RESEARCH ARTICLE

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Aesthetic Perception of Stage Setups in Dance

Marisa Kempe and Thomas Heinen

ABSTRACT

Dance as moving art is an adequate medium for exploring visual perception and the aesthetic value of movements. The aesthetic experience in dance movements and performances was investigated over the last two decades. Still, research on stage setups in dance is severely underrepresented despite their importance in dance choreographies. The study aimed to assess dancers (hip-hop and modern dance) and non-dancers' aesthetic evaluation of three different prototypical movements performed on five prototypical stage setups. *N*=27 dancers (hip-hop and modern) and non-dancers evaluated various movements performed on different stage setups on their perceived aesthetic. It was hypothesized that symmetrical stage setups and a fast movement or a movement with a wide form were generally preferred. It was furthermore expected that dancers and non-dancers, as well as dancers from different styles, differ in their aesthetic perception of stage setups and dance movements. Results revealed that the movement contract-release and the stage setup V were generally evaluated as most aesthetic. Nevertheless, while hip-hop dancers and non-dancers preferred a free stage setup as the least aesthetic, modern dancers preferred a bloc setup as the least aesthetic. It can be concluded that there is a general preference for movements comprising a large amplitude and range of motions and for stage setups that contain symmetry and a wide form. Thus, symmetry seems essential when developing stage setups in dance. This can be used as a tool trying to delight the observer as well as trying to play with contrast and convergence throughout a whole dance performance.

Keywords: computer animation, hip-hop, modern dance, pairwise comparison.

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I. INTRODUCTION

Dance as moving art is seen as an adequate medium for exploring visual perception and the aesthetic value of movements (Cross *et al*., 2012). The aesthetic experience in dance movements and presentations was investigated over the last two decades. Still, research on stage setups in dance is severely underrepresented despite their importance in dance choreographies. The study aimed to assess dancers (hip-hop and modern dance) and non-dancers' aesthetic evaluation of three different prototypical movements performed on five prototypical stage setups.

Aesthetic experience is described as a state of mind that comprises focusing on an object, feeling a strong connection to that object, and thus reducing the perception of the surrounding environment when observing and evaluating that object (Cupchik & Winston, 1996; Marković, 2010; 2012). It is thought that, on the one hand, beauty and liking (Jäger & Kuckhermann, 2004; Martindale & Moore, 1988; Winkelman & Cacioppo, 2001), and on the other hand, pleasure as well as unpleasure (Marković, 2010), can elicit aesthetic experience. Yet, in most dance performances, the general aim is to delight the observer. However, the fundamental question remains which aspects of dance performances are aesthetically preferred by observers?

On the level of the observer, it is thought that humans generally like what they know **(**Zajonc, 1968) and that familiar stimuli are preferred over unfamiliar stimuli (Reber *et al*., 2004), while at the same time being influenced by personal and cultural preferences when watching a dance performance (Hagendoorn, 2005). Nevertheless, there is still great diversity in the average observers' aesthetic appreciation of (dance) stimuli. Some observers prefer more surprising and chaotic stimuli than others, and some prefer a harmonious balance of known and unknown stimuli (Berlyne, 1974; Song *et al*., 2021). However, research indicates that observers' expertise in dance is essential in perceiving dance performances' aesthetics (Calvo-Merino *et al*., 2010; Glass, 2005; Kirsch *et al*., 2013; Vinken & Heinen, 2022). For example, Stevens *et al*. (2007) investigated the eye movements of novice and expert dancers while watching a dance performance. The authors determined that the expert dancers and non-dancers differed in their visual perception, concluding that the experts' perception is supported by specific, dance-related knowledge.

On the level of the performed dance movements, research indicates that perceived aesthetics in dance depends not only on which movements are shown but on how they are performed. For instance, faster movements are evaluated as more aesthetically pleasing than slower ones (Orlandi *et al*., 2020).

Furthermore, large amplitude and range of motion are other aspects of an aesthetically pleasing dance movement (Brown *et al*., 2021; Sato *et al*., 2014; Torrents *et al*., 2013; Vinken, 2022). In addition, Orgs *et al*. (2013) state that symmetry is preferred in watching dance performances. Their results show that aesthetic judgments in dance depend on symmetry in posture, movement, and the structure of choreography.

