square, so

billboard walls with distorted corners or curved surfaces were not welcomed by advertisers. However, after the emergence of naked-eye 3D techniques, this kind of billboard located at a lively corner street with an excellent location is more likely to highlight the effect of perspective. It not only makes more efficient use of idle advertising billboards but also highlights the characteristics of naked-eye 3D.

The global upsurge： Cases of popular works in Europe, America, Japan, and South Korea began to bring a global trend. The presentation method is novel and interesting, and many marketing companies in Taiwan have begun to think about how to bring this new idea to Taiwan, and further use their creativity to think about whether they can create their own IP works in Taiwan. (Interviewee B, CG Supervisor)

The booming for online sharing and hashtags: Because of the widespread availability of social media platforms and the growing trend of online sharing and hashtags, businesses must showcase their products or services in an eye-catching and interactive manner. The use of naked-eye tech help businesses create interactive 3D contents for their products or services that can be easily shared and viewed.

Audiences desire more interaction: Today's audiences are no longer satisfied with static images or text-based content. They want more interactive and engaging content that allows them to explore and interact with products or services. Naked-view 3D technology provides this level of interactivity, as users can get a better understanding of its features and functionality via 3D effects. This has made this technology more popular among audiences and has contributed to its widespread adoption.

Development of new technologies: The development of new technologies has also played a significant role in the rise of naked-view 3D technology. The increasing power of computer processors, the availability of high-speed internet, and the development of new format LED billboards have all made it possible to create complex 3D animation that can be rendered in a sense of space. This has enabled the development of naked-view 3D technology, which allows users to view and interact with 3D models without the need for specialized hardware or software. This has made this technology more accessible and affordable, which has contributed to its popularity. (Interviewee D, Animation Designer)
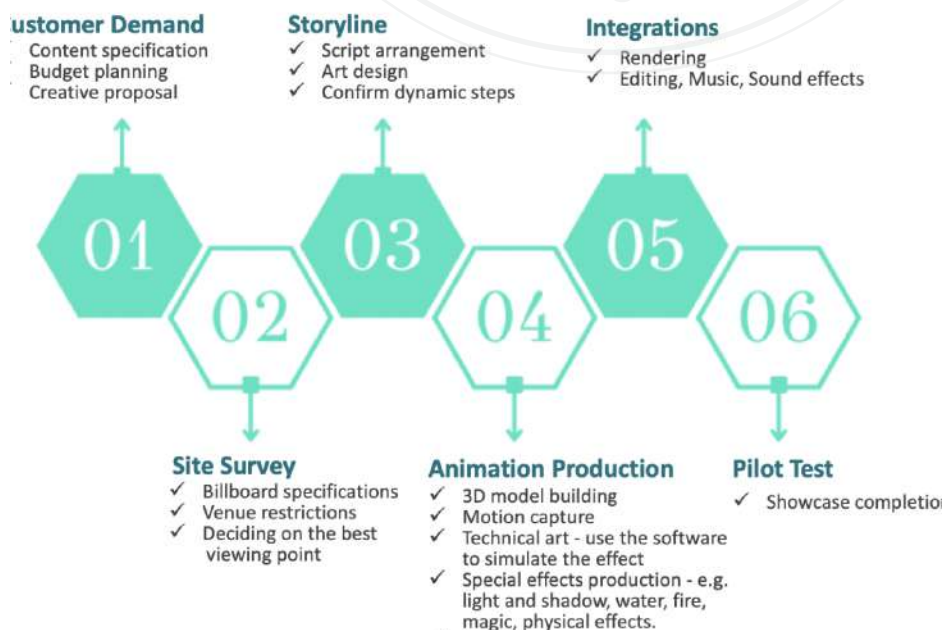
Some argue that immersion requires being there or in it; in other words, only VR worlds can provide immersion. Other technologies, like augmented reality, naked-eye 3D, and holography, are incapable of doing so. However, some argue that being immersive should focus on whether it provides users with a sense of engagement rather than a single framework of technology use. Immersion could be related to any of the technologies. Because our perceptions, memories, and experiences associated with a specific location influence this emotion. (Interviewee H, Marketing Strategies Planner) Is immersion defined by the sensation of being present in a particular location or environment, as well as our emotional attachment to it? Immersion is a property of the medium itself: more immersive media communicate with (and even saturate) the human perceptual system more directly. Then, presence is most likely the result of immersion, which influences engagement. (Bowman, 2023)

Design of the Naked-eye 3D Content

Naked-eye 3D has several customized features unique: LED billboard size, shape, position, plot, and protagonist. In response to the needs of customers with specific IPs in the industry, this kind of plot is usually a storyline type. The design focuses on how to combine IPs with the rendering effect of naked-eye 3D. The other is to play with visual effects, such as ocean waves, falling spheres, and the UFO flying out of the screen. Use the sense of visual perspective to produce a three-dimensional fresh experience.

