

# Review and Prospect of Group Gymnastics Research: A Literature Review at Home and Abroad

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## Abstract

Group gymnastics, as a grand artistic sports performance, serves not only as a vital component in building a sports powerhouse but also as a crucial pathway to achieve this national goal. By promoting and developing group gymnastics, we can enhance public sports participation, boost the nation's cultural soft power, and ultimately advance the construction of a sports powerhouse. This practice holds significant importance in demonstrating comprehensive national strength, boosting morale, and facilitating cultural dissemination. Through literature review, video analysis, and logical examination, this study delves into the profound significance behind group gymnastics. It summarizes its forms of expression and functional characteristics based on its origins, while offering practical suggestions for better promoting its development in light of current circumstances.

## Keywords

Group gymnastics; Large-scale sports performances; Sports power.

## 1. Introduction

Rhythmic gymnastics, a grand performance art that blends sports, artistic expression, and team spirit, serves as both a vital platform for athletic showcases and a symbol of a nation's cultural soft power. It is frequently featured at major events like sports opening ceremonies and national celebrations, playing a key role in showcasing national pride and promoting cultural heritage [1]. In 1987, the academic community further defined group gymnastics as a comprehensive performance art that integrates music, dance, sports, and costumes [2]. After entering the 21st century, scholars have further defined and interpreted the concept of group gymnastics. In 2013, some scholars pointed out that China's group gymnastics is a form of group performance that highly integrates sports and art, a form of human aesthetic culture, and even more importantly, a sports culture form worthy of preservation, innovation, and development. This is a value judgment on China's group gymnastics from a historical development perspective based on cultural levels [3]. In 2020, group gymnastics was defined as a comprehensive collective performance that masterfully blends sports and art. As a staple at major sporting events, this spectacular display typically involves thousands to tens of thousands of performers, predominantly college students. Its awe-inspiring scale and innovative choreography create a visually stunning experience, often leaving audiences deeply moved by its artistic impact [4]. In summary, group gymnastics is a large-scale sports activity with artistic and expressive qualities. As China advances its efforts to build a sports powerhouse, the value of group gymnastics in improving public fitness and promoting collectivism has become increasingly prominent. However, systematic research on group gymnastics remains fragmented both domestically and internationally, lacking a comprehensive overview of its developmental trajectory and academic hotspots. Therefore, conducting a review of this field will help clarify the current research landscape and provide references for theoretical innovation and practical development.

## 2. Historical Evolution

### 2.1. The Origin of Group Gymnastics

The tradition of group gymnastics originated in Slavic nations. Historically, Slavic peoples were nomadic communities inhabiting the Eurasian steppe at the crossroads of Europe and Asia. Through historical evolution and sustained migration from Asia, these groups expanded into Europe, forming three distinct clusters: West Slavs, East Slavs, and South Slavs. The West Slavs evolved into the ancestors of modern Dutch, Czech, and Ukrainian populations. The East Slavs became the forebears of contemporary Russians, Belarusians, and Ukrainians, while the South Slavs gave rise to the ancestors of Croatia, Slovenia, and Serbia [5]. The earliest form of group gymnastics was grand in scale. This grand performance style gained significant attention from Slavic nation-states. For instance, under the Czech government's promotion, by the mid-20th century, Czech group gymnastics had achieved such popularity that 'one performer out of every 15 people and one spectator out of every three people' could be found nationwide [6]. The performers of the group gymnastics are mainly from various family members who volunteer to join, students from various schools, and workers from all walks of life, including children aged 3 to 5 and old people over 60.