Various stage setups are used in dance presentations to create scene settings, set choreographies in space, and organize the stage area for dancers, equipment, and all actors (Gerber & Mattis, 2017). They are part of the criteria at dance competitions and influence the result of the performance (DTHO, 2021; DTV, 2016). However, it is yet unknown how the shape of stage setups is related to perceived aesthetics. Nevertheless, a particular stage setup usually comprises one or more specific geometric shapes, thereby eliciting a particular geometric impression in the observer. Amir *et al*. (2011) investigated participants' visual perception and neural activation when observing three-dimensional forms. The results show higher neural activity and attract eye movements when the observers watch curves and curvatures. Gilmartin (1983) investigated geometric shapes and revealed a strong preference for ellipses over rectangles. Silvia and Barona (2009) showed that observers prefer circles over angular hexagons and curved polygons over angular polygons. Latto *et al*. (2000) could show that observers like horizontal and vertical lines more than oblique lines when watching paintings (see also Latto & Russel-Duff, 2002). Additionally, observers seem to like symmetrical objects more than objects that are not symmetrical (e.g., Jacobsen & Höfel, 2002; Makin *et al*., 2018; Palmer & Griscom 2013; Tinio & Leder, 2009).

In summary, there is an apparent lack of research on the relationship between the shape of stage setups in dance and their aesthetic perception. Nevertheless, exploring the aesthetic perception of stage setups is essential to improve dance presentations and support choreographers. Familiar stimuli are preferred over unfamiliar stimuli (Zajonc, 1968; Reber *et al*., 2004), and expert dancers differ from non-dancers in their aesthetic perception (e.g., Stevens *et al*., 2007). Thus, one could speculate that dance experts from different styles (i.e., hip-hop vs. modern) should differ from each other and non-dancers in their aesthetic perception of familiar (i.e., prototypical dance style-related) stimuli such as movements and stage setups. Therefore, this study compared dancers from two styles (hip-hop vs. modern) and non-dancers based on their aesthetic evaluation of movements and stage setups.

On the one hand, fast movements (Orlandi *et al*., 2020), with an extensive range of motion and wide forms (Torrents *et al*., 2013), are perceived as more aesthetic. On the other hand, preferred properties of geometric shapes are curves and curvatures (Silvia & Barona, 2009), horizontal and vertical lines (Latto *et al*., 2000), and symmetry (Orgs *et al*., 2013). It can be highlighted that a combination of preferred properties (e.g., symmetry and wide form) could derive the greatest pleasure and be perceived as the most aesthetic. Consequently, different movements and stage setups possess a more significant potential to elicit a high degree of aesthetic evaluation in dancers and non-dancers.

Three dance movements (bounce, contract-release, demi plié, see method section for a description) and five stage setups (bloc, circle, free, V, mixed) were selected for the current study. The movement bounce is performed faster than the movements contract-release and demi plié, and one could speculate that there is a higher aesthetic preference for bounce than for demi plié and contract-release. Yet, the movement contract-release comprises a more extensive range of motion and wide form and could thus be preferred over demi plié and bounce. Since bounce is typically found in hip-hop dance, and demi plié is typically found in modern dance, there could be different dance style-related preferences. Additionally, different stage setups could comprise various geometrical aspects. For example, a circular stage setup could generally be preferred over other shapes due to its round form and a high degree of symmetry. However, different setups comprising aspects such as horizontal lines or a wide form could also be highly preferred.

First, it was hypothesized that symmetrical stage setups (bloc, circle, V, mixed) were generally more preferred than the unsymmetrical free setup, with either the stage setup bloc (horizontal lines), V (symmetry and wide form), or circle (symmetry and round form) to be the most preferred. In addition, the fast movement bounce and the contract-release with its wide form should range a higher score in aesthetic rating than the demi-plié. Second, it was hypothesized that the dancers and non-dancers differ in their aesthetic perception of stage setups and dance movements. Modern dancers were expected to prefer modern-typical stage setups and modern-typical dance movements. Hip-hop dancers were expected to prefer specific hip-hop stage setups and hip-hop movements more than stimuli of the other dance style due to their expertise and familiarity with the just mentioned aspects.

II. Material and Methods

A. Participants

$N = 27$ participants took part in this study. The number of participants was derived from a power analysis when expecting a medium effect (Cohen's $f = 0.25$, type-I-error-probability = 5%, type-II-error-probability = 20%). Each participant was assigned to one of three groups: 1) hip-hop dancers ($n_1 = 9$, all female, age

[mean ± SD] = 24±3 years), 2) modern dancers (n_2 = 9, all female, age = 29±7 years), and 3) non-dancers (n_3 = 9, all female, age = 25±4 years). Participants reported dancing or doing other sports several times a week. The dancers (hip-hop and modern) reported having an experience of more than ten years in their respective sports. Participants' task was to watch videos of avatars performing different dance movements in different stage setups and to rate which stage setup they perceived as more or less aesthetic. All participants participated voluntarily and signed an informed consent and privacy form before participation in this study. The study was conducted according to the ethical guidelines of the local university.