Naked-eye 3D animation production process

ustomer Demand
- Content specification
- Budget planning
- Creative proposal

Storyline
- ✓ Script arrangement
- ✓ Art design
- ✓ Confirm dynamic steps

Integrations
- ✓ Rendering
- ✓ Editing, Music, Sound effects

01 02 03 04 05 06

Site Survey
- ✓ Billboard specifications
- ✓ Venue restrictions
- ✓ Deciding on the best viewing point

Animation Production
- ✓ 3D model building
- ✓ Motion capture
- ✓ Technical art - use the software to simulate the effect
- ✓ Special effects production - e.g. light and shadow, water, fire, magic, physical effects.

Pilot Test
- ✓ Showcase completio

The production process of creating a naked-eye 3D content billboard. (tabulator: Wei-Li Ting)

Curved screens offer more creative designs to play with. A surface is more like a canvas, which can create various effects, including right-angle effects. But if the screen itself is a square or right-angle screen, there will be a line in the middle that forms interference. It is difficult to ignore the existence of this line in design, which is currently a problem that cannot be avoided in technology. In terms of viewing, the optimal viewing angle is approximately 30 to 45 degrees. A right-angle screen may cause some angles to be difficult to view, while a curved screen may not have this problem. (Interviewee B, CG Supervisor)

Compared with other metaverse experiences, naked-eye 3D is relatively simple to operate using naked-eye and physical space. Normally, if we want to watch AR and VR, we need to wear goggles or download a mobile app, and we also need to understand the operation method. The additional medium will create an extra layer of barriers for users.

Generally, the setting for 3D video is 60 FPS. The physical volume of the LED billboard screen is large enough to create a sense of depth, thus producing a three-dimensional effect. The development of naked-eye 3D technology includes the combination of software and hardware such as photography, projection, and animation. From scouting the site at the beginning to finishing the setup at the end, the production process takes about one month. The customization process is divided into scene survey, pre-setting planning, data import to the back-end for design reference, animation production, post-production conversion to 3D, and finished product presentation.

Predecessor activity: Surveying the hinterland, including setting the best viewing spot and observing the flow of people. For example, the best viewing spot cannot be placed in the middle of a road with heavy traffic, or on a viaduct, which is unsafe for pedestrians. To figure out how the surrounding environment matches the work and what are the restrictions for the content. After the product is completed, it needs to be tested and adjusted on the screen. However, there was time pressure in the case of Shilin Tiger. It needed to be played as soon as the LED screen was set up, and there was no time for testing. In order to overcome this problem, the production team create a special method to verify the final rendering effect. The team first went to the scene to take pictures of the surrounding environment and then used a

computer program to build a 3D solid model based on the pictures. Adding the data provided by the manufacturer to simulate the effect, the finished product with high accuracy is finally presented.Naked-eye 3D uses virtual space to interweave physical space to present effects. If the space script or background is too complicated, the visual focus will be scattered and the focus will be lost. The method of overcoming the design can be, for example, adding soft focus or depth of field to the background to enhance the three-dimensional sense of spatial perspective. (Interviewee A, Senior Technical Artist)

The difference between making naked-eye 3D animation and other animation scripts is that naked-eye 3D animation needs to match its uniqueness to create a storyboard script. For example, the storyline scene of Shilin Tiger is continuously played back and fro (loop) at the same fixed point. It cannot use the dissolving skill which overlaps two shots for the duration at the end of one scene and the beginning of the next like traditional 2D movies. So when we were designing the script, the little cute tiger will return to the original scene after showing various interesting and cute actions and playing, forming a loop-like playback effect. And then bring the viewer an infinite loop of fun. Also, in order to emphasize the visual effect of going out of the frame, it is necessary to think more about what kind of actions and angles can highlight the three-dimensional perspective and bring viewers an unexpected experience of surprise. For example, it is possible to increase the spatial layering of some front, middle and background scenes. Add in some actions to let the protagonist break through the space from the back to the front. But be aware that when converting from a 2D sketch to a 3D stereo, some angle actions may be deformed and the stereo effect may not be obvious.   (Interviewee C, Art Team Manager)

