

# Exploring The Intersection of Geometry and Ballet

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## ABSTRACT

Ballet originated in the courts of the Italian Renaissance in the 15th century is still a popular dance art today. It is characterized by diversity, and the expression of emotion varies from situation to situation. Geometry plays a crucial role in ballet formation, human form, and movement proportions. This paper focuses on the relationship between ballet and geometry, deeply discusses how geometric principles such as line, triangle, circle, symmetry and asymmetry are integrated to ballet choreography and performance. By analyzing ballets such as Swan Lake and Giselle, this paper highlights how dancers use geometric concepts to create visually compelling formations that emphasize harmony and unity. These geometric elements are shown to enhance the precision, beauty, and storytelling in ballet performances.

**Keywords:** Ballet; Geometry; Lines; Circles; Symmetry; Asymmetry

## INTRODUCTION

The origin of ballet can be traced back to the Italian Renaissance courts of the 15th century, where it was initially performed as an elaborate court spectacle that combined music, dance, and drama (1). In 1681, ballet moved from the courts to the stage in France integrating with French opera. Until mid-1700s, Jean Georges Noverre, a French ballet master, advocated for ballet as an independent art form and created the early dramatic style of ballet called “ballet d’action” (1, 2). In the late 19th century, ballet flourished in Russia, where choreographers

like Marius Petipa took ballet to new levels. Many classical ballets, like the Sleeping Beauty, and Swan Lake, were formed in that period (1, 2). Over 500 years of sustained historical growth, ballet has significantly influenced various countries worldwide, spreading its artistry and becoming a vital cultural force.

Geometry plays an essential and practical role in ballet, and dancers employ these geometric concepts to ensure precision in their movements, creating visually compelling formations. Through their movements, dancers can create various lines, shapes, and angles, all of which enhance the visual appeal of ballet (3). Performers create angles with their bodies to achieve the desired shapes, and stay parallel lines to one another to maintain formations, consistently keeping the same distance between themselves as they move. In addition, geometry is also essential in creating unity, such as synchronization and the formation of shapes, among ballet dancers(3). In this article, we will focus on the relevance of geometric principles in ballet techniques and choreography.

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## GEOMETRIC CONCEPTS IN BALLET MOVEMENTS

### Lines in Ballet

Ballet emphasizes the creation of long, clean lines with the body, which are essential for achieving visual harmony. Dancers maintain these lines while executing complex movements, ensuring a graceful aesthetic. For instance, in Act II of Adolphe Adam's *Giselle*, the Wilis, ghostly spirits, create four parallel lines of traveling arabesques, embodying a force of nature. One of the most powerful moments in this ballet happens when the Wilis suddenly move to the sides of the stage, creating an open path for Myrtha. She then charges across the stage with powerful leaps (*jetés*) in a diagonal line (3).

The creation of clean lines is demonstrated in the *pas de deux* between Odette and Prince Siegfried in Act II of the Tchaikovsky's "*Swan Lake*" (Figure 1A). In this piece, Odette performs a series of arabesques and *developpés*, where she extends her leg behind her, creating a beautiful line from her fingertips through to her toes. The way she arches her back and lifts her arms enhances the visual effect, making her appear almost swan-like. As she dances, the prince mirrors her lines, enhancing the overall aesthetic. Their harmony movements emphasize on clean lines and fluidity to conveying the emotion and beauty of the story.

The *Danse des petits cygnes* in Act II of the "*Swan Lake*" is another excellent example of ballet's emphasis on clean lines and synchronized movements (Figure 1B). In this piece, four dancers who represent young swans stand side by side and move together in perfect harmony like a single unit. They hold hands throughout the entire dance and perform quick and small steps. They keep their upper bodies still and allow their legs and feet to create clean, fast-moving lines across the stage, creating the illusion that the swans are moving as one, which makes the dance look very smooth and graceful.

### Shapes and Angles in Ballet

In ballet, dancers often use their bodies to form specific shapes, such as circles, triangles, or other forms. These shapes are not only about aesthetics; but also help tell the story and convey emotions through the dancers' bodies, enhancing the overall experience of the ballet.

Circles in ballet are often associated with themes of eternity, unity, and the cyclical nature of life, adding both aesthetic appeal and symbolic meaning to the performance. In Act I of Adolphe Adam's *Giselle*, during the harvest celebration, the peasants and nobles come together to celebrate the season by dances. In their performance, they often form circles, holding hands or linking arms, which fosters a sense of unity. The circular formations allow the dancers to move fluidly, transitioning from one



**Figure 1.** Ballet emphasizes the creation of long, clean lines with the body, which are essential for achieving visual harmony. (A) In Act II of Tchaikovsky's "*Swan Lake*", Odette performs a series of arabesques and *developpés*, where she extends her leg behind her, creating a beautiful line from her fingertips through to her toes. (B) The *Danse des petits cygnes* in Act II of *Swan Lake* showcases ballet's emphasis on clean lines and synchronized movements, with four dancers moving in perfect harmony to create the illusion of a single, unified entity.

formation to another, while maintaining the lively and joyful feeling of the celebration (3).

