From Brain to Ballet: Mapping the Neural Landscape of Dance and Aesthetics

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The arts and sciences have often been treated as separate domains. However, a growing body of interdisciplinary research–particularly in the emerging field of neuroaesthetics–is beginning to bridge the divide by using scientific tools to explore artistic phenomena. Dance offers a unique avenue for researchers interested in the intricate connections between cognition, embodiment, and movement expertise. New methodologies in neuroscience have enabled researchers to examine the neural mechanisms underlying both the production and perception of dance. This vein of research falls into the realm of neuroaesthetics, which aims to explore the neural underpinnings of aesthetic experience, perception, and judgment. The human action observation network (AON), which supports our ability to understand and imitate other's movements, plays a central role in this process and is strongly modulated by movement expertise. This review synthesizes research on how the brain and body produce and perceive dance, contributing to a deeper understanding of the neural basis of artistic expression, embodiment, and aesthetic experience..

Keywords: Dance, neuroscience, neuroaesthetics, action observation, embodiment

Introduction

Our bodies and minds are constantly in conversation, each influencing and responding to the other in a dynamic exchange of signals and sensations. In the realm of dance, this ongoing dialogue between bodies and minds takes center stage, as dancers use their bodies to create meaning through movement. This interplay exemplifies embodiment—the integration of mental, emotional, and physical processes through the lived experience of the body. Unlike other complex physical activities, such as sports, dance requires not only technical precision but also expressive depth and stylistic nuance. Dance transcends cultural boundaries, uniting people from diverse backgrounds in an amalgamation of various dance styles. While these styles differ in form and tradition, they share a common foundation: experienced dancers are movement experts. They are masters of physical control, exhibiting exacting precision, beauty, and athleticism through embodiment.

At the heart of dance-neuroscience research lies a fundamental inquiry into the neural processes that govern motor control, sensory integration, and emotional resonance during dance performance and observation. The following is a review of the existing literature on the brain of the dancer and the brain of the dance-observer. This review examines the literature on how exactly the brain coordinates with the body to produce embodied, aesthetic movement, in addition to the neural mechanisms of how people subjectively process and perceive dance. This emerging field of aesthetic processing is called neuroaesthetics and examines neural underpinnings of aesthetic experience, perception, and judgment (Chatterjee & Vartanian, 2014). New methodology and imaging techniques have allowed researchers to gain a more comprehensive understanding of this body-brain connection from a neurobiological standpoint. This review draws on peer-reviewed journal articles, focusing on studies relating to the neuroscience of dance, motor control, and aesthetic perception, identified through database searches (PubMed, JSTOR, Google Scholar) using keywords related to dance, embodiment, neuroaesthetics, and aesthetic perception. Inclusion criteria prioritized studies employing empirical methods (e.g., fMRI, EEG, behavioral analysis) while also considering theoretical and conceptual works that address neural, cognitive, and embodied aspects of dance.

How Do We Learn to Dance

Motor Activity Pathway

The basic pathway of motor activity is as follows: voluntary movement is planned in the premotor cortex and those instructions are projected to the primary motor cortex. From there, signals are sent to the muscles through the spinal cord (Brown & Parsons, 2008). Muscles contract and movement is produced. Sensory organs within the muscles then relay feedback to the brain, informing us of our exact spatial orientation—a process known as *proprioception*, or the perception of one's limbs in space (Konczak et al., 2009), which forms the foundation for understanding body positioning and movement.

This is the structure of voluntary movement that allows us to move our bodies though the world every single day. To become expert movers, dancers take this motor pathway to the next level through years of intensive practice, which not only enhances efficiency of movement, but precision in motor planning, proprioception, and sensorimotor integration.

The Human Action Observation Network

Dancers learn by doing, but they also learn by watching. They observe an action and simulate it. The human ability to integrate new movements through perceptual processing can be readily examined in dancers, whose ability to learn new movements and replicate them successfully is paramount.
ourselves, yourselves, and themselves (Trask, 1993).

Observational learning was first studied in macaque monkeys–where the discovery of mirror neurons, cells that fire both when an action is executed and observed, sparked major interest in how we understand others' movements (Rizzolatti & Craighero, 2004). While direct evidence of individual mirror neurons in humans is limited due to methodological constraints (Marshall, 2014), neuroimaging studies strongly support the existence of a comparable human system (Grezes & Decety, 2001; Rizzolatti, 2005). This network, often referred to as the mirror neuron system (MNS), activates during both action execution and observation and is thought to underlie abilities such as imitation, empathy, and action understanding (Gallese, 2001; Keysers & Perrett, 2004).

