An Interdisciplinary Practice-based Research on Constructing "Techno-Art Cloud Exhibition Platform"

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Abstract

In order to provide the possibility of unlimited expansion of the museum in the future, the focus of this practice-based research project is on the underlying platforms available for actual execution, guest-made subsystem modules, including entrance construction, cloud exhibition hall, multi-person connectivity and other pre-period studies and experiments, and through its infrastructure, guided to the three layers of the work and the archive stack, across the boundaries of the real and virtual exhibitions, create new virtual integration and reality expansion relationships.

Keywords

Techno Art, cloud exhibition, practical research, interface design, archivability

Introduction

Ushered in the digital era, museology is undergoing a revolutionary change. We need to be aware of the far-reaching influence of the digital on every corner of the modern society and the concomitant cultural turn. By the same token, the museological turn also involves various aspects such as place (space), community, culture, and technology. [1] In his article "Manifesto for a New Museum," Peter Weibel pointed out that cooperation with science and technology is a necessary commodity for the survival of art museums in the future, which was exemplified by the rise of techno art. Besides, media artists and scientists often enlist the same tools. [2] As digital technology improves rapidly, the digital culture has become an essential element in the social, cultural, artistic, and economic dimensions. Nonetheless, we should clearly distinguish between the following kernel concepts: "digital" and "digitalized." Even though "digital" can be further divided into "digitalization" and "born-digital" in terms of form and type, it is quite different from "digitalized" that digitally transforms traditional, surviving artworks so as to meet the need for collection or exhibition.

Taiwan's artistic presentations, exhibitions, and museum accessibilities transitioned from physical to online, moving towards a seamless integration of the virtual and the real during the era of the pandemic from 2019 to 2021. Leveraging Taiwan's robust technological capabilities injected a formidable force into the cultural and artistic endeavors. Similar to the emphasis in the 2018 report "Culture is Digital" by the UK's Department for Digital, Culture, Media and Sport (DCMS), digital experiences are transforming the ways audiences' engagement with culture. Digital technology provides opportunities for audience participation, enabling cultural organizations to attract more viewers and reach new user communities. By implementing digital technology, there is a deeper and more meaningful interactive relationship, fostering a new form of cultural engagement and practice where users actively plan and produce content. In the challenging year of 2021, as the pandemic raged on, the humanities faced significant challenges, sparking contemplation and action towards changes. Moving forward from the pandemic-ridden 2021, human's everyday life gradually returned to normal in 2022, with a positive attitude of "coexisting with the virus," actively embracing the impact of the novel coronavirus on the life. Similarly, in the field of technological art, creativities and exhibitions demonstrate a shift from "the virtual" towards the "coexistence of the virtual and the real" in artistic practices.

To the extend, the purpose of this research attempts to break the immediacy characteristics of art appreciation in physical spaces through the primary dimension of the virtual metaverse. It aims to transform artworks into archival forms in the virtual space, allowing the characteristic of "liveness" in exhibition and performance can be viewed at any time and place through the characteristic of virtuality (time-shift viewing). The goal is to invite viewers to engage in the "event" fully and consciously by participating with diverse senses. Specifically, the main objectives of this project are to explore how contemporary art museums can reconstruct themselves in the virtual space through the 3D transformation and environmental computation technologies, and to achieve a multi-sensory and immersive experience with augmented reality exhibitions through the integration of virtual and real interfaces (UI) that satisfy user experience (UX), along with the interactive experience of multiple participants in real-time synchronization.

Trending towards Contemporary Virtual Exhibition

The meteoric rise of contemporary digital media and new technologies have dramatically impacted museums' traditional functions such as exhibition, collection, restoration, and education. Today, via the World Wide Web, museums transcend the spatio-temporal confines, allowing virtual visitors to access their online databases and interact with artworks in an unprecedented way. The consequence has become apparent in the building of visual arts websites by prestigious art institutions around the world, which increases the visibility and accessibility of their collections to wider audiences. Although most scholars of museology are optimistic about digital media, the significance of techno art is always a source of contention in curatorial practice. The contentious issues include the impact of digital media on the orthodox concept of museum, the effectiveness of multi-media in enhancing visitors' experience in museums, the ownership of artworks, professional ethics, and the influence of digital media on the traditional source of knowledge for museums.