In order to emphasize the visual effect of going out of the frame, it is necessary to think more about what kind of actions and angles can highlight the three-dimensional perspective. (Internet)

Call to action effectiveness conversion indicators

1. Video views： When the Shihlin Tiger video was released on social media, it quickly became popular and attracted a wave of media attention. This story has accumulated over 150 online news articles, including the TV show "Queen", "Super Taste", and the BBC News Science website. The video has over 8.05 million views per day on FB.

The video views of the Shihlin Tiger has over 8.05 million views in a day on FB. (FaceBook)

2. Customer returning rate： After the launch of Shilin Tiger's naked-eye 3D billboard, has there been an increase in external demand for this type of new technology marketing? It is obvious that there has been an increase. If the year 2022 is the promotion period, the number of inquiries this year is ten times more, and the market's results resonate greatly. Naked-eye 3D technology has sparked a craze in recent years in the United States, Europe, Japan, South Korea, and China.

Since 2021, we have observed this upsurge and felt that it should be developed. Why is development slower in Taiwan? There were not many high-quality LED advertising billboards built and produced in Taiwan, most of them were just flat advertising billboards.

After we developed the naked-eye 3D technology know-how, we made a simulation effect test and went to Taiwan's largest outdoor advertising agency, Impression, to discuss cooperation possibilities. After discussion, both parties were very willing to develop, but it

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was found that there were not many suitable LED advertising electronic billboards. For example, at that time, only the electronic signage positions of Ximen MRT Exit 6 and Ming-Yao Department Store in the eastern district were more suitable. So we found a hardware vendor "Joy Light LED" to work together again. We are collaborating to launch naked-eye 3D billboard advertisements on a 24-meter rectangular LED advertising display wall above a "Joy Light LED" store in Taichung, testing market response. In addition to incorporating hardware elements such as screws, pliers, and screwdrivers sold by the store itself, the design also utilizes the blurry edge of night space to create a visual illusion of hollowing out and extending into the sky. This way, even a hardware store can become a popular check-in point. (Interviewee E, Business Development Manager)

The naked-eye 3D billboard on a 24-meter rectangular LED billboard above a "Joy Light LED" store in Taichung. It utilizes the blurry edge of night space to create a visual illusion of hollowing out and extending into the sky. (Joy Light LED)

3. Social volume：Take the recent popularShihlin Tiger as an example, it was very sensational when it was launched. Nearly more than 90% of the advertisers in the near future come from specifying naked-eye 3D advertisements. Because they saw the hot topic caused by the little cute tiger. Videos on the online communities are also very active. According to our estimates, there are more than a thousand related posts in addition to keywords, and the video alone has more than 24 million views in the community. Naked 3D advertising not only attracts on-site crowds but more importantly, it is shared through the community via UGC. Many people may not be able to go to the scene, but they can spread and share content

through netizens uploading videos, checking in, and hashtags, forming eWOM. (Interviewee F, Animation Studio CEO)

Restriction of naked-eye 3D on LED billboards.

If the LED billboards want to present a naked-eye 3D effect, some adjustments and cooperation are required on the hardware. In principle, the higher the specification of the LED billboards, the more detailed the presentation effect will be. However, it is also necessary to consider the best viewing angle, that is, the best viewing position for naked-eye 3D stereo presentation. Because naked-eye 3D needs to use parallax, the effect is not obvious at certain angles. For example, most billboards installed on buildings are located at a higher position, you have to take the distance of the viewer, the viewing angle, the fusion of the appearance of the building, and the sense of perspective into consideration before designing. (Interviewee B, CG Supervisor)


When the viewing angle exceeds 90 degrees, you will find that the cat's body is deformed. (ク ロス新宿ビジョン)

Since the best viewing spot and angle are customized and unique, if it is designed for Shihlin's LED, it cannot be applied to other LED billboards. Unless their height, length and angle are exactly the same. Some customers want to display and play the same naked-eye 3D advertising video on YouTube and in stores. This content cannot be compared to traditional TVC commercials. You can not broadcast a 3D video on average TV and the Internet.