B. Instruments

1) Stage Setups

German dance competitions (regional competitions and German championships) in hip-hop and modern dance were observed by the authors to investigate which stage setups are most commonly used in hip-hop and modern dance. Video recordings of eight prototypical performances (hip-hop = 4, modern dance = 4) in the start class formation from 2011 to 2022 were selected for qualitative analysis. The performances lasted up to three minutes and consisted of a maximum of 17 different stage setups per performance. Hip-hop formations most commonly use stage setups consisting of two, three, or four lines in one bloc. Modern dancers most commonly use free stage setups with neither a particular geometrical shape nor order. Both dance styles also use circular stage setups, V-like setups, and mixed setups in their performances. Thus, for further stimuli generation, the aforementioned five stage setups were selected: 1) bloc, 2) free, 3) V, 4) circle, and 5) mixed (as a combination of bloc and V, see below).

2) Stimuli Generation

Experimental stimuli were generated from the recorded dance performances of one female dancer with extensive experience in modern and hip-hop. The dancer (female, 24 years) reported having 12 years of dance experience in hip-hop and modern dance with a weekly training amount of six hours in both dance styles. The dancer was asked to perform three dance movements: 1) bounce, 2) contract-release, and 3) demi-plié.

The movement *bounce* is a rhythmic all-over body movement predominantly found in hip-hop. It can be described as a repetitive slight and fast bending and straightening in the knees. The dancer's upper body swings up and down due to bending the knees (Sato & Nunome, 2016). The movement *contract-release* is a slow movement with a prominent position changing in the upper body, typically found in contemporary dance. The dancer rounds the torso and bends the head forward while leading the arms forward in a round position. The knees are bent in a slow, small, and controlled way. The movement is executed fluently (Rosenberg, 2000). The *demi-plié* concentrates on the dancer's legs and is found in hip-hop and contemporary dance. It is described with a slow and controlled knee bending while the upper body stays upright. The knee bending and stretching is performed in a fluent and controlled way. The arms are held at the side (Wessel-Therhorn, 1996). Eight valid trials of each movement were recorded for stimuli generation.

The performances of the three movements were recorded using an inertial sensor-based motion capture system operating at 120 Hz (Perception Neuron®, Noitom Technology Co., Ltd, Miami, USA). Computer animations were created from the recorded data using a standard yet human-like-looking and gender-neutral avatar in the 3DSmax software (Autodesk, Dublin, 2021). The avatar was copied to generate different stage setups, and stage setups were arranged with nine duplicates. This number of avatars is in line with the number of allowed dancers at hip-hop and modern dance competitions in Germany. The arranged setups were 1) bloc, 2) free, 3) V, 4) circle and 5) mixed (see above). While the setup bloc is typical for hip-hop formations, the free setup is typical for modern dance, and V and circle are contained in both dance styles, and the mixed setup is a mixture of both dance styles. Computer animations were created for all three movements (bounce, contract-release, demi-plié) and all five stage setups (bloc, free, V, circle, and mixed), equaling 15 animations. The animations lasted 12 seconds on average.

3) Stimuli Evaluation

The participant's task was to evaluate the perceived aesthetics of all experimental stimuli. Therefore, an online questionnaire was created using Unipark (Tivian, 2022). Participants evaluated the perceived aesthetics of the experimental stimuli in pairwise comparisons. In each comparison, two experimental stimuli were presented side-by-side, and participants were asked to indicate which of the two stimuli they evaluated as more aesthetic. Both stimuli could be replayed as often as necessary. Each stimulus was compared to all other stimuli, resulting in 105 pairwise comparisons. The number of positive evaluations was summed up for each stimulus as used as the dependent variable. The stimuli could receive scores ranging from a maximum of 14 (if a particular stimulus was always evaluated as more aesthetic than all other stimuli) to a minimum of zero (if a specific stimulus was never evaluated as more aesthetic than all other stimuli). The pairwise comparisons were presented in a randomized fashion.

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C. Procedure

The participants were personally invited via e-mail to take part in this study. The online questionnaire consisted of four parts. In the first part, the participants were informed about the purpose and the main goal of the study and asked to sign the informed consent and privacy form. Participants were further instructed to complete the online questionnaire in a calm environment with no time pressure and on a PC or laptop screen of at least 13 inches in size. In the second part, sociodemographic and personal data such as age, gender, experience in dance, and current training amount were assessed. The third part of the questionnaire comprised the aforementioned pairwise comparisons between all stimuli. Participants were shown two familiarization trials before completing the 105 pairwise comparisons. There was no time pressure, and participants were allowed to take breaks as requested. The questionnaire took, on average, 30 minutes to complete. Participants were debriefed and thanked for participating in the study in the fourth and final part of the questionnaire.