Theoretically, Museums often use new technologies for virtual exhibitions, with Virtual Reality (VR) and Augmented Reality (AR) interfaces being the most prevalent. Virtual display comprises two major elements, viz. virtual gallery and cultural objects, and has several online interactive functions: (1) pluralistic context design that allows users to seamlessly blend exhibitions with learning contents; (2) easily operable design; (3) the context of active learning; (4) the balance between learning and leisure; and (5) a user-friendly webpage without complex characters and other disturbance. As digital technology and social media flourish every day, the Internet has been construed as a "virtual third place," which not only meets the criteria of individualization, accessibility and comfortability, but also satisfies the public needs for social interaction. In 2012, the California Association of Museums issued its foresight research report "Museums as Third Place," in which "virtuality" was included as one of the key characteristics of a third place. [3] In fact, an online/virtual museum has transcended the limitations of traditional visitor participation. It is not so much a cyber-colony of physical museums as a digital existence with complementary functions, because all the interactive mechanisms, games, videos, 3D simulations, forums, and community management that online/virtual museums provide can supplement or enhance visitors' viewing experiences.

If we turned our attention back to the true essence of the "virtual world" or "metaverse," it emphasizes the construction of a "parallel and enduring" virtual world on the fundamental physical existence pf real-world through technological capabilities. These two parallel spaces interact with each other, allowing people in the physical world to digitally project themselves into the virtual space. In other words, as a logical evolution in the development of Web 3.0 internet, the metaverse is not just a trend but an establishment of a virtual world parallel to the real world, complete with a fully operational socio-economic system. To actively address the impact of cloud spatialization, the influence of virtual-real integration, and reconsider the relational models between physical and cloud spaces, this practiced-based research attempts to experimentally produce a mechanism of virtual-real integration through interdisciplinary collaboration. The goal is to propose new design patterns and experiences for museum exhibitions. In this regard, the project focuses on three main components: (1) experimental planning of platforms and systems, (2) planning of physical exhibition spaces, and (3) design of cloud-based exhibition spaces.

Design Concept for Cloud Exhibition Space

Briefly speaking, the interfaces between media technologies and museums have to perform the functions of promoting/positioning/strengthening "digital interpretation," whether in terms of strategy, practice, technique or theory. It is also a means to match/integrate/graft "content" and "technique." "Digital interpretation" is a "superimposed third party specialization" that emerged to meet the need for introducing digital technology-based innovation into conventional museums' contents and functions. It is also the quasi-projection technique of edge blending & warping that enables the perfect fusion and augmentation of "content + technology," or the third pillar that supports the structural stability and development of "museum technology," which renders itself nothing if not crucial.

The design concept for this cloud exhibition space is derived from the Greek word "AGORA," which signifies a marketplace, square, or assembly place—a space for intellectual exchange and collective participation. Grounded in the digital era's networked thinking and advancements in viewing and sensory technologies, this cloud exhibition space aims to supplement the limitations of analog material collection methods with a culturally stratified historical framework. It seeks to create new digital narrative experiences, intending to establish a space for historical dialogue. The goal is to unlock the potential of physical works that are yet to be activated in reality, and stimulate them through virtual translation, and juxtapose works from different times and spaces within various environments, thereby fostering a virtual and open reflective relationship. The experimental exhibition content features four works selected from the Digital Art Festival Taipei from 2009 to 2016: (1) *Static Position* (2009) by WANG Lien-Cheng, (2) *Law of Light* (2014) by HU Chin-Hsiang, Hsiao Su-Ying, Chao Yen-Hsiang, WU Ting-Chen, and CHEN Cha-Yi, (3) *Sound Creature Maker* (2016) by WANG Sheng-Chieh, and (4) *Notations* (2016) by CHOU Jia-Ying, ZHU Jie-Jun, WANG Sheng-Chieh, and Johnson LIEW. This virtual exhibition would like to

engages the audience in a digital reinterpretation and art dialogue.