However, you can shoot the 3D effect of the screen on the spot, and then share the video on the Internet. There are also limitations in terms of cost and the best viewing point. The WOW effect brought by special effects is the main element, and the story cannot be integrated into too many complicated plots. Finally, since you don't need to wear glasses or headphones when watching, the surrounding environment such as people and cars can easily interfere with the overall immersion effect. (Interviewee E, Business Development Manager)

How to avoid interference moiré patterns on LED screens?
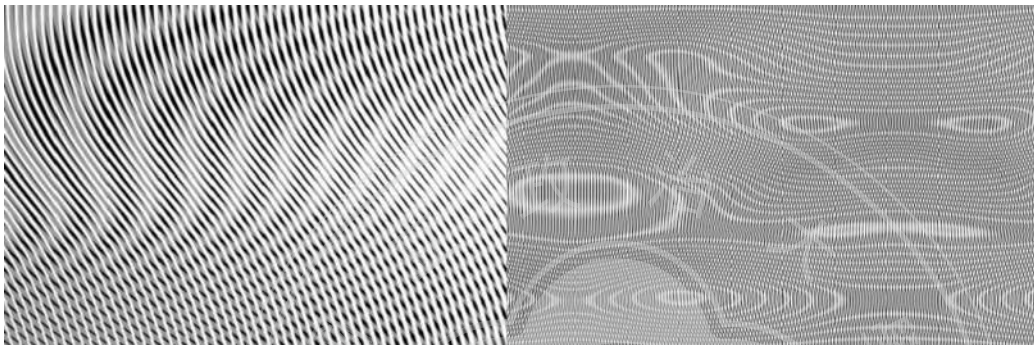
When the spatial frequency of the photography sensor's pixels is close to the spatial frequency of the stripes in the image, a new wave-like interference pattern may be generated, known as a moiré pattern. (Internet)

When the pixel density in image rendering is not suitable, it is easy for a moiré pattern to appear when captured by a machine. This is a high-frequency interference wave pattern that occurs when photographing stripes or high-density textures using digital cameras or scanners. When the spatial frequency of the photography sensor's pixels is close to the spatial frequency of the stripes in the image, a new wave-like interference pattern may be generated, known as a moiré pattern. Moiré patterns do not have a clear shape because they are irregular. When the fine stripe structure in the pattern intersects the structure of the sensor at a small angle, significant interference may occur in the image. This phenomenon is very common in some intricate texture situations, such as fabrics in fashion photography. To eliminate moiré patterns, the lens resolution should be much lower than the spatial frequency of the photography sensor. Of course, this will also reduce the sharpness of the image.

The distribution of LED pixels that are too dense or too sparse is also critical. Sometimes, the most precise screen pixels are not necessarily the best. Precise screens are not only expensive but also can produce visual interference, such as moiré patterns when machine-captured. Therefore, when designing works, the screen resolution should also be considered. For example, the LED wall of Shilin's tiger has this kind of problem. The LED wall in Shilin has

excellent picture quality, but sometimes the better things are, the more obvious the moiré patterns become.

Technically, to avoid the occurrence of moiré patterns, it is essential to keep the picture clean during production and calculation. Do not use too complicated or fancy designs or Gothic or Baroque styles. Instead, use simple designs to highlight the subject. To present clear images on LED screens that are discernible to the human eye, the settings should be adjusted so that the LED picture quality maintains a higher resolution even when photographed by a lens. This will allow the audience to appreciate the work while also being able to take pictures with their phones and share them on social networks. (Interviewee B, CG Supervisor)

Benefits and effects of naked-eye 3D advertising

Technology is becoming more advanced in the digital age, which has caused a shift in the way how businesses market their products and services. The primary benefit of using naked-eye 3D displays for advertising is that it allows brands to engage with their audience on a much more personal level, which encourages exploration and discovery about a brand or product. This type of immersive experience can help brands foster stronger relationships with their customers by creating an emotional connection that traditional 2D adverts simply cannot match. Additionally, since there is no need for extra hardware like VR glasses or goggles, naked-eye 3D displays are much easier and cheaper to set up than other virtual reality technologies.

