

Research on the Stage Art Expression of the Opening Ceremony of Large Sports Events: A Case Study of the Beijing Winter Olympics

Yage Lu*, Gaofeng Mi

Department of Art & Design, Shaanxi University of Science and Technology, Xi'an, Shaanxi, China

**Corresponding Author.*

Abstract: As a significant global sporting event commanding worldwide attention, the Winter Olympics functions as a crucial platform for nations to project their national images and convey their cultural legacies to the international arena. The 2022 Beijing Winter Olympics, themed "Together for a Shared Future", emphasized multi-dimensional cross-border exchanges in culture, art, and technology, integrating diverse aesthetic experiences such as oriental poetic aesthetics, national aesthetics, and emotional aesthetics. It amalgamated stage media with digital imagery, graphic representations, and audio - visual instruments among other media forms, to produce a spectacular audiovisual extravaganza. Through the coordinated resonance of the full-media matrix, it effectively narrated the Chinese story and propagated the Olympic spirit. This paper takes the 2022 Beijing Winter Olympics as a case study and employs methods including literature review, case analysis, and video - image observation. Drawing on theories from disciplines such as aesthetics, art research, communication studies, and sports science, it conducts a systematic exploration of the stage art expressions in the opening ceremonies of large-scale sports events from three perspectives: narrative aesthetics, media convergence, and Olympic hosting concepts. The objective is to probe into the digital development trajectory of the Olympic stage in the new era.

Keywords: Beijing Winter Olympics; Sports Events; Stage Art; Media Convergence; Digital Technology

1. Introduction

Stage art, often referred to as on-stage

performance art, amalgamates diverse art forms including drama, music, and dance, and communicates the human spirit and emotions via symbolic means. [1] Throughout the annals of Olympic events, the stage of every opening ceremony has manifested the distinctive cultural allure of the host nation through vivid aesthetic symbols. For instance, the 2024 Paris Olympics opening ceremony adopted a unique narrative approach, leveraging the iconic urban landscape as an open - air theatre. Above the flowing Seine River and beneath the majestic Eiffel Tower, a humanistic urban tableau was crafted, integrating sports and art, culture and fashion, history and modernity. During the 2016 Rio Summer Olympics opening ceremony, the Brazilian populace presented to the world their exuberant samba, refined bossa nova, and enigmatic totems. Olympic elements were seamlessly interwoven with urban symbols, giving rise to a singularly exotic Brazilian culture and breathtaking spectacle. The 2014 Sochi Winter Olympics opening ceremony offered a magnificent and elegant display of Russian aesthetics. There were passionate and profound literary titans, venerated artistic forebears, the periodic table and the space station, all of which together converged the splendors of Russian history and culture into a dreamlike artistic realm. In the 2012 London Summer Olympics, with the opening ceremony theme "Isles of Wonder", the pastoral stage design exhibited the charm of the British Isles. A succession of quintessential British cultural symbols, such as the Industrial Revolution, Harry Potter, Mr. Bean, and The Beatles, made their appearance to recall history and look forward. Amid the unprecedented international context, the 2022 Beijing Winter Olympics opening ceremony, with its nuanced narrative and spectacular stage art presentation, staged a grand opening

event replete with Eastern aesthetic connotations, robust technological underpinnings, and a distinct contemporary ethos.

2. Narrative Aesthetics of the Opening Ceremony of the 2022 Beijing Winter Olympics

As Mr. Zhang Yimou, the chief director of the opening ceremony of the Winter Olympics, said: "We should open the door to let guests see the spirit of the Chinese people." In this event that attracted worldwide attention, the long and splendid Chinese national culture not only showed the vibe of a great country, but also showed the unique oriental aesthetic meaning of "Chinese style". The romantic stage narrative aesthetics told the world about the proud Chinese spirit.