This spatial modeling utilizes Blender to construct 3D models, and based on the audience's movement patterns and program performance on the VRChat cloud platform, determines the size, texture, and polygon count of the spatial model. Additionally, it adjusts the lighting according to the overall artistic style to create the atmosphere within the scene. As mentioned above, this cloud exhibition space is a response to the concept of "AGORA" as a public activity space in ancient Greece. Its architectural appearance is centered around the concept of a city-state tower-style spiral staircase (Figure 1), symbolizing the continuous derivation of history. The design features a floating structure, presenting the exhibition hall as independent within the flow of history (Figure 2). Simultaneously, it extends outward to broaden perspectives and enters one secluded room after another, exploring the spatialized artworks.

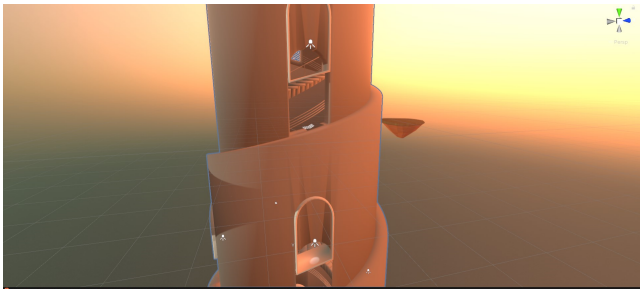

Figure 1. Exterior of cloud exhibition platform

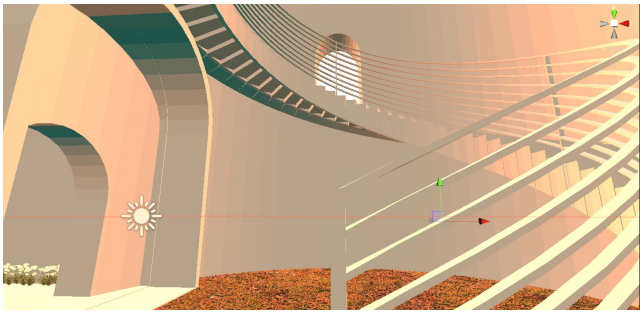

Figure 2. Interior, material and lighting design of cloud exhibition platform

Interactive Setting for Cloud Exhibition Space

This interactive mode (Figure 3) considers the perspective of exhibition visitors, providing intuitive ways of movement, main menus (Figure 4), quick teleportation portals, etc., allowing visitors to freely roam within the exhibition hall while also experiencing artworks in different rooms through point-to-point navigation. There are three main settings for interaction:

1. The keys "W," "S," "A," and "D" on the keyboard can be used to move forward, backward, left, and right, and holding down the shift key enables running can be used to move forward, backward, left, and right, and holding down the shift key enables running.
2. The space bar is used for jumping.
3. Basic interactions, such as encountering objects that can be picked up. Use the left mouse button to pick up, hold down the right mouse button, and release to throw.

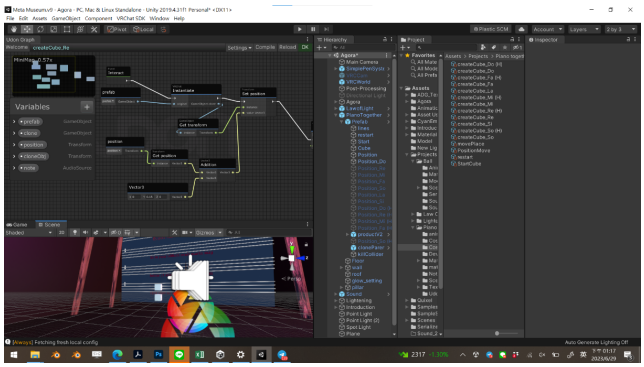

Figure 3: Flow chat for interactive interface design in the backend of exhibition space

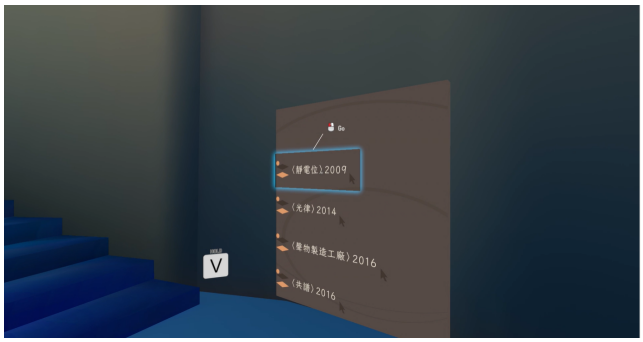

Figure 4: Meum function inside of exhibition hall

Result of Modelling for Cloud Exhibition Hall

This cloud-based exhibition piece, through communication with the original artist, extends the characteristics of unreproducible works. It transforms these features into the virtual world through 3D modeling, and, in conjunction with related videos of the artwork, allows viewers to experience the piece from juxtaposed perspectives.