Effective diffusion of messages

Another obvious benefit of using naked-eye 3D advertising is its ability to grab attention and draw in customers from far and wide. People are naturally drawn to unique visuals that they haven't seen before, so using naked-eye 3D can help the message stand out among the competition. Additionally, it also offers higher-resolution images than traditional two-dimensional displays, allowing viewers to get a better sense of detail and depth when viewing advertisements or product demos. The potential for creating a social media explosion as people share videos of their experiences online. As people post these videos across various social media platforms such as YouTube, TikTok or Instagram(UGC), they can help drive even more traffic and reach a wider audience than before.

Cost reduction

Naked-eye 3D technology offers many advantages including saving space and cost savings due to fewer components required for installation. This makes glasses-free 3D perfect for commercial establishments such as shopping malls or airports that want to showcase powerful visuals. Additionally, these displays can be used both indoors and outdoors due to their high durability level, meaning you can reach out to an even greater audience. Furthermore, naked-eye 3D technology is incredibly versatile as it can be used for a variety of applications including education and training simulations, gaming experiences, medical imaging solutions and more. It's also easy to use. With no AR/VR glasses or headwear required, anyone can get started in no time at all.

New Opportunities for Engagement

Beyond just storytelling, naked-eye 3D displays also open up new opportunities for audience engagement. For example, it could be used as part of interactive experiences where viewers can interact directly with virtual objects or take part in virtual worlds—all without having to put on any kind of headgear or specialized equipment. In the process of interacting with the audience, such as shooting videos or uploading photos to SNS, creating new User-generated content (UGC), and spreading more messages.

Advertising Aggregation Effect

Naked-eye 3D displays create an unprecedented visual impact on audiences, allowing them to connect with brands in a way that wasn't possible before. This kind of immersive experience can be used to great effect in advertising, providing a more powerful and memorable message than traditional 2D advertising could ever hope to achieve. Stereoscopic 3D content encourages both more cortical regions and neural networks than 2D content, according to experimental evidence from an EEG study comparing learning and long-term retrieval (Amin et al., 2021). And It was experimentally shown that the human brain processed the Stereoscopic 3D (S3D) contents differently by utilizing more cortical regions and neuronal networks than the traditional 2D contents, which modulates the participants' behavior by recollecting the LTM faster in the recall task. (Slobounov, et al., 2015)

Brand Image Enhancement

Another benefit of glasses-free 3D LED displays is that they are capable of conveying more complex messages through artistry and connotation than traditional static signs. These types of advertisements can help enhance a company's brand image by evoking positive emotions in viewers. The visual impact of these advertisements will leave a lasting impression on viewers and make them more likely to remember the brand name associated with it. This types of advertisement also allows companies to create unique stories about their products or services that will help consumers better understand what they have to offer.

Creating the City IP

For example, Shinjuku Cat in Japan has become a world-famous tourist attraction for clocking in in addition to its nude 3D effect. Many foreign tourists specialize in pilgrimage to the large LED billboard buildings of Shinjuku Cat, driving surrounding businesses to travel and buy in. In addition, the content of the Shinjuku Cat Kanban is also broadcasted 24 hours a day through the YouTube channel, allowing global netizens to watch it synchronously without time difference, and even actively want to watch which advertisements are playing. In addition, other content played in the same advertising space can also be co-branded or interacted with Shinjuku Cat, such as the ghost film protagonist Sadako and Shinjuku Cat in the same frame. It not only creates more hot topics through creativity but also forms higher peripheral benefits.

The ghost film protagonist Sadako and Shinjuku Cat are in the same frame. It not only creates more hot topics through creativity but also forms higher peripheral benefits. (クロス新宿ビジョン)

Naked-eye 3D skills in the feature

Everything is metaverse, and naked-eye 3D technology can be used in traditional equipment manufacture, merchandise outlets, environmental recycling, and exhibition settings. Depending on how cleverly designed the content is, every business can use naked-eye 3D to sell products and brands. As there are more and more giant LED billboards in Taiwan, everyone's design will become more creative and innovative. For example, there is currently a skyscraper in India with LED billboards covering the entire exterior walls. On the streets of Tokyo, there are also attractive special effects that use many LED billboards to create a naked-eye 3D appearance, such as waterfalls crossing external walls, and even 3D dragons flying over the street. In the future, there will be more breakthroughs in the application of this technology in marketing with technological progress. (Interviewee E, Business Development Manager)

Shibuya's Akita Inu creates special effects by using 8 LED billboards to interact with and form a naked-eye 3D connective appearance. (Hit)

We are enthusiastic about the growth of the naked-eye 3D market, so we began investing in development early on. Taiwan's market is still in its early stages and will continue to mature. LED billboards are not extremely popular in Taiwan right now, but they are steadily being updated. Seeing how more and more billboard owners in the market are eager to do so.