2.1 The Opening Prologue and Its Poetic Aesthetics

Compared with the cliché countdown in the opening ceremony, the Beijing Winter Olympics chose 24 solar terms to create a unique countdown overture. The flow of time, beginning with Rain Water, ending with the Beginning of Spring, staged a Chinese-style countdown. As modern aesthetic art and traditional Chinese culture complementing each other, ancient poems, ancient proverbs and other forms of Chinese culture together constituted a novel and beautiful world. Every element and every second on the stage provided a great feast for domestic and abroad audience. It could be seen that the countdown design for the opening ceremony of the Beijing Winter Olympics was deeply influenced by traditional Chinese culture both in form and content, which was reflected not only in the application of symbolic elements, but also the deep aesthetic expression with unique Chinese significance.

"The Book of Changes" says: "One Yin and one Yang is called Tao", Tao refers to the law. The "24 Solar Terms" is a scientific system created by the ancient Chinese people in the long-term observation of the nature of animals, plants, climate, environment and other changes. As a countdown device, the "24 Solar Terms" reflects the Chinese people's understanding of time, and represents the way of human and natural society to get along. In 2016, "24 Solar Terms" was officially included in UNESCO's

Representative list of the Intangible Cultural Heritage of Humanity. During the countdown, cultural heritages such as "Beijing Opera", "Tree-beating Flower" and "dragon boat head and tail production skills" were demonstrated, making the wisdom of Oriental civilization shine again on the stage of the Winter Olympics. The date of the opening ceremony of the 2022 Beijing Winter Olympics coincided with the Beginning of Spring, the first of the "24 Solar Terms", which also represented the beautiful hopes that "all things contain new ideas, enjoy the holy day long", and the valiant spirit of athletes embedded in the ancient Chinese proverb "Spring sky rumbles with thunder while all things start to thrive".

2.2 Mining Cultural Symbols and Establishing Ethnic Aesthetics

National aesthetics originates from the aesthetic thoughts and artistic concepts of the people of all ethnic groups in their long-term social life, and dynamically evolves with the development of the times [2]. It is the reflection of a nation's artistic achievements. The creation of symbols is closely related to emotional expression in human social activities. The famous American philosopher Susanne K. Langer was the first to incorporate art into the field of semiotics and construct a system of artistic semiotics [3].

On the stage of the opening ceremony of the Beijing Winter Olympics, the design of venue signage and the styling of costumes and props all showcased the traditional aesthetic background of the Chinese nation, and used modern artistic means to reconstruct and innovate local cultural symbols, presenting a splendid "national style" feast. The emblem design of the imagery calligraphy "Winter Dream" combined ancient Chinese character symbols with abstract logo design, depicting the strong Eastern charm and national emotions of Chinese character culture. The design of the Winter Olympics venues was based on traditional Chinese image elements such as Dunhuang murals, flying ribbons, and auspicious jade pendants. The naming of venues such as Big Air Shougang, translated directly as "snow flying to sky", also has its unique symbolic meaning. The relay torch lamp inspired by the Changxin Palace Lantern of the Western Han Dynasty expresses people's

eternal beliefs and longing for light in their hearts. From ceremonial attire to athlete robes, national cultural symbols such as auspicious snow and clouds, blue and white porcelain, and tiger head hats have also been cleverly transformed into clothing embellishments, reflecting the traditional aesthetic spirit of the Chinese nation of reciprocity and kindness in souvenir exchanges.

It is worth mentioning that the design team of the Winter Olympics mascot "Bing Dwen Dwen", which combines a sense of culture, fashionable style and scientific elements, takes the national treasure giant panda as the IP design prototype to carry the humanistic concept of harmonious coexistence between human and nature to the world through in-depth excavation of the connotation of cultural symbols. Its cute and adorable design has been deeply loved by people, becoming a unique representative of the Beijing Winter Olympics and leading to a nationwide mania. From building cultural confidence to establishing national brand, it has achieved a leap from "national style" to "China-Chic", and jointly witnessed the "Made in China" shining on the Olympic stage.