A. *Static Position*

The conception of this artwork originates from the flash of light and sound of an electric swatter killing mosquitoes. WANG Lien-Cheng remembered that when he was little, he used to go to grandparents' home where many mosquitoes biting his legs. The experience was painful; nevertheless, the artist was inspired whenever he heard the electric mosquito trap electrocuting mosquitoes. So, he scaled up this delightful feeling into a much bigger electrical current. But he found that people are still showing fear of electrical current while enjoying it. He is interested in exploring people's mental perception and physical action in such situation (Figure 5).

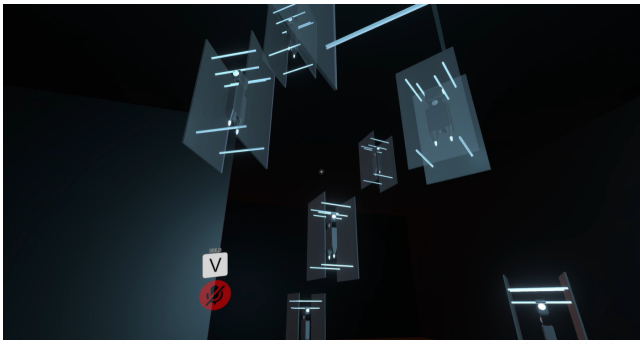

Figure 5. Virtual version of *Static Position* in Cloud Exhibition Hall

B. *Sound Creature Maker*

"Sound Creature Maker" performance 3D printer operates like a living organism; everyone's voice can be stored as a file and converted into a physical specimen. It opens the discussion of whether, in this digital era, our voices can be considered "acoustic presences" with their own identity. Viewers may tell a story through a microphone facing the organism's image displayed on the screen. When operating the program, the frequency and amplitude of the sound made by the viewer will be converted into a unique digital form (Figure 6).

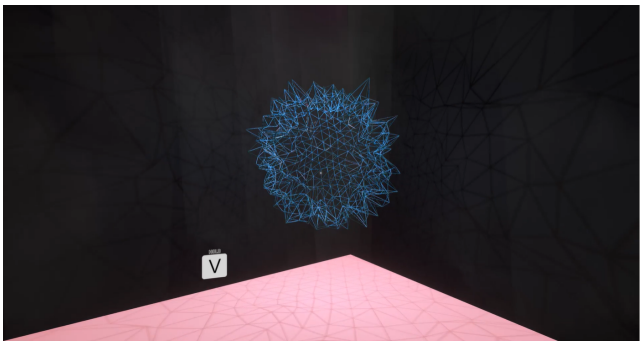

Figure 6. Virtual version of *Sound Creature Maker* in Cloud Exhibition Hall

C. *Law of Light*

"Law of Light" is a light field installation that states in totally control. In order to make the viewers feel the flow of light, it also contains a heated tungsten filament to exude energy. The sound coming from the installation is generated by the insulating transformer. To establish a magnetic field to produce electricity, it has to lighten up the lights through the current. The amount of the current generates natural sounds, interacting with the audiences through the vibration of the coil. Behind of the light installation are the programmed electronic signals, generating light with people, light with network, light with space and light with time. Giving lights awareness, rhythm and breathing. The light not only represents the visual reception but can also be influenced by the participatory audience. It can bring the audience warmth, stability and a sense of belonging (Figure 6).

