

A Comparative Study on the Development of the Use of Advanced Technology in Modern Chinese Theatres

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Abstract: Recent advancements in multimedia technologies, such as LED integrations, advanced acoustics, and virtual reality applications, are revolutionizing stage design, underscoring an era of sophisticated technological implementation. This study, delving into prominent productions like the Han Show in Wuhan and The House of Dancing Water in Macau, critically examines the infusion of multimedia elements and their transformative effect on the overall aesthetic and sensory immersion of water-based performances. The findings reveal a dual impact: an operational advantage characterized by cost-effective design solutions and a pronounced enhancement in creating a dynamic stage tableau. These performances blur the boundaries between reality and fantasy by synthesizing audio, visual, and kinetic components, offering the audience an unparalleled experiential journey. Such advancements in theater stagecraft mirror the broader, burgeoning trend of multidimensional cultural tourism and the evolution of performing arts paradigms.

Keywords: Multimedia Technologies, Stage Design, Sensory Immersion

1. Introduction

Scenography has recently assumed a pivotal role in diverse dramatic performances, encompassing various artistic elements with a multidisciplinary approach. The contemporary performance art form represents a vast and varied artistic and cultural ecosystem spanning cities, both urban and rural areas.^[1] This ecosystem embraces various art forms, entities, media, and a blend of virtual and real worlds. Moreover, the interplay between humans and computers informs all these elements, influenced by the evolution of digital media, artificial intelligence, cultural equipment, and the cultural tourism industry. This confluence of factors gives rise to a new genre of performance art characterized by multiple interactive components. As the renowned Czech scenic designer Josef Svoboda stated, "Knowledge of the technical makes creativity possible."^[2]

Leveraging significant technical benefits, multimedia technologies such as LED, sound and light, and virtual reality have gained prominence in recent scenography. Traditional stage designs involving physical objects and manual operations have been time-consuming, resource-intensive, and error-prone.^[3] However, multimedia technology has addressed these limitations, enhancing stage effects, reducing design costs, and creating immersive audio-visual stage environments via integrated sound, image, and video components.

The impact of multimedia technology is multifaceted: Firstly, it enables a fluid transition between reality and stage-presented fantasy, generating captivating dreamscapes and leaving indelible visual impressions^[3]. It has even supplanted physical stage elements with virtual ones, conveying lifelike visuals, augmenting perception, crafting real and illusionary scenes, and stimulating profound audience emotion. Secondly, integrated effectively with stage art, multimedia technology intensifies the stage's audiovisual resonance. It amplifies audio-visual effects, enhances design quality, and broadens creative scope by harmonizing sound, technology, light, and shadow. Finally, in stage design, multimedia films, and large-screen LCDs significantly boost the stage backdrop's grandeur, shifting audience perceptions and elevating the overall aesthetic appeal.

The integration of multimedia technology enables vivid presentations of sound, images, and videos on stage. Employed during the design process, this technology enhances the stage atmosphere, injects dynamism, and facilitates the transcendence of traditional scene constraints.^[1] Effective display of the background and artistic expression communicates the work's ideas and content, reinforcing its interaction

with the audience. The burgeoning use of digital media technology in theatre parallels the growing trend of multi-dimensional cultural tourism and performing arts.

2. Han Show

Wuhan Han Show is Chinese mainland's first large-scale indoor aquatic show operating since December 20, 2014. Wanda Group invited Mark Fisher to design the theatre building and Franco Dragone to direct the show; together, these two have developed a world-class stage water performance. "Han Xiu" is how "Han Show" is pronounced in Chinese. In Chinese characters, "Han" both means the essence of the Chinese Han ethnic group and also represents the culture of Wuhan City. Meanwhile, "Xiu" is transliterated from the English word "Show," which refers to the dramatic variety of live performances.