Although there is an initial updating fee, a dozen or twenty consumer adverts can be put up per day, and the benefits outweigh the drawbacks in the long term. Customers are increasingly inquiring about naked-eye 3D, and they will be eager to try it if they see others doing it. In the future, with Taiwan's urban planning layout and marketing strategy, and even with virtual and real integration applications, I believe that the naked-eye 3D market will get better and better. Naked-eye 3D is more participatory for some clients or audiences in activities or commercial marketing, creating a new visual impact. There used to be print posters and billboards on the route. It took several weeks to modify the content, and the amount of information available was limited. However, some countries and towns have now replaced large signboards with high-standard LEDs - there are unique criteria for LEDs to show 3D effects, and there are certain needs for colors and details in order to present three-dimensional effects. LED billboards of high quality are becoming increasingly common in the industry. (Interviewee F, Animation Studio CEO)

The advantages of naked-eye 3D marketing

1. More efficient use of the Kanban area. LED billboards, in addition to quickly changing content, can make better use of kanban space. Advertisers in the same position can maximize profits.

2. The advertisement content is varied. The effects and messages that can be achieved by consumers who want to transmit company information are more diverse. A one-minute film can transmit more information, and the constantly changing presentation effect differs from the usual one.

3. Extend the audience's impression. Naked-eye 3D special effects can have a big impact. Assist the audience in absorbing the material and making a good impression. The greater the impact on the spectator, the more effectively the message will be communicated. For example, everyone believes the little cuddly tiger is quite attractive and unusual, attracting many passers-by or those who come to observe it specifically. Everyone who visits the scene is willing to capture photos and films to share, and it becomes a check-in attraction, and their friends will also see and share. The publicity effect has shifted from a local place to an Internet diffusion. Initially, there was only one point, but the multiplier effect was generated through news media and social media advertising. The brand content marketing contact is expanded when one person, ten people, or one hundred people share continually. Previously, when a TV commercial aired, viewers had to go to this channel at precisely the proper time

and see the program commercial in order to receive the message. Even if they notice it, they may not take photos and post them to the community to share with family and friends. When you open Facebook, YouTube, Instagram, or Twitter, you can see what other people are sharing. The group that can be contacted is larger and more diverse.

4. Enrich the urban image. A city with more and more electronic interactive billboards can make the appearance of buildings more colorful and vibrant, which has a positive effect on the urban image. If there is representative IP (Intellectual Property), it can further promote the urban image. (Interviewee F, Animation Studio CEO)

Conclusion and Discussion

When virtual IP goes real, naked-eye 3D brings huge commercial value. In Tokyo's Shinjuku station's east exit, Louis Vuitton placed a 3D anamorphic billboard show to commemorate the partnership in December 2022. Kusama actually moved and appeared to be engaging with people in the anamorphic billboard with an astonishing amount of fluidity. A polka-dot LV Damier trunk in the animation unlocked to expose two Kusama pumpkins that had been animated to resemble an extraterrestrial vegetable with tendrils resembling an octopus. Kusama appeared between the two pumpkins and peered over the edge while donning the yellow pumpkin that was erected on the Naoshima art island as a helmet. The billboard received over 10 million views on Instagram after becoming viral there.

In December 2022, Louis Vuitton collaborated with Kusama to launch a 3D anamorphic billboard display outside of Shinjuku station's east exit in Tokyo. The billboard went down a storm on Instagram where it got more than 10 million views. (Louis Vuitton)

It took 2 months for the well-known sports brand NIKE's naked-eye 3D advertisement to create a viral video that greatly increased awareness of 2022 AIR MAX DAY. It attracted a lot of attention and received nearly 10 million views around the world. "Since last year, we have seen the influence of glasses-free 3D in different regions. We have been exploring new forms of communication between new technologies and consumers and found that the naked eye 3D LED often brings us unexpected creativity. " Julie Igarashi, Creative Director of NIKE Tokyo said.