The action observation network (AON) expands on the MNS by encompassing a broader network of regions active during the observation of both familiar and unfamiliar actions, including those not part of one's own motor repertoire (Cross et al., 2009). While the MNS is closely tied to imitation and internal motor mirroring—activating brain areas as if the observer were performing the action themselves—the AON involves a wider set of processes. This includes motor resonance, which refers to the brain's automatic response to observed movement, as well as higher-level visual and cognitive interpretations of others' actions. Internal motor mirroring can be described as a simulation process, where your brain imitates the action internally. Motor resonance is an automatic reaction to movement, but your brain does not necessarily copy the movement. Figure 1 illustrates key components of the AON, particularly those involved in movement perception (Calvo-Merino, 2018). As shown in the figure, key components of the AON include the ventral premotor cortex (vPM) and dorsal premotor cortex (dPM), which play crucial roles in planning and stimulating motor actions. The superior parietal lobe (SPL) is involved in integrating visual and proprioceptive information, allowing for the spatial mapping of observed movement. The intraparietal sulcus (IPS) helps transform visual input into motor commands. The superior temporal sulcus (STS) is sensitive to biological motion and is involved in decoding meaning behind actions (Grafton et al., 1996; Buccino et al., 2001; Keysers & Perrett, 2004; Blake & Shiffrar, 2007; Acharya & Shukla, 2012). Together, these areas highlight the significant overlap between the AON and the neural pathways involved in the motor activity pathway.

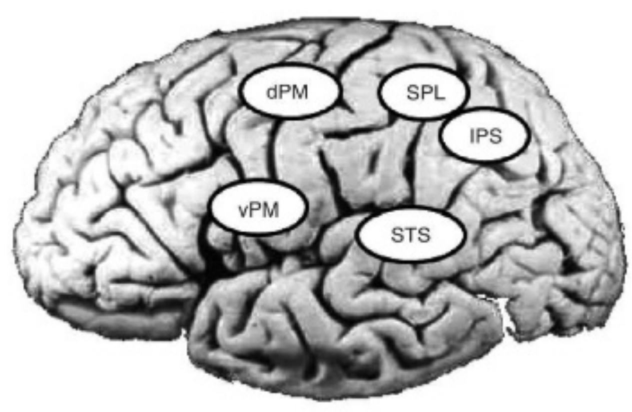


Figure 1: *Brain regions active in movement perception*

Figure 1 represents the AON: the areas active in movement perception.

These areas respond both during action execution and action observation (Calvo-Merino, 2018).

Note. vPM: ventral premotor cortex; dPM: dorsal premotor cortex; SPL: superior parietal obe; IPS: intraparietal sulcus; The function of the AON is well-understood, but questions remain about how this system adapts to different types of expertise. As an activity that demands complex motor control and extensive observational learning, dancers are a compelling population for examining the neural underpinnings of the AON.

What can dance tell us about the AON?

Dance training appears to modify and enhance the AON. The AON responds more strongly when dancers observe movement from their own style (Calvo-Merino, 2005). A study by Cross et al., 2009, investigated observational learning by training inexperienced dancers to perform dance sequences, while modulating the presence or absence of physical rehearsal. A strong correlation was evident between the neural areas activated during observational training (watched condition) and those engaged during physical learning (danced condition). Substantial AON activity was demonstrated both when participants underwent physical rehearsal or passive observation. Participants in the passive observation condition were not instructed to learn the movements to later perform, yet their ability to perform greatly benefited from the observation task. This study offers evidence in support of the formation of similar neural representations within the AON for movement sequences that have been physically rehearsed and those that have been passively observed (Cross et al., 2009).

Dance is a valuable model for studying the AON, but it is important to understand what distinguishes dancers from other groups. This helps clarify whether observed neural changes are specific to dance or reflect general effects of motor training. The next section examines how dance training shapes brain structure, function, and connectivity, highlighting how practice uniquely shapes the neural systems involved in dance.