2.3 Enhancement of Aesthetic Experience and Interpretation of Emotional Aesthetics

Mr. Zhu Guangqian, a renowned contemporary Chinese aesthetician, defined the emotional aesthetics into two dimensions, namely aesthetics and subjectivity. Aesthetics "is an important element of stage art, conveying emotions and spirits to humans through rhythm, imagery, empathy, and other forms." Subjectivity "is the aesthetic experience and emotional resonance created by humans as aesthetic participant, integrating ideology and artistic practice from their own perspective. These two dimensions are interconnected and complementary to each other. The venues of the Winter Olympics are not only a sports arena, but also a big stage that highlights the humanistic concepts of various countries.

From the perspective of overall aesthetic experience, we can explore the presence of multiple emotional aesthetics in the opening ceremony of the Beijing Winter Olympics. It was not professional singers, but 44 Chinese children who came from remote mountains perfectly performed the Olympic anthem in Greek, with pure and ethereal sounds of nature

surrounding the audience. In the dance performance "Building a Snowflake", snowflakes with the names of different countries on them gradually gathered together as the dancers were performing, combining 96 individual small snowflakes into an organic whole, vividly demonstrated how "I" became "us", allowing individuals to transcend their identity and integrate into the harmonious time and space of the "community of shared future for mankind" under the collective of "big snowflakes". Accompanied by the touching melody of the song 'Let the World Be Filled with Love', 76 young people from all over the world took the lead and confidently performed to bring the audience back to the arduous years of overcoming the epidemic and the passionate moments of hard work and struggle, paying tribute to the people's heroes in ordinary life. Allowing ordinary people to indulge themselves into the grand stage and gain emotional sublimation through highly participatory aesthetic experiences, the "people-oriented" values were vividly reflected on the opening ceremony stage of the Beijing Winter Olympics.

3. Media Convergence of the Opening Ceremony of the 2022 Beijing Winter Olympics

Stage, as a spatial medium for presenting artistic achievements, carries the value of cultural dissemination [4]. Along with the continuous innovation of digital media technology, technological aesthetics, characterized by ultra-high definition, immersion, and interactivity, have broken the spatial limitations of traditional stages and greatly enhanced the artistic value of stage performances. The Olympic Games have gone through a hundred years of history while literary and artistic workers constantly try to use new media technologies and presentation methods in order to lead revolutionary changes of stage art. The artistic performance of the opening ceremony has evolved from the most primitive simple ceremony to today's magnificent audio-visual art feast, which cannot be separated from the integration and symbiosis of multiple media.

In the 1980s, American communication scholar Professor Ithiel De Sola Pool first proposed the concept of "media convergence". The concept of "media convergence"

emphasizes the benign combination between two or more media rather than simple stacking, ultimately presenting multiple aesthetic effects of mutual integration [5]. The opening ceremony of the 2022 Beijing Winter Olympics featured music, dance, and singing as the main forms of performance, supplemented by light and shadow, props, and scenery. In addition to relying on the most basic stage media, it cleverly integrated different forms of artistic language such as digital image media, graphic image media, and audio-visual aesthetics. The combination of abstract visual imagery and figurative stage performance created stunning performance effect, leading to a both physically and psychologically immersive experience. It was an attempt to integrate stage media styles and a bold exploration of the new trend of digital development of stage art for large-scale sports event opening ceremonies.