Alex Wilson, creative director of global brand experience consultancy Amplify, said: "The naked eye 3D animation video is a huge opportunity for advertising, whether it's for virtual IP or branded products, which will allow them to break down the fourth wall and combine the content in ways that have never been possible before, outdoor advertising, and user experience, making IP more real, can easily cause social media virality." When a product or brand to be promoted is increasingly enlarged and can get the attention of a large number of target audiences at the same time, the naked eye 3D LED screen is a superior promotion strategy no matter how you look at it.

NIKE's naked-eye 3D advertisement greatly increased awareness of 2022 AIR MAX DAY. It received nearly 10 million views around the world. (Nike)

We are more likely to understand the message and meaning conveyed in a 3D billboard than we would be if the same message were presented in facts or numbers. The characteristics of 3D authenticity are "a psychological state in which 3D virtual objects are perceived as actual objects in a sensory way" (Algharabat & Dennis, 2010). According to Lee, Li, and Edwards (2012), 3D aspects have the power to increase consumers' favorable reactions to the goods. They can also be crucial to the success of online shops. The future of retail advertising will continue to be shaped by narrative as virtual reality. giving businesses a chance to introduce the sensory layer of depth awareness and a new level of storytelling. Consumer purchasing decisions appear to be significantly influenced by the novelty of 3D advertising (Yim, Drumwright, & Cicchirillo, 2012) and 3D product displays (Edwards & Gangadharbatla, 2001). In compared to 2D product visualizations, 3D product visualizations increase brand accessibility and attitude confidence (Lee et al., 2012).

With the flourishing development of metaverse technology, 3D display technology has grown rapidly in recent years. This technology, which was once just an imagination for the future, can now be widely used in real life. By projecting digital images onto large LED curved advertising screens, an anamorphic illusion effect can be achieved, creating an extremely realistic three-dimensional image that immerses the viewer. With the assistance of stereo sound, the realism of the image can be enhanced, making the viewer feel as if they are there.

Naked-eye 3D images merge with a sense of unreality and spatial perception, providing a fresh and novel immersive experience that has brought back people's attention to outdoor advertising. However, how should this eye-catching and hot naked-eye 3D technology be developed? Can it bring sustained and breakthrough commercial value to the outdoor media industry?

"One of the most remarkable aspects of immersive virtual environments is that people tend to respond realistically to virtual situations and events even though they know that these are not real. "(de la Peña. et.al, 2010). Research has demonstrated that interactivity plays a crucial role in enhancing users' sense of spatial presence, which refers to their subjective experience of "being there" in a virtual environment (Biocca, 1997; Lombard & Ditton, 1997; Slater, 2009; Wirth et al., 2007). The combination of immersive and interactive elements contributes to the formation of distinctive experiential states, including the sense of being in a specific place (place illusion), perceiving the virtual environment as plausible (plausibility illusion),

and experiencing a sense of embodiment (Pan & Hamilton, 2018; Slater, 2009; Slater & Sanchez-Vives, 2016; Wirth et al., 2007). These experiential states have a profound impact on users' psychological and behavioral responses to mediated content.

Presence can be described as the sense of unmediated perception, wherein individuals feel as though they are truly present in a physical environment (commonly known as spatial presence) and engage in genuine interactions or are conscious of others (social presence) while immersed in a digital encounter (Lombard & Ditton, 1997; Steuer, 1992). Slater and Wilbur (1997) assert that presence is a psychological state that arises from being perceptually immersed in a technological system. It is important to note that presence is not inherently granted by technology; rather, technology offers an opportunity for individuals to experience presence—an inherently perceptual phenomenon. However, certain technologies possess specific characteristics that provide greater potential for inducing a heightened sense of presence (Slater & Wilbur, 1997; Tamborini & Bowman, 2010).

Immersion and presence are distinct concepts and should not be used interchangeably; rather, immersion is expected to facilitate an increase in the sense of presence (Ahn & Bowman, 2019). The fundamental differentiation lies in the fact that immersion is directly linked to the technological features themselves, as immersive technologies engage various human perceptual systems such as touch, taste, smell, sight, and sound. On the other hand, presence is a psychological state that emerges from the state of being immersed (Biocca, 1997).

The development of communication technology and the evolution of consumer culture have opened up new immersive directions for brand communication. Outdoor media has gradually realized intelligent, scene-based, and personalized communication through its technological advantages. With the pace of urban renewal, outdoor LED billboards have developed new uses and demands: they not only have artistic value in the urban public space, but also convey content information and form part of the city's lighting system. It is becoming a new form of media. Through the integration of virtual and reality, LED screens should not only be considered as independent screens, but also as a part of the public space in front of the screen when planning and designing.