Water-based shows, such as those depicting major naval wars, gained popularity during the Middle Ages. Aqua drama was born during this period and became a prominent type of theatre in France, England, and the United States during the 19th century. Some locations engaged so extensively in this once-popular genre that they went so far as to install permanent water tanks on stage. Aqua dramas are unique in that they can provide the audience with a wide variety of intense sensory stimulation and an engaging aesthetic experience. Han Show is considered one of the best shows currently being performed worldwide.

Franco Dragone, Han Show's principal director, is one of the world's top show directors: he was once one of the core members of Cirque du Soleil, and his works are globally recognized. He has participated in and directed many of the world's top stage shows, including *O Show*, *Le Rêve*, *A New Day*, and many others. It should also be noted that he has directed another water-based show in China, Macau's *The House of Dancing Water*, which is also one of the best-known indoor aqua dramas in the world. By merging Chinese and Western traditions, Han Show has pushed the boundaries of the medium and created the most recent technological interpretation of the show. It simultaneously preserves the spirit of Wuhan's native culture while employing Western show culture as a performance format. This genre includes music, dancing, acrobatics, high-altitude diving, stunts, and other performance. The whole stage can be augmented by a customized stage construction and moveable seats, which creates a highly spectacular technical presentation. More specifically, through the usage of acousto-optics to create startling performance effects, the performance incorporates interpretations of water, earth, and air, as well as music, light, electricity, and other high-tech elements.

Han Show's rich scenography creates a dreamy, stunning performance and intensively stimulates the audience's senses. Understandably, to accommodate the variability of the scene, the equipment required for these kinds of functional stages are pretty high. The show resembles a sophisticated technology factory, housing 12 underwater stage-raising machines, stage effect equipment, and highly complicated lighting and sound apparatus. As a result, the show scenario uses stage technology as a guide to create the first-class Han Show and achieve a high level of artistic and technological coherence.^[4]

The Han Show Theatre is located next to East Lake, with a total construction area of 89,872 square meters. The building is constructed in a circular shape with a diameter of 110 meters, and its auditorium can seat 2,000 spectators.^[5] The building's architect, Mark Fisher, is a world-renowned British stage designer with decades of experience in scenic design. Whether he creates large-scale concerts, Las Vegas shows, or other world-famous performances, his innovative designs, and application of developing technologies have revitalized the concept of what a show can be and propelled the field of stage design forward. Also, he was the sole western stage designer for the 2008 Beijing Olympics' opening and closing ceremonies while also assuming the role of head of scenic design for the 2012 London Olympics four years later. Sadly, Fischer passed away in June 2013 at 66, and Han Show has become a posthumous work.

Traditional theatres are generally leased out, with various troupes alternating performances, while a show is a theatre devoted to a particular play. The Han Show Theatre is explicitly built for its aqua drama theme. The Han Show Theatre's performance hall is a circular space centered inward, breaking the traditional spatial pattern separating the auditorium from the upper and lower stages, thereby increasing the intimacy between the audience and the actor. The hall is designed to be movable and liftable to allow for better viewing and performance experiences for audiences and maximize stage space utilization. In this way, the theatre is full of change and diversity. This type of auditorium design can provide an immersive experience for the audience throughout the performance.^[4] It is worth pointing out that its function and space are coupled with the appearance of the Han Show Theatre's red lantern shape. The Chinese have utilized Lanterns for thousands of years as symbols of vitality, social position, and good

luck. The Han Show's facade design was inspired by these cultural meanings and aimed to present a Chinese cultural identity recognizable by the world.