3.1 The Integration of Digital Image Media and Stage Scene Media

With the iteration and upgrading of communication media, digital imaging technology has been successfully applied to stage performances of large-scale sports events, with touching visual images that change people's stereotypical impressions of traditional sports events [6]. In the beginning, a poetic countdown video of the "24 Solar Terms" kicked off the opening ceremony of the Beijing Winter Olympics. The winding and undulating Great Wall blurred in the clouds, and the giant stone lions in the Forbidden City stood tall in the rain. Modern cities shone with neon lights, and high-speed trains roared like dragons. Skilled intangible cultural heritage craftsmen and heroic ice and snow athletes showed their spirit to the world. In this short three and a half minute video, the magnificent rivers and mountains of our motherland and the vigorous style of sports athletes were presented one after another. The last second of the countdown fell on the Beginning of Spring, and the scene transferred from video to live performance. Nearly 400 performers holding luminous poles rhythmically performed in a matrix, and the dance "the Beginning of Spring" started, like a green sprout of new grass, overwhelmed with infinite vitality and hope. At the end of the program, the color of the glowing pole changed from green to white,

forming a huge dandelion. A picture of a little boy appeared on the left side of the ground screen, gently blowing the dandelion away and falling over the romantic and ethereal stage. At this moment, the dandelion seeds transformed into fireworks in the sky, and the words "Beginning of Spring" bloomed on the bird's nest, symbolizing a refreshing atmosphere of revival.

After the solemn and sacred flag raising ceremony, a drop of ice blue ink fell from the long screen in the center of the stage, and the majestic Yellow River water poured down, gradually spreading throughout the entire stage, making the audience feel as if they were there. The scene gradually quieted down, and a huge ice cube slowly rose in this frozen blue ocean. Starting from the first Winter Olympics in Charmaine, France in 1924, the logo of the 24th Winter Olympics was carved with flashing light and shadow. Finally, the crystal clear ice and snow rings broke through the ice and amazed the whole audience. Undoubtedly, the wonderful integration of digital imaging technology and stage scenes in the opening ceremony of the Beijing Winter Olympics would inspire a "Olympic imaging revolution".

3.2 The Integration of Graphic and Image Media with Stage Performance Media

Famous American scholar F. Harary mentioned in his book "Graph Theory" that "a thousand words are not worth a picture." [7] Graphics and images are common forms of visual information in people's lives. Static pictures are processed into dynamic images through computer software, and this technology is called computer graphics and image technology and is widely used in stage performances. If we consider the stage of the opening ceremony of the Beijing Winter Olympics as a subtle compass, each performance sector is a clever design that integrates graphic and visual media with stage performance media, presenting a unique sports extravaganza to the audience.

In the show "Salute to the People", dozens of young people from different regions walked side by side. Under their feet, a carefully designed photo scroll slowly unfolded, showing the touching moments of people's ordinary lives as well as the moments of athletes' hard work. In fact, this seemingly simple performance was designed by the

director's team through countless discussion and arguments. As the image film was shot beforehand, in order to achieve the effect of synchronous live performance, the director carefully calculated based on the proportion of the ground screen and unfolding speed of video scroll, as well as the audience's optimal viewing angle. The final precise walking interval was 176 meters long from north to south, lasting for exactly 100 seconds, with actors' walking distance being accurate as 82 centimeters per step. It was precisely this set of cold numbers that perfectly integrated the ground screen image with the stage performance. Instead of complex performance, the director chose to use the most basic human body movements as walking and conveyed the beautiful concept of "one family under heaven" in this sector. Subsequently, under the melody of the song "Imagination", 24 young people wearing red sportswear stepped on the snow and left their traces, outlining beautiful Chinese knots via human screen interaction.

3.3 The Integration of Audio-Visual Communication Media and Stage Language Media

The use of sound and light media is an important means of expression in stage art [8], and the stage language of the Winter Olympics has both similarities and differences compared to the language concepts we use in our daily lives. On the one hand, it refers to the brilliant commentary of the sports program by the commentators; On the other hand, as a communication tool, it conveys ideas and emotions, demonstrating spirits and spreading cultural connotations through the rendering of stage environment and actor performances. Different from the colorful fireworks at the previous opening ceremony, 2022 Beijing Winter Olympic Games used the atmospheric white fireworks to create a pure "northern scenery" for the audience, which was a metaphor for the aesthetic concept of "one leaf knows the autumn" of the Chinese culture. The clothing design of the Chinese ice dance group was inspired by elements of Chinese landscape painting, using color gradients in the design of green and water blue racing suits, making athletes seemingly dance among mountains and waters, giving the audience a beautiful artistic conception of "people swimming in the painting", and also a perfect presentation of the

charm of traditional Chinese culture. The main tones of the Winter Olympics venues were rosy red, sky blue, and glacier white. With the magnificent changes of light and shadow, the design of venues carried humanity's pursuit of beauty.