The circles can also capture the audience's attention, creating a visually stunning display. In *Swan Lake* Act II, the circle formation during the "Entrée of the 24 swans" serves both symbolic and visual purposes (Figure 2A). The swans' movement in perfect harmony highlights their shared fate and emphasizes the visual symmetry of the stage. This circular arrangement not only creates a serene yet dramatic contrast but also mirrors the natural gliding of swans, enhancing the connection between the dancers and their swan personas. The circle's structure reinforces the unity and strength of the swan group while framing key interactions of the principal characters, thus intensifying the emotional tension and making it a memorable part of the ballet.

Triangles are another important geometric shape that is frequently incorporated in ballet. These shapes can be formed by the positioning of arms, legs, and body, or by the arrangement of multiple dancers. The retiré position in ballet forms a triangle with three lines. The first line is the thigh of the working leg, which is lifted to the side and held up in the air. In this position, the thigh needs to be high enough so that the lower part of the working leg can bend and touch the knee of the supporting leg (Figure 2B). Additionally, triangles are often used to create a sense of focus, direction, or strength, helping to structure the dance and draw the audience's eyes to important aspects of the performance. In Act I of *Giselle* ballet, Giselle, who is heartbroken, sometimes bends her body in a way that forms a triangle during the "Mad Scene". This shape

emphasizes her pain and the moment her heart breaks when she finds out Albrecht has deceived her. Take the second act of *Swan Lake*, for example. Shortly after the swan corps enters, they form a formidable triangle, aimed like a spear towards the audience, which defines the power of the flock (3). They then form circles around Siegfried in unity of their sisterhood. These shapes embody the music's emotional and energetic charge.

### Symmetry and Asymmetry in Ballet

Symmetry, a foundational aspect of ballet for its ability to mirror every dance step, is often used in ballet to create a sense of harmony and balance. George Balanchine often utilized symmetry to organize the space on stage, guiding the audience's eyes and emphasizing the collective movement of the corps de ballet. The dancers in "Serenade" are placed in such a way that their positions mirror each other, forming geometric patterns that are pleasing to the eye (Figure 3A). This use of symmetry not only adds to the aesthetic appeal but also reinforces the unity of the group, making their movements appear as a cohesive whole rather than as individual performances. The symmetry in "Serenade" is not static but dynamic, evolving as the dancers move through different formations. Symmetry is a great tool for both visual beauty and narrative structure in ballet (Figure 3A).

In Act I of *Swan Lake*, symmetry is well applied by the corps de ballet (Figure 3B), showing the corps de ballet in a visually striking formation. The dancers are arranged in a V-shape on the stage, with the leading dancer positioned at the point of the V. The symmetry of the arrangement is



**Figure 2.** In Act II of *Swan Lake*, the "Entrée of the 24 Swans" features a circle formation that is both symbolic and visually striking (A). The retiré position forms a triangle with three lines. The first line is the thigh of the working leg, which is lifted to the side and held high enough for the lower part of the leg to bend and touch the knee of the supporting leg (B).