Through literature review, the countries with the earliest and best-developed group gymnastics include Czechoslovakia, the former Soviet Union, Japan, and North Korea. The development of group gymnastics in China can be traced back to the Tang and Song dynasties of China, when performance forms such as "word dance" and "flower dance" already existed, which can be regarded as the embryonic form of group gymnastics. According to historical records, during the reign of Emperor Gaozong of Tang, Empress Wu Zetian created the "Shengshou Dance," which involved 140 performers wearing golden copper crowns and colorful painted costumes. These costumes could rapidly change colors during the dance, and each change of formation would form a single character. During the Song dynasty, prefectures and counties often performed "word dance" during grand festivals, indicating that it had evolved into a folk celebration of festivals. With the continuous development and reform of sports, the "word dance" shifted from being primarily a song and dance performance to a program featuring bare-handed or apparatus gymnastics, serving as a grand opening ceremony for major sports competitions. Therefore, it can be said that group gymnastics in China has a long history and cultural tradition.

## 3. The Elements of Group Gymnastics

Early domestic research categorized the components of group gymnastics into three major elements: performance movements, formation patterns, and artistic decorations. Mao Xueshen (1988) pointed out in "China Group Gymnastics" that performance movements include gymnastics, calisthenics, rhythmic gymnastics, martial arts, and movements from other sports disciplines; formation patterns encompass entry, in-field performance, and exit formations, with in-field performance formations further divided into five categories: scattered points, straight lines, angular lines, curved circles, and composite patterns; artistic decorations involve music, costumes, props, and stage backgrounds. This framework laid the foundation for subsequent research [7].

### 3.1. A Study of Movements in Group Gymnastics Performance

Academic research on group gymnastics movements primarily focuses on two aspects: movement types and movement characteristics. In terms of classification dimensions, Zhang Fengwei categorized the movements of the group gymnastics at the National Games opening ceremony into four dimensions: event categories, functional categories, apparatus categories, and form categories [8]. In terms of movement design, Yang Mingzhen proposed that movement

design should be carried out in sequence according to the scene, including five categories: gymnastics without equipment, light equipment movements, skill modeling, martial arts and dance movements, and collective coordination movements [9]. Regarding the conceptual explanation of group movements, Huang Kuanrou and Zhao Haibo (2014) emphasized that group gymnastics constitutes a 'collective of movement,' where its actions should encompass gymnastics, other sports, and artistic movements, all presented through coordinated group performance [10].

Foreign scholars have primarily focused their research on gymnastics routines, patterns, and formations in artistic gymnastics, rhythmic gymnastics team events, and large-scale opening ceremony performances. Their perspectives emphasize the integration of movements, formations, and music, as well as the guiding role of competition rules in choreography. For instance, Manos and Popescu (2014) noted that the International Gymnastics Federation (FIG)'s "Scoring Rules" directly influence the choreography of artistic gymnastics team events. Coaches select and combine movements based on the "composition criteria" outlined in the rules to enhance artistic scores [11]. Foreign studies rarely classify movements similarly to China's "bare-handed" and "equipment" categories. Instead, they categorize movements based on difficulty elements (such as rotation, jumping, and balance) and collaborative methods, emphasizing the technical integrity of movements in collective coordination [12].

### **3.2. A Study on the Patterns and Formations of Group Gymnastics Performances**

Academic research on group gymnastics formations and patterns is closely tied to performance themes and content, as specific formation changes and pattern presentations reflect the cultural significance and values of the performance. Consequently, domestic studies on group gymnastics formations and patterns have become comprehensive and rich. For instance, Zheng Xinghong and Zhang Hanjin (2002) categorized and summarized group gymnastics formations and patterns based on their classification and choreography principles. They classified patterns into three types: general, symbolic, and character-forming patterns, while grouping formations into three categories: scattered points, linear patterns, and block patterns. The researchers emphasized that formation changes should convey a sense of fluidity [13]. Yan Limin (2007) proposed integrating visual communication design principles into formation pattern design, using patterns to 'speak' and 'convey emotions' to enhance visual impact and aesthetic value [14]. At the same time, Chinese scholar Yang Ming (2009) emphasized that the formation pattern should be consistent with the theme, change quickly and regularly, and the composition of the pattern should be appropriate in proportion and highlight the subject [15]. Finally, Gu Huawei (2011) pointed out that the pattern of small group gymnastics should highlight the theme, reflect the sense of the times, and match the mood of the music [16].