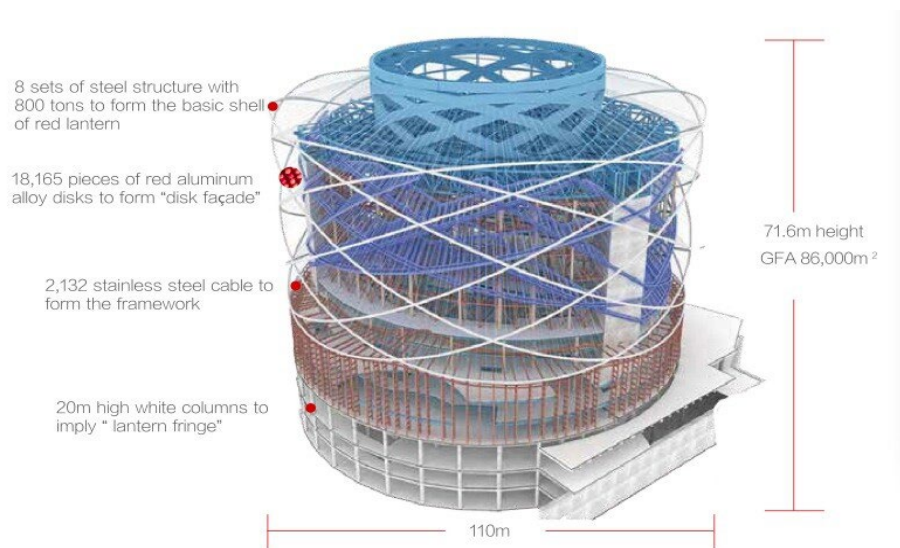


Figure 1: The Han Show - Theatrecrafts.com

In conclusion, from its architecture to show attractions, the Han Show's design focuses on merging traditional cultural features with modern technology and melding architectural purpose, space, and shape.

2.1. A Blending of Dynamic Auditorium and Multifaceted Stage

The Han Show Theatre is a marvel of modern design and engineering, epitomizing the union of state-of-the-art technology with innovative performance artistry. At its core, the theatre boasts the world's first movable auditorium, featuring 2,000 rotatable and liftable seats, which can encircle a massive 10,000 cubic meter volume water-pool stage. Specific parameters can refer to Figure 1. This configuration allows audiences to experience performances from an expansive 270-degree perspective. The auditorium's transformative seating remains unparalleled globally, marked by its complex functionality, impressive load capacity, and extensive range of motion. Designed in a fan shape, the seating is divided into two sections: the front contains 830 movable seats, and the rear comprises 1,170 liftable seats. As performances transition from dry to water scenes, the front seats split and move, creating a maximum distance of 30 meters between them, while the rear seats adjust vertically by up to 7 meters. [6] This dynamic transformation reveals the water stage, providing an immersive multidimensional viewing experience surrounded by water.

Complementing the auditorium's ingenuity is the meticulously crafted dual-stage system, designed to alternate between dry and wet performances seamlessly. The theatre has a vast 1,230-meter squared dry stage and an 800-meter squared performance pool, ensuring that both stages harmoniously interplay without compromising their functionalities. This water stage can transition fluidly between being a performance pool and a dry stage, adapting to the storyline and artistic needs. This adaptability is facilitated by the water stage's floor, constructed from permeable perforated metal plates, and advanced lifting mechanisms. Such an instantaneous changeover offers versatility and poses a significant design challenge, especially regarding water management.

Recognizing the need for precise water system requirements, the theatre features a triad of pools: the primary performance pool, a buffer pool, and a backup storage pool. The main performance pool, stretching 58 meters in length and 32 meters in width, can hold a whopping 9,278 meters cubed of water, equivalent to three standard swimming pools. With its 137.4-meter cubed capacity, the buffer pool primarily handles overflow and serves as an emergency reservoir. Lastly, the reserve pool, doubling as a municipal water intake, ensures a reliable water supply, enhancing safety measures.

In summary, the Han Show Theatre is more than just a performance space; it's a testament to what is achievable when architectural innovation meets artistic vision.

2.2. *Advanced Technological Implementations in Theatrical Performance*

The Han Show Theatre, in its groundbreaking execution of a water-based spectacle, integrates a series of avant-garde technological and design features. Among these are three sophisticated robotic arms tethered to a 7-meter by 11-meter rotatable LED screen.