The little trumpet players were playing 'Me and My Motherland', and the passionate Chinese delegation team was singing entree song 'Singing of the Motherland'. A series of world-renowned songs that resonate with people's hearts, from the singing of "Olympic Hymn" in Greek by children raised in remote mountains to John Lennon's famous song "Imagine", as well as overtures including "Swan Lake", "The Nutcracker", and "William Tell", With its unique charm, music connected people all over the world. The beats not only aroused the deep emotions in the heart, but also embodied the open and inclusive spirit of the Chinese nation. Last but not least, it composed a magnificent symphony of a community with a shared future for mankind.

4. The Olympic Concepts of the Opening Ceremony of the 2022 Beijing Winter Olympics

After the successful bid for the 2015 Beijing Winter Olympics, the Olympic concept of "green, shared, open, and clean" was proposed. On February 4, 2022, a simple, safe, and exciting Winter Olympics event was presented to the world as expected. Beijing Olympic concepts were transformed into vivid and magnificent events, with green technology as its highlights. China perfectly fulfilled its solemn commitment to the international community.

4.1 The National Image of the new Era in 2022 Beijing Winter Olympics

National image is a combination of subject construction and object cognition, and is a key element in enhancing a country's comprehensive strength [9]. In the current trend of globalization, the Olympic Games, as a large-scale international sports event, has significant and far-reaching significance for the enhancement of national image. The opening ceremony of the Winter Olympics, through visual arts such as performances, ceremonies, and images, effectively conveys cultural information to domestic and foreign audiences, becoming a special communication

system that combines cultural and ethnic characteristics, providing an important platform for telling the story of China well in the new era.

The opening ceremony of the Beijing Winter Olympic Games showed the world China's style as a big country of "reaching the goal of helping the world", which was mainly reflected in the following three aspects. The first is the people-oriented Chinese concept. As a sports event, the stage more highlights the subjectivity and initiative of people. Rising from "Chinese people" to the world wide human beings, it broke the stereotypes, enabling participants to conduct in-depth immersion interaction and exchange of experience, and create a "passionate ice and snow" visual landscape for all participants; The second is the long-standing Chinese culture. The design of the Winter Olympics emblem, venues, mascots and stage not only carried the connotation of 5000 years of traditional Chinese culture, but also boldly innovated and made break-through by modern technological means, leading to a confident interpretation of the ancient charm and new vitality of Chinese culture. The third is the Chinese initiative of a shared destiny. Adhering to the concept of "a community with a shared future for mankind", the theme comprehensively coordinated with the hosting of the event [10]. The slogan of 2022 Beijing Winter Olympics was "Together Towards the Future". The opening ceremony constructed an international communication discourse system through cultural performances, song singing, leadership speeches, media reports, and other activities, expressing the beautiful wish to work together with the world to build a better future and shape a trustworthy, lovely, and respectable national image of China.

4.2 Digital Technology Empowering Green Winter Olympics

In the opening ceremony of the Beijing Winter Olympics, the idea of green technology was expressed at various aspects such as venue construction, order management, and energy supply [11]. The goal of "carbon neutrality" has been achieved as competition venues were supplied by 100% green power, and the aerosol COVID-19 monitoring system was successfully built, and the main torch tower used hydrogen as fuel. Beijing

comprehensively created a "green Winter Olympics" with ecological priority, resource conservation, and environmental friendliness. At the same time, the opening ceremony of the Beijing Winter Olympics perfectly integrated art, culture, and technology, giving the ice and snow stage a "technological color" and presenting an immersive digital aesthetic journey for the audience.