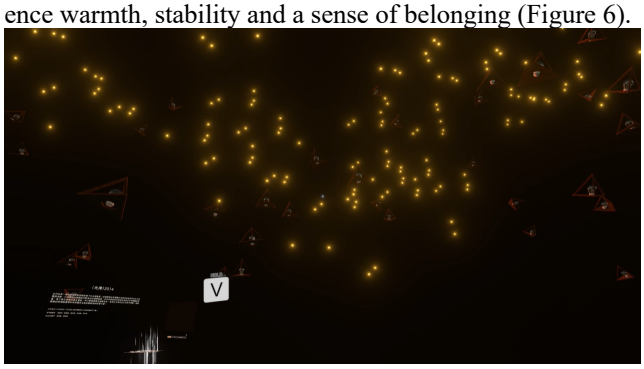

Figure 6. Virtual version of *Law of Light* in Cloud Exhibition Hall

D. *Notations*

For the work "Notations," viewers can pluck the interactive kinetic instrument to instantly compose music and produce clefs on the projection screen. The clefs on the screen appropriate from the ancient clefs used in Gregorian Chants of the 15th century. Composed of these ancient clefs and tabs, each note is presented through squares, belonging to unaccompanied monophonic music clefs. The interactive mechanical instrument creates clefs using Arduino, Adafruit, Processing, Max/MSP, Bluetooth, LED, 3D printing, acrylic, and metal tubes, enabling viewers to instantly play the instrument on-site and create various clefs. The music generated is instantly converted into the correct clefs, which are projected onto the screen. When there are no viewers present, it will automatically play and present the sounds and clefs previously created by viewers, expressing the digital aesthetics of interactive technology art and collaborative creation, and imbuing digital kinetic instruments with more cultural and musical qualities (Figure 7).

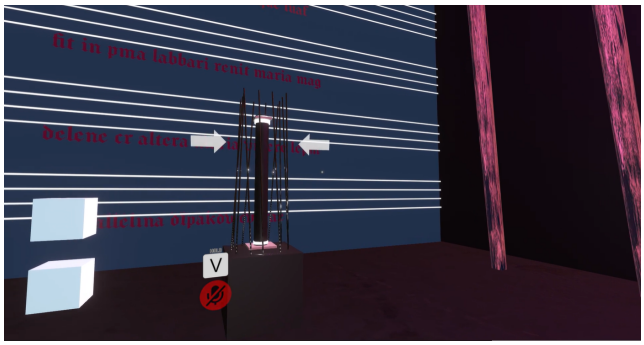

Figure 7. Virtual version of *Notations* in Cloud Exhibition Hall

Transcending the Confines of Materiality

The art world has long been accustomed to "objects." As such kind of static artworks is treated as spaces for exhibition and preservation, digital art has not only assumed

significance in contemporary art practice, but also kept challenging traditional art in terms of the curatorial model concerning display and documentation as well as the approaches to collection and preservation. Digital art re-orientates itself from object to process, and takes on diverse art forms that are time-based, dynamic, interactive, collaborative, and customized. Digital art refuses to be concretized, and further defies the conventional rules of artistic objects. Due to such process-oriented, participatory art form, digital art exerts tremendous impact on curators, artists, viewers and artistic institutions. It prompts curators to work with artists in developing and presenting artworks. Running counter to conventional museums as temples of rare artistic gems, digital art has redefined the roles of curators and artists as a new model of collaboration and exhibition that engages the viewers/public in creative practice.

The archiving of digital art is contingent on exhibition venues and related limitations. Many works can adapt to the properties of exhibition venues, insofar as to bring about desired effects. Owing to its high degree of iterancy, digital art resembles a circulatory system that produces different effects through looped replay or the viewers' random act. As a result, the methods for collecting and preserving traditional works are not applicable to digital art. Hardware is simply its carrier. The completeness of a digital artwork depends on the concerted contributions from hardware, software, exhibition atmosphere, and even viewer participation. It leads to the ambiguity for archiving digital artworks, since they may be carried by a USB flash drive, a projector, or meticulously programmed software, which makes their preservation more complicated than temperature and humidity control. [5]

Digital technology as a medium is regarded as a kind of "visual interpretive programs" [4] from the aspects of technology, aesthetics and related concepts, in which "content interpretation" is aimed at yielding the results of essential exhibition technology instruction; viz. "Interpretive Planning." The adoption of the term "interpretive planning" here is not so much to blaze a trail as to accentuate the fact that, in face of the necessity to incorporate transdisciplinary technology and form into exhibition contents, "interpretation" is more suitable for "transforming transdisciplinary contents" and "introducing technology into exhibition." All research data that support exhibitions are important contents. Nonetheless, the techniques of "Data Decipher," "Content Interpretation," and "Transmedia Storytelling" are necessary commodities if we are going to digitally display these contents. The issues arising from the accelerated development of exhibition technologies have highlighted the significance of "interpretive planning" which entails content design, digital literacy, the competence of leading or coordinating digital forms, as well as the specialization of content research and design.