In the backdrop of the dry stage, three expansive LED screens spanning an area of 225 square meters have been installed. These screens, maneuvered by advanced mechanical arms, facilitate three-dimensional movement, autonomous opening and closing, and various other performance-centric actions. Harmoniously synchronized with multiple performance elements such as water curtains, acoustics, illumination, electric effects, and more, the screens contribute significantly to the vitality of the depicted images and animations, becoming an integral element of the Han Show Theatre's unique presentation.

Aerially, the stage is equipped with rigging systems and lighting infrastructures, enabling performers to transition seamlessly between airborne and ground-based movements. These aerial dynamics allow performers a remarkable reach, with a maximum flight distance of 81.6 meters. Under the precision of an intricate control system, the performance optimally leverages the vast technological potential to project a mesmerizing spectacle in all dimensions. The synthesis of waterscapes, vapor effects, ambient lighting, and other specialized effects converge to craft a surreal and evocative ambiance unique to the Han Show.

The water stage, distinguished from traditional theatrical settings, harnesses a blend of curtains, state-of-the-art stage machinery, acoustics, and lighting to deliver a potent dramatic presentation underscored by technological innovation. The conception, design, and operationalization of the Han Show Theatre signify a pioneering stride in merging cutting-edge performance technology with avant-garde architectural paradigms, thereby elevating the sensory experience far beyond what conventional theatres have traditionally offered.

The Han Show Theatre's design demanded a meticulous fusion of traditional Chinese cultural elements with cutting-edge design innovations to integrate the viewing space with state-of-the-art performance techniques. The task required an orchestra of professionals, spanning show production, consultants, architectural design, stage equipment, lighting, and many more. This intricately layered design process required expertise across architecture, structure, and electromechanical systems.^[5] With the increasing influence of Chinese architects, modern design concepts and high-tech methodologies are being harnessed to craft cultural performance venues that resonate culturally, captivate audiences, and deliver unparalleled experiences.

Performance buildings center around the dual cores of the audience and performance. How the audience experiences a performance fundamentally shapes the internal space of such facilities. While traditional theaters distinctly separate the viewing and performing spaces, water stage theaters, like the Han Show Theatre, blur these lines. The dynamic water scenery in water shows is paramount, and performances aren't restricted to the water stage. This multifaceted performance approach fuses the spaces of the audience and performers. This design ethos mirrors Macau's iconic House of Dancing Water Theatre, tailored explicitly for water performances.

Projection technology is essential in the modern design toolkit, allowing for vivid, intricate visual representations of design concepts. Projections can augment or replace other visual scene components, enhancing the stage's ambiance. Given the cinematic techniques contemporary playwrights employ in their works, projections have become indispensable. For instance, once deemed unfeasible, quick location cuts are now achievable using points. Integrated with distinct Chinese elements, these technologies create uniquely immersive theatrical experiences.^[6]

3. The House of Dancing Water

The House of Dancing Water is shown in the City of Dreams, Macau, and is directed by the same director as Han Show, Franco Dragone. *The House of Dancing Water* focuses on water shows and incorporates difficult stunts. The wonderful performances, dreamy space, and special effects design, as well as its unique costumes, props, and refreshing audio-visual effects, work together to interpret the romantic classics and move them through time and space.

3.1. The Narrative and Artistry of *The House of Dancing Water*

Set in a picturesque kingdom, the narrative of *The House of Dancing Water* unfolds with simplicity yet depth. At the helm of this realm, the benevolent king is blessed with two progenies. His elder child, a princess, is the offspring of a graceful fairy, whereas the younger prince's birthright ties him to a covetous queen. The narrative turns dark upon the king's demise, with the queen incarcerating the princess, positioning her son as the legitimate successor. The captive princess's anguished cries set the stage for the narrative's pivotal turn; they invoke a powerful, mysterious force. This force, in response, conjures surging waves, bringing ashore a stranger who has faced the wrath of a tempest. Their destinies intertwined; the stranger, upon witnessing the princess's plight, pledges to liberate her, embarking on a captivating quest of heroism.^[7]