In international research on group gymnastics choreography, Camerino et al. (2015) demonstrated through T-pattern analysis that the formation design typically follows a flow structure: micro-groups → macro-groups → whole space, based on spatial composition and utilization to enhance visual hierarchy and dramatic impact [17]. In the comparative study of pattern regularity preferences, Xu Qiong (2014) compared the pattern selection of China and Olympic powerhouses in rhythmic gymnastics team events, finding that both sides tended to use regular geometric shapes (such as circles and symmetrical blocks). However, the number of patterns used by the Chinese team in transition formations was significantly higher than that of foreign powerhouses, reflecting higher requirements for pattern simplicity and smooth variation in foreign countries.

### 3.3. Artistic Decoration of Group Gymnastics Performance

The artistic embellishments in large-scale group gymnastics performances are an indispensable element, often serving as the crowning achievement. These elements primarily include performance music, costumes, props, venue design, and high-tech applications. This section systematically examines and analyzes the artistic embellishments in group gymnastics performances through literature review methodology.

#### 3.3.1. Classification of Costume in Group Gymnastics Performance

Research on the classification of group gymnastics performance costumes has been explored both domestically and internationally, though differing perspectives and systems exist. Chinese scholars typically categorize these costumes based on functionality, form, or symbolic significance. For instance, Ni Xufen proposed seven categories: 1) sportswear; 2) dancewear; 3) professional attire; 4) biomimetic costumes; 5) acrobatic and theatrical wear; 6) surreal costumes; 7) fashion show outfits [19]. In their book *Group Gymnastics*, Zhang Yunan and Gao Liuhong do not categorize performance costumes specifically. However, their research on performance attire suggests five main types: 1) sportswear; 2) ethnic costumes; 3) pictorial costumes; 4) object-inspired costumes; 5) solo performers' costumes [20]. In her work "Characteristics of Gymnastics Apparel Elements", Zhang Fengmei further categorizes biomimetic clothing into abstract and concrete types [21].

There is limited systematic classification of gymnastics uniforms internationally, with most discussions focusing on design standards and aesthetic considerations for artistic gymnastics and rhythmic gymnastics. For instance, Tetiana Shevchuk (2025) noted in her study of rhythmic gymnastics attire that modern gymnastics uniforms primarily use highly elastic fabrics and incorporate decorative elements like crystals and sequins, emphasizing the integration of functionality and aesthetics [22]. While the study does not propose a formal classification system, its analysis of materials, decorative elements, and cultural symbols indirectly reveals two key dimensions in clothing design: technical functionality and artistic expression. The research emphasizes that fashion design must adhere to safety regulations (such as prohibiting asymmetrical colors and overly long skirts) while maintaining harmony with musical themes and movement styles, thereby enhancing the aesthetic experience for both judges and audiences.

In summary, domestic research emphasizes the social symbolism and natural imitation of clothing, forming multidimensional systems such as sports, dance, professions, and biomimicry. International studies, however, focus more on balancing material technology and visual expression, while highlighting how competition rules constrain fashion design. Both approaches collectively demonstrate that group gymnastics performance costumes are not merely functional gear, but also crucial artistic vehicles for conveying themes and enhancing visual impact.

#### 3.3.2. Classification of props for group gymnastics performance

Chinese scholars primarily classify gymnastics apparatus based on size, weight, and user capacity. Mao Xuexin proposed a three-category classification system: small, medium, and large apparatus [23]. Wanhong further categorizes props by size: small props include lightweight items like garlands, ribbons, and fans; medium props cover collaborative equipment such as parallel bars and styling racks; large props refer to heavy-duty fixtures like combined equipment and floats that require fixed positioning or external propulsion [24]. In university group gymnastics, small and medium-sized props are widely used to achieve diverse stage effects through different combinations. In recent years, the use of high-tech props has become increasingly prominent. For example, during the torch relay of the Hangzhou Asian Games, a digital-designed torchbearer was used to bring an immersive visual experience to the audience.