What Sets Dancers Apart? Effects of Dance Training

Cognitive capacities including sensorimotor differences, memory, timing, and special learning methods have been shown to modify with dance training (Bläsing et al., 2012). Sensorimotor control is enhanced with dance training, and dancers exhibit better postural control and balance skills than non-dancers (Golomer et al., 1999; Rein et al., 2011). Expert dancers are able to control complex movement in part by optimizing motor synergies, efficiently combining movements in a way that reduces energy costs and muscle tension (Lepelley et al., 2006). This also functions to increase their accuracy of repeating complex movements and trajectories. Dance training is even said to alter the balance of sensorimotor control, shifting dominance from visual reliance to proprioceptive input (Golomer & Dupai, 2000). Golomer and Dupai found that dancers relied more heavily on proprioceptive feedback than non-dancers, particularly when visual information was limited. Dance training enhances the internal sense of body positioning, recalibrating the body's different sensory systems. Bläsing et al., 2012, compared dancers and non-dancers in static and dynamic equilibrium tasks: maintaining balance while the body is stationary, compared to maintaining balance while the body is in motion (while turning, jumping, etc.). Dancers out-performed non-dancers at dynamic equilibrium tasks, but not static tasks. This points to multimodal integration for dynamic equilibrium tasks, suggesting a task-specific training influence of dance on dynamic balance (Bläsing et al., 2012). Another study compared semi-professional dancers—individuals with advanced training and regular performance experience but who do not rely solely on dance for their income—in their ability to keep timing in a four-minute piece while modulating the presence of musical accompaniment, finding only a 5% difference in movement timing with or without music (Stevens et al., 2009). The ability to time movement correctly is modulated by motor expertise, with better and more accurate synchronization for familiar movements amongst professional ballet dancers (Honisch et al., 2009). Additionally, dancers show increased connectivity in cortico-basal ganglia motor learning loops compared to non-dancers, which are involved in the control of body posture, movement, and action selection (Nambu, 2004; Li et al., 2015).

In relation to learning and memory, dancers demonstrate an increased encoding ability of movement items compared to non-dancers (Smyth & Pendleton, 1994). In this study, participants were asked to observe and later reproduce two types of movement sequences: familiar ballet movements and unfamiliar "nonsense" movements—arbitrary gestures that do not belong to any known dance vocabulary. Despite the lack of familiarity or meaning in the nonsense movements, dancers exhibited longer memory spans for both ballet and nonsense movements. Dancers' movement memory is not limited to their trained style, but extends to novel, arbitrary movements as well, suggesting that dance training enhances a domain-general ability to encode, retain, and reproduce complex movement patterns, even in the absence of familiar structure or meaning. To better encode their movement, dancers often employ a variety of techniques. One of these strategies is called "marking," and involves rehearsing the dance with reduced energy expenditure, indicating body movements with the hands (Bläsing et al., 2012). These types of techniques aid in recall and serve as mental imagery cues amongst expert dancers, facilitating increased learning and memory.

Having explored some of the unique neuroplastic effects of dance training, it is evident that dancers possess distinct cognitive and motor abilities shaped by years of practice, suggesting that expertise not only alters motor execution networks, but also perceptual and integrative processes associated with action understanding. To examine how expertise shapes the AON more broadly, the following section examines the effects of movement expertise via neuroimaging studies.

Experience-Dependent Plasticity: Influence of Movement Expertise on Action Observation

A study was conducted establishing the influence of motor expertise on the AON (Calvo-Merino, 2005). This study used fMRI, measuring the brain activity of participants while they watched an action that they had learned to do and an action they had not. The participants were expert ballet dancers, expert capoeira dancers, and non-experts. When expert dancers observed movements in the style they'd been trained in, the researchers found greater bilateral activations in the premotor cortex, intraparietal sulcus, right superior parietal lobe, and left posterior superior temporal sulcus compared to when watching movements they were not trained in– all of which areas are associated with the action observation network. These findings indicate evidence that the AON has the ability to combine observation of other's actions with one's own personal motor repertoire and expertise (Calvo-Merino et al., 2005). The research suggests that the AON is equipped to differentiate between styles of dance, indicating sensitivity to abstract movement organization. Although all participants in the study were exposed to identical actions, the mirror regions of their brains exhibited distinct responses based on their ability to perform those actions, implying experience-dependent tuning of the AON.