The production commences with a captivating tableau: a man navigating the vast expanse of water on a punt. Yet, his journey is abruptly interrupted as he is cast overboard, disappearing into the watery abyss. What follows is a spectacular visual sequence: the ascent of three masts, symbolizing the rigging of a grand ship. Simultaneously, athletically adept figures adorned in form-fitting lycra emerge from the water's depth. Drawn to the masts, they commence an intricate dance, transforming the rigging into swings and platforms, their performance a delicate balance between air and water, eliciting audible admiration from the audience. The narrative's fluidity sees the ship's descent, with the acrobats in tow, only to be replaced by an engulfing fog. This misty veil is transient, giving way to a rain deluge, revealing a man rising from a chest adrift and the descending cage imprisoning the girl. Their paths converge on solid ground, a magical transition from the watery stage where divers once plunged with abandon. This transformation, epitomizing the coup de theatre, leaves audiences in awe. The production, a tour de force, masterfully integrates diverse performance elements—high-altitude dives, dance, acrobatics, yoga, motorcycle stunts, and innovative set pieces like "artificial chandeliers" and "Russian swings." The pinnacle of the show is undoubtedly the riveting acts by motorcyclists and rope dancers, propelling the spectacle to unprecedented heights.^[8]

3.2. Technical Brilliance and Artistry

The prodigious impact of *The House of Dancing Water* is not solely attributed to its compelling narrative or aesthetic prowess but also to its ingenious and swift transitions that redefine the performance milieu, alternating between aquatic expanses, aerial theatrics, and grounded scenography. The underpinnings of such a mammoth production are intricate technological systems complemented by time-tested circus methodologies. Yet, the distinction of this production lies in its harmonized aesthetic and operational blueprint.

A significant portion of the cast embodies versatility. Many of the performers adeptly transition between roles of high divers and acrobats. This hybridity extends to the technical team, where 28 underwater technicians seamlessly merge scuba divers' skills with stagehands' expertise. The underwater breathing stations are essential to the performance's fluidity, facilitating dramatic moments that might otherwise seem unattainable.

3.3. Architectural Excellence and Technical Innovation

Huge efforts were invested into *The House of Dancing Water's* performance: the stage design and creative process alone took five years, followed by two years of arranging and producing the drama. From the scene to the theatre design, the show mobilized all technical departments to create the show. The entire theatre is engaged in detailed unique design and planning for the performance and targeted reconstruction to meet the performance's requirements. The team strived to have the theatre's structure and equipment meet the needs of various versions and complex scenes.

The theatre itself is an architectural marvel. It boasts the world's most expansive commercial pool, measuring 8m (26ft) in depth and spanning a diameter of 50m (160ft). This behemoth reservoir can accommodate 3.7 million gallons of water, equivalent to the volume housed in five Olympic-sized pools. The transformative nature of this venue is epitomized when, within a mere minute, eleven elevators—eight of which bear an impressive weight of ten tons each—convert the aqueous expanse into a solid, dry platform with a diameter of 20m (65ft).^[9] Hovering above this dynamic stage is a state-of-the-art system of 40 high-velocity tracks and trolley winches that facilitate the fluid movement of aerial acts and scenic elements.



Figure 2: *The House of Dancing Water 2019 | disguise*

The House of Dancing Water's theater in Macau is a marvel of design and engineering. Although the pool boasts a diameter of 50 meters, only 21 meters are visible to the audience. The remainder extends beneath the auditorium as an underwater sub-stage for scenery storage and actor pathways. To ensure the safety of the actors, the water undergoes stringent purification. A team of twenty-eight divers orchestrates the underwater scene transitions and guides the performers, guaranteeing smooth and unseen entrances and exits. From the audience's viewpoint, performers seem to disappear instantly; however, beneath the surface lies a complex network of guarded pathways illuminated with colored lights for navigation. These pathways, positioned in cardinal directions, are equipped with respirators, allowing performers to prepare or await their entrance beneath the surface.