The entire stage of the opening ceremony consisted of a 11000 meter-square ground screen, a 1000 meter-square grandstand screen, and a 1200 meter-square ice waterfall, creating a world-record high-definition LED stereoscopic stage. Especially with a high contrast ratio of 10000:1, it ensured the vividness of colors and the fluidity of the image, providing the audience with the ultimate visual aesthetic experience. In the children's choir "Snowflakes", the beautiful and ethereal snowflakes danced in the sky, and the "peace dove" wandered and flied in the center of the stage. It was this simple and warm scene that had become the "technology summit" of the opening ceremony of 2022 Beijing Winter Olympics. Thanks to advanced AI algorithm technology, a large-scale real-time digital rendering of up to 660 people has been achieved for the first time. The information collected by 4 cameras was 3D modeled by computers, and the generated high-precision images were finally presented on the stage LED screen. Through real-time 3DAT tracking technology for each actor, the fluent interaction between virtual images and actors was ensured. In addition, advanced technologies such as mechanized stage scenery, holographic projection, and 360° VR virtual imaging brought about digital interaction and emotional resonance of physical presence, constantly enriching the aesthetic experience of the Winter Olympics visual feast.

4.3 Creation of A "5G+8K" Multimedia Communication Matrix

Looking back at the century-long history of the Winter Olympics, the evolution from traditional newspapers, radio, and television news to social media, portal websites, short videos, and other communication media in the digital age shows that the reporting media are undergoing continuous integration, transformation, and upgrading [12]. Along with the conclusion of the Beijing Winter

Olympics, China not only presented a spectacular sports event to the world, but also demonstrated the power of mainstream media in the era of integrated media.

China Central Television (CCTV) adheres to the concept of "technology-driven Olympics" and implements the high-quality development strategy of "5G+8K+AI". At the opening ceremony, for the first time, it achieved full coverage of 5G signals, and provided 8K ultra high definition public signals, and applied technologies such as 4K production and broadcasting for performances. The breathtaking scenes of the rushing Yellow River, the ice-breaking of the Olympic rings, and the sparkling snowflakes flying in the sky were jointly captured by seven 8K cameras on site and the A6 broadcasting vehicle. To better meet the broadcasting needs, the 4K track camera system called "Cheetah" captured the real-time position changes of performers throughout the entire process, providing audience with a stable and smooth viewing experience.

From the perspective of the communication matrix, the 5G media platform, news broadcast channel, sports channel and other TV channels reported the Olympic event in a panoramic way throughout the whole process, and the stage scene was relayed by multimedia matrices such as live broadcast, multi channel broadcast, and international broadcast. According to statistical data, the total click frequency of media reports related to the opening ceremony of the Beijing Winter Olympics reached 6.914 billion, covering an audience of 420 million people, setting a record in history and strongly driving the cross screen national discussion of 2022 Beijing Winter Olympics. In addition, "Winter Olympics Blue" appeared on city landmark screens with 8K ultra high definition channels, staging the "Hundred Cities, Thousand Screens" spectacle in 34 cities including Beijing, Shanghai, Shenzhen, Hangzhou, etc., building a fancy information dissemination matrix, allowing audiences to experience an immersive opening ceremony scene in multidimensional interaction.