A 2006 study by Cross et al. also examined the effects of dance expertise on the AON in relation to dancer's ratings of their own ability. In this study, ten expert dancers underwent weekly fMRI scans during the process of learning a 20-minute dance work entitled "Skylight" (Dean, 1982). During the scan, dancers were instructed to watch short dance clips (half were Skylight choreography, half were unrehearsed but similar movement), and *imagine* themselves performing the choreography. At the end of every short clip, the dancers rated how well they believed they could perform the material. Participants completed this task each week over the course of the six-week rehearsal period. The results were the following: the further in the rehearsal process, the more dancers rated their own ability to perform the rehearsed material, but not the unrehearsed material. This correlated with increased brain activity when the dancer imagined performing movement that they had physically embodied. Two regions of the brain were identified as modulatory as a function of the dancer's ratings of their own ability: the inferior parietal lobule and the left ventral premotor cortex, which the authors nicknamed 'the seat of embodiment.' Cross et al. found that the observation and internal simulation (imagination) of dance by dancers caused activation in regions of the brain classically associated with action simulation and action observation, with higher activation for movement they had physically embodied (2006).

Experience-dependent plasticity highlights how the AON is shaped by motor expertise. To deepen understanding of how the brain engages with dance, it is necessary to turn to the domain of neuroaesthetics, which examines the cognitive and emotional mechanisms underlying the aesthetic experience.
methodologies.

Neuroaesthetics

Although still in its infancy, the field of neuroaesthetics—coined by Semir Zeki in the late 1990s (Zeki, 1999)—has attracted the attention of neuroscientists, psychologists, artists, and philosophers worldwide. Research in neuroaesthetics seeks to understand and scientifically examine the complexity of aesthetic experience from a neurobiological perspective.

While neuroaesthetics represents a recent scientific approach to understanding aesthetic experience, the study of aesthetics itself has a rich history dating back centuries. The early British empiricist, Edmund Burke, was one of the first to put forth an explicitly physiological explanation for aesthetic experiences. He connected themes of sublimity and beauty to biological mechanisms of pain and pleasure (Burke, 1757/1948). In contrast, Immanuel Kant, writing later in the 18th century, famously rejected any associations between aesthetic experience and bodily sensation through his transcendental perspective (1790/1987). Consequently, any emerging conceptual link between physiology and aesthetics was ignored until later in the 19th century, as noted by Moore, 2002. With the development of Darwin's theory of natural selection (1859/2009), some began to argue that human capacity for aesthetic appreciation stemmed from sexual selection, implying a functional basis rooted in neural reward systems, a return to earlier ideas linking physiology and aestheticism. These exciting developments in neuroaesthetic ideas were soon eclipsed, this time by the rise of behavioral psychology, in which the study of human cognition was reduced to observable behavior. A psychological approach to aesthetics regained momentum towards the end of the 20th century, supported by the rise of neuroimaging technology and new methodologies for studying the brain. Now, it is believed that a dynamic interaction of various cognitive processes, including perception, memory, decision-making, reward, and emotion is involved in the appraisal of aesthetic experience (Kirsch et al., 2016). While non-invasive neuroimaging techniques like EEG have existed for decades, recent advances in imaging resolution and analysis have revolutionized the field by enabling scientists to study brain changes specifically during aesthetic experiences—an area of research that has only gained attention in recent years.

An Evolutionary Perspective of Aesthetic Appraisal

One influential theory is that the neural network that allows us to appreciate art evolved from a fundamental biological system for evaluating the importance of objects in our environments. Brown et al. 2011 argue that the neural circuits activated during the aesthetic evaluation of art significantly intersect with circuits responsible for assigning value to various evolutionarily significant stimuli, including the attractiveness of a potential mate or the desirability of food. They argue that aesthetic judgement may have provided reproductive or survival advantages. From this perspective, aesthetic judgement may have emerged as a repurposing of neural mechanisms originally designed to support adaptive decision-making. Kirsch et al., 2016 agrees with this, suggesting that our ability to evaluate artistic works is grounded in the same neural processes that allow us to make biologically-adaptive decisions. The theory has strong explanatory power in that it connects aesthetic experience to well-established, evolutionarily conserved brain systems. It offers a biological understanding of how art can evoke powerful emotional responses in us, by framing it as an extension of survival-based valuation. One limitation of this view is that it may oversimplify the aesthetic experience by inherently tying it to survival. Artistic expression is complex and often involves symbolism and cultural knowledge, which may extend beyond the explanatory reach of valuation assignment alone. Nevertheless, this theory remains relevant to current neuroaesthetics research, particularly its emphasis on reward processing, a core theme in understanding how the brain engages with art. While the evolutionary perspective emphasizes the adaptive value of aesthetic judgement, contemporary neuroscientists build on this framework, seeking to map the specific neural correlates underlying aesthetic appraisal.