While systematic classifications of gymnastics apparatus in international research remain limited, existing literature highlights that large-scale opening ceremony performances prioritize visual impact and technical integration in prop design. A prime example is the underground circular shaft used as a covert entrance during the 2004 Athens Olympic Games opening ceremony. Its structural design seamlessly combined engineering requirements with performance demands, demonstrating the pivotal role of large-scale props in ceremonial events. Furthermore, foreign studies emphasize the integration of props with stage machinery and digital media, utilizing automated control systems and projection technologies to enhance dynamic effects rather than relying solely on dimensional categorization [25].

### 3.3.3. A Study of Music in Group Gymnastics Performance

Music serves as the conductor of group gymnastics, where its style and rhythm directly shape the performance's emotional tone and structural framework. Research by Gao Liuhong et al. indicates that musical selection should align with performance themes, incorporating lyrical, passionate, and intense styles while transitioning between phases to match narrative pacing. Research directions in ritual music encompass: exploring and innovating traditional ritual music, documenting its historical context and critical analysis, and developing recitation scripts and voiceover compositions. These efforts aim to enhance the cultural depth and artistic expression of group gymnastics through musical elements [27]. Foreign studies have focused more on the synchronization between music and movement and its improvement of performance quality. For example, research on rhythmic gymnastics shows that the high degree of coordination between music and movement can significantly enhance the audience's perception of performance consistency [26]. In addition, digital music editing tools are often used in foreign arrangement practice to adjust the beat, sound effect and dynamic range, so that the music can better guide the formation change and action rhythm, reflecting the integrated design concept of music, formation and action.

### 3.4. The Performance Form of Group Gymnastics

Chinese scholars Zhao Haibo and Huang Kuanrou (2013) introduced the concept of "artistic expression in group sports," categorizing gymnastics performance techniques as "block textures of collective movements." Specifically, a single block texture refers to a single movement unit, while multi-block textures are further divided into homophonic and polyphonic textures. This structural approach was prominently featured in opening ceremonies like the Beijing Olympics and Guangzhou Asian Games, where large-scale venues and multi-block coordination demonstrated practical applications of both homophonic and polyphonic textures [28]. Regarding the formats of group gymnastics performances, instructors Zhao Haibo and Huang Kuanrou primarily categorize them into three types based on choreographic content: 1) Main-color performance format – featuring gymnastics movements to highlight sports' gymnastic characteristics and athletic aesthetics; 2) Characteristic performance format – incorporating traditional ethnic sports or sports imitation performances, showcasing cultural features through ethnic costumes, music, and apparatus; 3) Enhanced performance format – utilizing artistic elements like dance, magic, and acrobatics to elevate aesthetic appeal and deepen thematic expression [29].

Foreign studies on group gymnastics performance primarily focus on quantitative analysis of formation parameters and choreography structures. For instance, research on rhythmic gymnastics team events reveals that spatial and movement parameters such as formation arrangements, running paths, throwing distances, and movement synchronization significantly influence team performance [30]. Furthermore, research on youth group rhythmic gymnastics reveals that coaches must prioritize formation design, equipment-body coordination, and synchronization when choreographing routines. These "core criteria" directly determine competition scores and rankings. The findings demonstrate that international standards

emphasize using quantifiable kinematic metrics to enhance the scientific rigor and competitive edge of performance routines [31].

## 4. Conclusion

Literature review reveals that China's research on group gymnastics primarily focuses on its historical development, core components, and opening ceremony applications, with scant attention to international large-scale performances. Furthermore, despite recent technological advancements, studies on integrating high-tech elements to enhance performance quality and rehearsal efficiency remain limited. Future research should explore creating more dynamic group gymnastics routines by incorporating each nation's unique historical and cultural contexts. As a major sports event, group gymnastics has significant market potential—from Olympic and National Games openings to provincial sports events and school athletic competitions. However, there is a critical shortage of professionals trained in choreography, making it challenging to innovate without systematic training in performance design.

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