D. Data Analysis

A significance criterion of $a = 5\%$ was defined a priori for all results reported. To test the main hypotheses of this study, an analysis of variance (ANOVA) with repeated measures was calculated, taking the summed scores of aesthetic evaluations as the dependent variable. Group (hip-hop dancers vs. modern dancers vs. non-dancers) was treated as a between-subject factor. In contrast, the stage setups (bloc vs. circle vs. free vs. V vs. mixed) and the movements (bounce vs. contract-release vs. demi plié) were treated as within-subject factors. In case the sphericity assumption was violated, the Greenhouse-Geisser correction was used. η_p^2 was calculated as the effect size for all significant results. Posthoc tests were calculated by applying Holm's procedure (Knudson, 2009).

III. RESULTS

First, it was hypothesized that symmetrical stage setups (bloc, circle, V, mixed) were expected to be generally more preferred than the unsymmetrical free setup, with either the stage setup bloc (horizontal lines), V (symmetry and wide form), or circle (symmetry and round form) to be the most preferred. In addition, the fast movement bounce and the contract-release with its wide form should range a higher score in aesthetic rating than the demi-plié. Second, it was hypothesized that the dancers and non-dancers differ in their aesthetic perception of stage setups and dance movements. Modern dancers were expected to prefer modern-typical stage setups and modern-typical dance movements. Hip-hop dancers were expected to prefer specific hip-hop stage setups and hip-hop movements more than stimuli of the other dance style due to their expertise and familiarity with the just mentioned aspects.

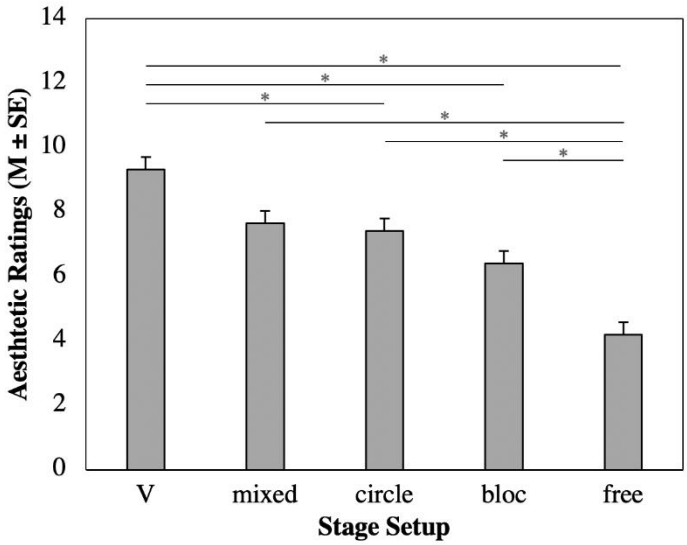

Fig 1. Participants' aesthetic ratings (means ± standard errors) of the stage setups.

Analysis of variance revealed a significant main effect of movement, $F(2, 48) = 3.233$, $p = .048$, $\eta_p^2 = 0.119$, and of stage setup on aesthetic evaluations, $F(4, 96) = 19.599$, $p < .01$, $\eta_p^2 = 0.450$. Furthermore, there was a significant interaction effects of stage setup × group, $F(8, 96) = 2.306$, $p = .026$, $\eta_p^2 = 0.161$. In particular, inspecting the structure of the significant effects revealed that contract release (means ± SE = 7.933±0.395) was evaluated as more aesthetic compared to demi plié (6.215±0.395) but not compared to bounce (6.852±0.395). When averaging over all groups, the V setup was evaluated as the most aesthetic, followed by the mixed setup, the circle setup, the bloc setup, and the free setup (see Figure 1). However,

differentiating the aforementioned main effect by the factor group revealed that the V setup was evaluated as the most aesthetic stage setup in all groups, followed by the mixed setup for hip-hop dancers and non-dancers, but the circle setup for modern dancers. Modern dancers evaluated the mixed setup as the third most aesthetic. In contrast, the hip-hop dancers evaluated the bloc setup, while the other evaluated the circle setup as the third most aesthetic. Consequently, the modern dancers evaluated the bloc setup as the least aesthetic over the free setup. In contrast, the other two groups evaluated the free setup as the least aesthetic over the bloc setup (non-dancers) and the circle setup (hip-hop dancers).