Through the analysis of this case, we understand that LED naked-eye 3D provides a lot of creative space for video content, bringing a refreshing feeling to the market through various

imaginative content. It is also highly topical and easily becomes a hot topic on social media. However, the current application mode and communication effect of LED naked-eye 3D are still in the early stage, with a higher emphasis on visual effects than advertising communication.

Although the popularity of naked-eye 3D advertising is not waning, there is still a lot of room for development in naked-eye 3D technology. Naked-eye 3D requires higher screen quality and installation precision. It also has high creative requirements for real-life materials. From a hardware perspective, not all outdoor LED media are suitable for naked-eye 3D effects.

For the outdoor media industry and commercial customers, the equipment and creative costs of applying naked-eye 3D technology are relatively high, which can lead to a relatively low cost-effectiveness ratio. In addition to continuously optimizing equipment quality, media operators also need to spend thousands to tens of thousands of yuan per second on creative production, which not all media suppliers and commercial customers can afford.

In terms of the shape of advertising billboards, the most well-known naked-eye 3D billboards are corner screens. By presenting different faces of three-dimensional objects in two adjacent right-angle two-dimensional plane billboards, using spatial perspective and the adjacent imaging properties of corner screens, optical illusions such as light and shadow, brightness and darkness, and virtual and real are created for the human eye. The right-angle screen makes it easier to present a sense of volume in the content, but it also has limitations on the best viewing angle.

Currently, LED billboards in urban spaces are mostly located in areas such as crossroads, with viewing angles coming from multiple directions. The forced perspective limits the viewing angle of the 3D advertising we see, making it largely the same. Whether naked-eye 3D, which is achieved by utilizing HumContent errors, can solve this problem and achieve a 3D effect with no dead angles is worth observing.

As the technology matures, the visual experience and creative content delivered through naked-eye 3D technology become increasingly important. However, being satisfied with technological achievements alone is not enough to translate it into an interesting human experience on a creative level. A large amount of similar content such as wave tanks and

spaceships flood the internet, leading to homogenization and aesthetic fatigue as copycats follow suit. Some studies also stress the negative consequences of AR features (e.g., distraction and information overload) that can reduce consumer hedonic motivations and intentions to purchase. (Jayawardena et al, 2023)

For media operators and creative companies, technology is not the hardest part. The challenge lies in how to commercialize the application of naked-eye 3D and combine it with the client's products and brands. Designing a vivid character animation, such as a tiger or a dinosaur, is just one example to create a strong visual impact. The key is how to accurately express this cutting-edge visual effect and creative idea. The realization of commercial value is the key to achieving the desired results. The visuals should be stunning while being aligned with the client's marketing needs.

Is this visually striking 3D effect matching the brand tone and promoting the product stage goals? Will it attract and engage the audience, while making them understand and love the brand and product, rather than just being flash in the pan?

Therefore, for the outdoor media industry, it is important to fully evaluate the cost and value. It is necessary to continuously improve and explore the social, artistic, aesthetic, and commercial attributes of creative content, instead of blindly following trends. While digitizing and advancing technology, the social value of the content itself should be emphasized.

Limitations and Suggestions for Future Research

Although naked-eye 3D technology is developing vigorously worldwide, it still belongs to a relatively new field in commercial applications. This study conducted in-depth interviews and analysis of the well-known case of Shihlin Night Market in Taiwan. However, there is still a shortage of hardware technology and software design in Taiwan's animation and virtual technology companies, resulting in a lack of representative data.

In addition, due to the limited number of naked-eye 3D billboards in Taiwan, 3D works are limited to a few well-known animation companies in the market. The quantity and diversity of finished products are relatively insufficient, and the evaluation of 3D content marketing

effectiveness can only be based on online reputation and returning customer performance, lacking detailed data analysis of indicators such as CPA, CVR, ROAS, and CQI.

Therefore, future research can focus on deeper research of conversion indicator data and the feedback of the audiences. By analyzing big data, we can understand the weight of various parameters for finished products. At the same time, we can further examine the correlation between immersive experience, interactivity, and advertising effectiveness to improve the evaluation of 3D content marketing performance. In addition, future research can broadly explore the application of animation and virtual technology companies worldwide to improve the representativeness of research.

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