5. Conclusion

The 2022 Beijing Winter Olympics established an opening ceremony stage featuring Chinese culture and green technology, demonstrating

the organic integration of artistic aesthetics, stage media, and digital technology. This enabled the Olympic spirit to radiate through a novel manifestation of stage art. In shaping a distinct Chinese-style aesthetic, the value of "openness, inclusiveness, and co-creation for the future" was emphasized. The 2022 Beijing Winter Olympics endeavored to explore the optimal synergy of art and technology in the cross-media expression between new media and stage space. Within the "green + technology" smart stage, China's national image as responsible, charming, and admirable was enhanced. The Beijing Winter Olympics not only offers diverse insights into the stage art presentation of large-scale sports events but also presents new opportunities for effectively telling China's story and conducting international communication. Looking forward, under the profound influence of digital technology and mainstream media, the stage art expression of sports events will continue to grow in diversity and sophistication.

Acknowledgments

This paper is supported by the Shaanxi Provincial Philosophy and Social Science Research Special Project "Research on the Cultural Tourism Performing Arts Communication of Xi'an's International Image in the Context of the Belt and Road Initiative" (No. 2022HZ1608), the Shaanxi Provincial Major Theoretical and Practical Issues Research Project "Research on the All-Media Communication System of 'Internet + Revolutionary Cultural Relics' in Shaanxi in the 5G Era" (No. 2020Z064), and the 2023 Industrial Design Industry Research Center project of the Key Research Base of Philosophy and Social Sciences in Sichuan Province "Research on the Path of Cultural Resource Protection and Revitalization Utilization in Sichuan Province under the Background of Building a Culturally Strong Province" (No. GYSJ2023-10).

References

- [1] Yajing Li. Research and Practice on the Trend of Contemporary Stage Art Design. *Art and Performance Letters*, 2023, 4 (6).
- [2] Wang Yichuan. The Battle at Lake Changjin: A National Aesthetic Paradigm for Chinese Blockbusters. *Journal of Chinese Film Studies*, 2022, 2 (1): 199-

- 205
- [3] Yueting Huang. Symbols, Artistic Creation and Aesthetic Appreciation: on Susanne K. Langer's Art Semiotics. *Art and Performance Letters*, 2023, 4 (3).
 - [4] Daniel Chorbe Ayuba, Jacob Enemona Onoja. The Aesthetics Of Space As A Design Element In Stage Production: A Case Study of Esiaba Irobi's Cemetery Road Production. *Arts and Design Studies*, 2014, 22 7-16.
 - [5] Mirian N. Tavares, José João Hogueane, Sandra Boto. The Use of Media Convergence in the Preservation and Dissemination of Cultural Assets: Case of Mozambicans Timbila. *International Journal of Creative Interfaces and Computer Graphics (IJCICG)*, 2020, 11 (2): 16-26.
 - [6] Interactive Multimedia Performance Technology Augmented Stage. *Ambient Intelligence and Smart Environments*, 2011, 10 578-578.
 - [7] Harary Frank. *Graph Theory (on Demand Printing Of 02787)*. Taylor and Francis; CRC Press: 2018-03-05.
DOI:10.1201/9780429493768.
 - [8] Xiang Wei, Bachimon Philippe. The Chinese Mountains as a Night-time Stage: a Study of the Sound and Light Show Impressions of Liu Sanjie (*Guil. Revue de géographie alpine*, 2018, (106-1).
 - [9] Yiren Zhang. Digital Diplomacy: The Role of Media in Constructing National Images. *Data Research*, 2024, 8 (2).
 - [10] Yilei Wang, Dezheng (William) Feng, Hua Wang. Modernity, Aesthetics, and Nation Re-branding in Olympics: A Multimodal Discourse Analysis of the Opening Ceremony of the 2022 Beijing Winter Olympic Games. *Communication & Sport*, 2024, 12 (6): 1139-1158.
 - [11] Zhao Lihua, Li Da, Yang Ke, Guo Qinglei. Design and Implementation of Green Power Traceability System Based on Blockchain Technology in the 2022 Beijing Winter Olympics 2022.
 - [12] C. Edwards. 5G'S Olympic leap [mobile communication networks at the 2018 Winter Olympics]. *Engineering & Technology*, 2017, 12 (9).