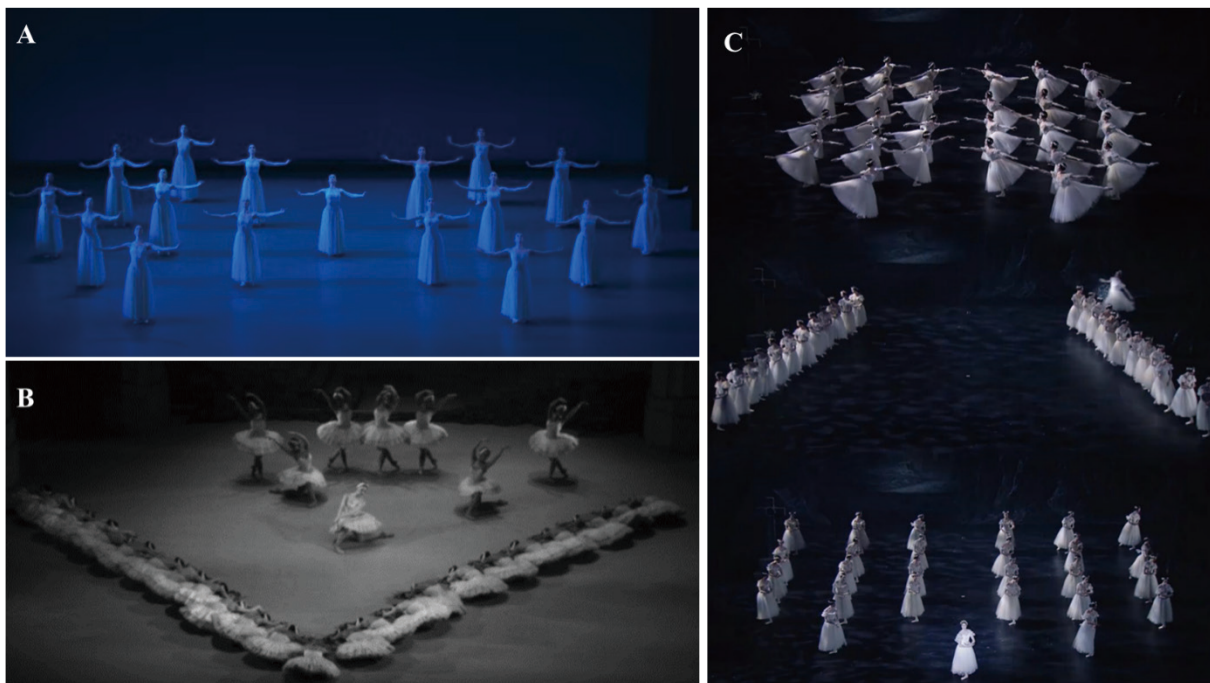


emphasized by the uniformity of the dancers' poses and costumes, creating a powerful visual effect. The dancers on the ground, in particular, form a continuous line that adds to the geometric precision of the scene. The use of symmetry and the collective movement of the dancers highlight the discipline and coordination required in classical ballet, contributing to the overall aesthetic beauty of the performance. This use of symmetry not only enhances the visual appeal of the performance but also highlights the precision and discipline required in ballet.

Symmetry is skillfully applied in Act II, *Giselle*. The dancers are arranged in perfect geometric formations, creating a mirror-like effect across the stage. The top image features two symmetrical lines of dancers extending their arms and legs in unison, their movements synchronized to form a balanced, harmonious pattern (Figure 3C). In the middle and bottom images, the dancers are arranged in symmetrical rows, with equal spacing between them, contributing to the overall sense of order and balance. The leading dancer, positioned at the center, serves as the focal point, further emphasizing the symmetrical arrangement (Figure 3C). This use of symmetry not only enhances the

visual appeal of the performance but also highlights the precision and discipline required in ballet.

The connection between beauty and symmetry has sparked extensive discussion throughout both the arts and sciences. In this context, psychologist and medical educationalist Chris McManus provides the following summary: "philosophers and art historians seem generally agreed that although symmetry is indeed attractive, there is also a somewhat sterile rigidity about it, which can make it less attractive than the more dynamic, less predictable beauty associated with asymmetry" (4). McManus' view about symmetry and asymmetry was concurred by choreographer and dancer Doris Humphrey in her book titled "The Art of Making Dances"(5) . In the contemporary choreographer Mats Ek's version of "*Giselle*" which has widely believed to be a masterpiece of reinterpretation of the classical "*Giselle*", Ek uses asymmetrical choreographic patterns throughout the ballet. For instance, in Wilis' dance, the Wilis' choreography is intentionally asymmetrical, and the Wilis move in irregular and scattered patterns rather than neat, symmetrical lines (Figure 4A). Their movements



**Figure 3.** George Balanchine's "*Serenade*", dancers are arranged to mirror each other's positions, creating visually appealing geometric patterns (A). In Act I of *Swan Lake*, the corps de ballet employs symmetry effectively, forming a striking V-shape on stage with the leading dancer at the V's point (B). In act II of *Giselle*, willis show the symmetry in multiple places. In the top part, symmetrical lines of dancers extend their arms and legs in unison, while in the middle and bottom parts, the dancers are arranged in symmetrical rows with the leading dancer positioned at the center to serves as the focal point (C).

are unpredictable and often off-balance, creating the chaotic feel of the scene. This use of asymmetry helps to highlight the haunting and unsettling nature of Wilis, making the emotional and psychological intensity of the scene even stronger. In George Balanchine's "Symphony in Three Movements," asymmetry is a defining feature that energizes the choreography. Unlike traditional ballets that emphasize symmetry, Balanchine arranges dancers in irregular, staggered formations, creating visual tension and unpredictability. This use of asymmetry highlights contrasts in movement, as seen in the distinct groups of dancers performing different motions and shapes (Figure 4B). The off-center placements and lopsided arrangements challenge conventional ballet norms, drawing attention to the individuality of each dancer within the ensemble.



**Figure 4.** Mats Ek's reinterpretation of "Giselle" features asymmetrical choreographic patterns, with the Wilis' dance marked by irregular and scattered movements (A). In George Balanchine's "Symphony in Three Movements," asymmetry drives the choreography, with dancers arranged in irregular formations that create visual tension and highlight contrasts in movement (B).

The central figures in pink help bridge the contrasting groups, adding a layer of cohesion to the otherwise disjointed composition. This deliberate imbalance not only aligns with the ballet's complex, abstract themes but also enhances the visual and emotional impact of the performance. Balanchine's innovative approach blends classical technique with modernist aesthetics, using asymmetry to disrupt traditional forms while creating a dynamic and compelling visual narrative.

## CONCLUSION

This paper deeply discusses the relationship between ballet and geometric mathematics, and analyzes the wide use of lines, triangles, circles, symmetries and asymmetries in ballets, and different geometric elements can present different visual effects and emotional expression. However, this study also has some limitations. For instance, the analysis is based primarily on famous popular ballets such as Swan Lake and Giselle, which may not fully represent the diversity of modern or contemporary ballet forms. Future studies of differences between geometry elements in modern and classical ballet are warranted. Additionally, it does not consider other critical factors in ballets, such as the influence of music, lighting, and costume design, which also contribute to the overall performance.

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