IV. Discussion

The study aimed to assess which movement and stage setup is perceived as the most aesthetic by hip-hop, modern dancers, and non-dancers. First, it was hypothesized that symmetrical stage setups (bloc, circle, V, mixed) were generally more preferred than the unsymmetrical free setup, with either the stage setup bloc (horizontal lines), V (symmetry and wide form), or circle (symmetry and round form) to be the most preferred. In addition, the fast movement bounce and the contract-release with its wide form should have a higher aesthetic rating score than the demi-plié. Second, it was hypothesized that the dancers and non-dancers differ in their aesthetic perception of stage setups and dance movements. Modern dancers were expected to prefer modern-typical stage setups and modern-typical dance movements. Hip-hop dancers were expected to prefer specific hip-hop stage setups and hip-hop movements more than stimuli of the other dance style due to their expertise and familiarity with the just mentioned aspects.

First, all groups generally evaluated the movement contract-release as the most aesthetic movement. This finding is in line with previous research (Brown *et al*., 2021; Torrents *et al*., 2013), and this could potentially be due to the larger amplitude and wide form of this movement compared to the movements bounce and demi-plié. Additionally, there were no differences between the groups. Thus, hip-hop and modern dancers do not necessarily prefer stimuli of their dance style, so expertise or familiarity may not be of explanative value here. The general preference for movements comprising a large amplitude and range of motion seems to be a general preference for dancers (hip-hop and modern) and non-dancers. However, a manifold of dance movements comprises different movement features, making it often hard to compare their execution directly (e.g., Vinken *et al*., 2021). Thus, future studies could focus on the role of specific movement features in differentiating between movements and how these features drive aesthetic evaluation.

Second, the stage setup V was evaluated as the most aesthetic stage setup averaging over all groups. This result is in line with the finding that symmetry and wide forms derive the greatest pleasure (e.g., Orgs *et al*., 2013). Nevertheless, setup V consists of two oblique lines, which should not be preferred over horizontal lines in literature. Therefore, the result contradicts other studies' findings (e.g., Latto *et al*., 2000). Yet, stage setups are different from paintings or geometric forms, and stage setups comprise human actors. The observation of stimuli containing biological information is considered to be different from that of stimuli containing non-biological information (Blake & Shiffrar, 2007).

Considering the groups, the modern dancers evaluate the setup circle as the highest and the bloc as the lowest in rating aesthetics, supporting the statement that dancers prefer familiar over unfamiliar stimuli (Zajonc, 1968; Reber *et al*., 2004). Typical modern dance choreographies contain round forms, and the circle shows the same roundness property. Conversely, the bloc is angular and straight and was evaluated at least by modern dancers. However, quite surprisingly, the modern typical stage setup free was considered more unaesthetic than the other stage setups. Despite modern dance performances traditionally comprising the setup free, symmetrical (and round) setups seem to be preferred by modern dancers. It can be summarized that big movements are preferred more than movements with other properties. This effect appears to be stronger than the influence of expertise or familiarity on aesthetic ratings.

It is acknowledged that computer animations of real dance movements in different stage setups were used as stimuli for pairwise comparisons. This was done to ensure experimental control over the experimental stimuli. Nevertheless, one could argue that observing computer animations over real-live performances could potentially elicit a different aesthetic evaluation. This, however, may also depend on the overall level of naturalness of the computer animation (e.g., human-looking avatar vs. stick-figure avatar, naturally rendered stage vs. artificial stage, etc.) and other qualitative factors that may be hard to measure (see, for example, Glass, 2005). Additionally, the character of dance performances also lives from the dancers' expressions that are likely to influence audiences' (aesthetic) judgments (e.g., Orlandi, 2020; Vukadinović & Marković, 2017). Finally, music is essential to dance presentations (Stevens *et al*., 2007). This study did not consider the factors above in favor of experimental control over the stimuli. However, given that there are potential interactions of the factors just mentioned with people's aesthetic evaluations, future studies should systematically integrate these factors into their designs. This would help understand how to dance performances are best set up and structured to maximize observers' pleasure when watching them.

Finally, results revealed that dancers and non-dancers generally prefer symmetrical stage setups. Thus, symmetry seems essential when developing stage setups in dance. This can be used as a tool to delight the observer and play with contrast and convergence throughout a dance performance (Gerber & Mattis, 2017). It might also serve as an assistance for inexperienced dancers when learning new choreographies. However, one should yet acknowledge the specifics of particular dance styles when selecting one symmetric stage setup over the other. Nevertheless, given the strong effect found in this study, it is speculated that this aspect might also generalize to other fields such as cinema, drama, and new media, where choreographed performances are an essential part.

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CONFLICT OF INTEREST

Authors declare that they do not have any conflict of interest.

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