Additionally, VR as a creative medium has become a key element to the development of digital art museums. Using VR, art museums can not only accelerate the formation of a new symbiotic relationship between art and technology, but also attract greater audience attention to their exhibitions. [6] Nowadays, VR facilities are commonly seen in science museums, e.g., the Science Museum in London and the Morrison Planetarium in San Francisco. Contrarily, they are not popular in traditional museums except those of contemporary art, in which they are usually applied to new forms of artworks as the bridge between the works and the viewers.

All in all, the key to digital art archiving is to establish standard operating procedures in terms of "acquisition" and "lending." The former sets great store by detailed data collection that keeps the ball rolling. It can be divided into three major phases: "before acquisition," "confirmation of acquisition," and "after acquisition." The phase of "before acquisition" underscores "pre-acquisition evaluation," including further information of the work, pertinent details, and budget. Different from the checklist for ordinary artworks, the acquisition of techno art works stresses the importance of installation specifications, captions, display formats, and spatial requirements. Most collection institutions tend to overlook the cost and labor necessary for maintaining technoloogical artworks. Enabling the buyers to think in a comprehensive manner, the "evaluation form of acquisition costs" indicates three primary sources of expenditure: (1) acquisition cost: the price of the work and the charges for consultancy, equipment, and transportation; (2) exhibition cost: the fees charged by the artist or technician, the charges for installation and de-installation, electric lighting, display equipment, and recording; and (3) maintenance cost: the charges for consumables, software maintenance, storage, and technical consultancy.

Conclusion

Many museums have introduced portable electronic guides since the 1950s. Visiting museums has also become a source of social experience. Therefore, grasping the exhibition contents that visitors would like to share has constituted a real challenge to museums. In her "post-museum" discourse, Eilean Hooper-Greenhill argued that museums, as cultural institutions emerging with modernization, can no longer act like before, namely treating themselves as the only place capable of imparting knowledge and truth. She proposed the approach of "visual culture," providing the contents of education and learning by focusing on the way of "display." As one of the core functions of museums, display per se is a presentation of visual arts at the material dimension. This approach aims to trigger richer and more diverse imagination and discussion about museum display. In addition, "archiving," a core function of museums as well, is a manifestation of our material civilization. However, the archived exhibits do not speak for themselves. Their meanings are produced within their respective contexts through the interpretive strategy of curating. What the visitors see, identify, grasp, or interpret is structured by their own knowledge backgrounds. [7]

Based on the practice-based research project conducted, this article offers synthetic suggestions concerning the application of digital media technology in the following four dimensions: (1) the display and re-creation of digital archive; (2) the introduction of digital technology into research and development; (3) the practice of display technology; and (4) the digital preservation and application of techno-art.
With regard to the innovative thinking of the digital archiving trend, museums have to recognize the merits of digital information technology, and preserve the massive body of existing knowledge for a long period by dint of digitalization. The popularization of the Internet further facilitates the real-time transmission of massive knowledge to every corner of the world (i.e., knowledge sharing). On the other hand, the digitally archived contents may produce added value in diverse forms. Take this "Techno-Art Cloud Exhibition Platform" as an example. It successfully blends digital archiving into environmental creation and role design. Harnessing the power of social media, it customizes personal products through digital fabrication, which is closer to new aesthetics and full of digital value. Accordingly, to materialize digital archiving, we should think outside the box and find its added value, and the government should devise more forward-looking and innovative strategies. Practical application and product value are possible only after the market demand is fully grasped.

To sum up, when applying innovative technologies, be it AR, VR, MR, IoT, 5G, cloud computing, or AI, museums and galleries must use digital technology to design "emotive projects" that feature not so much objects as stories and underpin the interaction among virtual characters, real visitors, and objects. Furthermore, apart from connecting online experiences with on-site ones, museums and galleries should render their activities before, during, and after exhibitions coherent, and make a unique blend of tangible and intangible experiences, insofar as to create a captivating hybridization of 2D planes and 3D spaces, in which the narrative frameworks for social and emotional engagement can be developed.

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Authors Biographies

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