The theater employs eleven automated platforms which can adjust from 7 meters below to 1 meter above the water, converting the pool into a dry stage. As shown in Figure 2, the stage is in the process of dry-wet exchange. The platforms are strategically positioned around the pool and have long strips for easy access to the central stage. Their precise leveling is paramount for performance safety, achieved using advanced echolocation technology. This technology allows constant calibration to accommodate performances at varying heights. Immersed within the pool are intricate stage props like a pavilion, a model of a traditional Chinese bridge, a Russian diving swing, and a sizable three-masted sailboat. Divers assist in positioning these props, with some requiring propulsion units for placement.

Powering the fountain are 63 state-of-the-art submersible pumps nestled beneath the platforms. These pumps, more potent than conventional ones, enable dynamic fountain displays. The water clarity is maintained throughout, with objects 7 meters below still easily discernible. To conceal underwater apparatus, six air compressors discharge approximately 125,000 liters of air per second via 380 nozzles, generating a vast bubble layer emulating boiling water. Complementing this illusion are 35 geysers and specialized lighting effects.^[10]

Designed for an audience of 2,000, the theater's seating creates an immersive experience. The front row sits at the water's edge (towels are provided to those patrons), and 14 rows ascend behind. While each seat has a unique fabric design, collectively, they present an abstract masterpiece. Above, a 36-meter high ceiling houses an 8-story platform and framework for aerial acts and dives. The 4th floor features a 360° track, 17 meters above the pool, for performer movements and scene transitions. Behind the scenes, stage management operates elevators, ensuring the timely positioning of performers. Essential machinery like hydraulic pumps, air compressors, and the water filtration system are housed in five dedicated equipment spaces below the pool. The theater boasts an array of dynamic projection surfaces, encompassing a fountain, a mobile mountain, and an expansive 270° drum wall. This drum wall, a specially designed waterproof curtain, envelops the back fence, presenting an extended canvas for projection. The intricate interplay of projection and illumination necessitates close collaboration between the projection and lighting teams to realize the envisioned artistic effects.^[10]

A standout feature of the production is the video content crafted by Patrick Neys. This captivating visual journey transitions from pastoral China landscapes to the urban sprawl of Hong Kong. The audience is immersed in a world of flying snow, fiery flames, imposing Gothic castles, majestic arches, and the symbolic mother of the earth. Neys' work goes beyond mechanical displays, adding layers of depth and emotion that enrich the performance experience.

4. Conclusion

The advancement of technology has had a significant impact on the evolution of stage art creative ideas and working techniques. At the end of the nineteenth century, the stage art creation concept of ancient Greek drama was a transition from stylized and decorative functions to space art that expresses a specific environment atmosphere; the world stage art innovation movement in the twentieth century pushed it to a more diverse development direction. The creative law that runs through it is that stage art's ability to participate in performance narrative is gradually recognized and strengthened; the rapid development of new media technology has triggered revolutionary changes in stage art concepts and spatial forms—real and virtual spaces. The focus on the audiovisual components of the theatrical environment has progressively evolved into a multi-sensory cross-media story design.

Some individuals believe that stage designers are skilled counterfeiters or magicians. TV stage art, particularly in the present, extensively uses modern technology and materials to combine art and science. An in-depth explanation of how to utilize performance space The problems that stage art designers must confront today is how to correctly use stage technology and how to make stage art a better present for art. A TV stage designer's work is a type of creation, a process of performance art and space art always exploring the unknown, a rebellion of creative design against conventional design, and the designer's self-innovation and pursuit of the aesthetic spirit. Of course, we are fascinated with introducing sophisticated equipment and using different contemporary technologies to achieve a feeling of aesthetic modernity. Simultaneously, what development trend will the stage design have in the future? The interaction of people with space, people with technology, and people with the times. These are essential issues to consider.

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