Neural Correlates of Aesthetic Experience

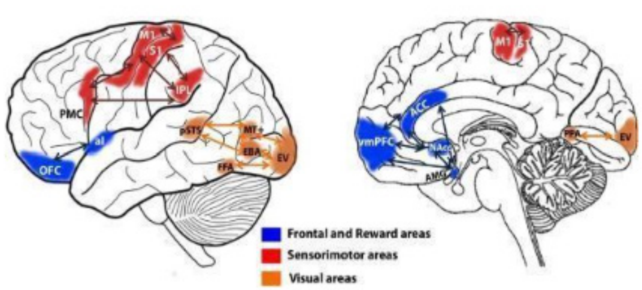
Chatterjee and Vartanian (2014) propose a neurological framework for studying aesthetic experience, conceptualized as an *aesthetic triad*: a link between three core neural systems involved in aesthetic processing. This model links the emergence of aesthetic experience to the interaction between three neural systems: sensory-motor processes, emotion-valuation, and meaning-knowledge. This view suggests that aesthetic experience arises from the interactions between these systems, rather than activity from a single brain region.

Kirsch et al., 2016 builds on this framework with neuroimaging data. Figure 2 is a representation of the neural circuitry involved in aesthetic judgment tasks (Kirsch et al., 2016).

Figure 2: *Neural circuitry implicated in aesthetic evaluation.*

The reward processing system– the orbitofrontal cortices, ventromedial prefrontal cortex, anterior cingulate, amygdala, anterior insula, and nucleus accumbens– is consistently implicated in the appraisal of aesthetic experience (Nadal et al., 2012; Chib et al., 2013; Cattaneo, 2019). Kirch's model also elaborates on the sensorimotor system, demonstrating involvement from the primary motor cortex, somatosensory cortex, inferior parietal lobule, and premotor cortex (Kirsch et al., 2016). These areas are involved in embodied responses and perception, aligning with the sensory-motor branch of the aesthetic triad. Finally, the visual areas– including the extrastriate body area, motion integration area, early visual cortex, parahippocampal place area, and posterior superior temporal sulcus– contribute both perceptual and contextual information, an overlap between the sensory-motor and meaning-knowledge domains of the triad.

Neuroaesthetics in Dance Observation



This field aims to explore the neural underpinnings of the artistic experience, which includes not only the artist, but crucially, the artist's observer. By examining the neuroaesthetics of dance observation, we ask the question: what neural mechanisms underlie the observer's capacity to perceive the beauty and artistic expression in dance? Jola et al., 2012 identifies two approaches as ways to investigate the experience of watching dance: phenomenological and neuroscientific. The phenomenological approach explores the subjective experience of watching dance, while the neuroscientific approach focuses on the physical brain changes that occur while viewing dance. There is a case to be made for marrying these two approaches to gain a more holistic understanding of the viewer's experience of dance (Jola et al., 2012). A combination of approaches to these questions can reveal much about a viewer's perception of art and the underlying neurophysiological changes associated with that perception.

Dance Observation by the Non-Dancer.

There is no complete explanation of why we like to watch dance, nor can an appreciation for an art form be reduced to quantifiable measures. However, research on human movement perception has vastly improved in recent years, illuminating aspects of what makes dance an enriching audience experience (Orgs et al., 2018).

Kirsch et al. (2015) investigated how motor familiarity influences aesthetic appraisal by having participants train over four days on different sets of dance sequences. Each day, participants physically rehearsed one set, passively watched a second, listened to the music of a third, while a fourth set remained untrained. Functional MRI scans and self-reported affective and physical ability ratings were collected both before and immediately after the training period. The study found that participants reported higher liking and perceived ability ratings for sequences they had physically practiced or passively observed compared to untrained sequences. Crucially, increased enjoyment ratings for these dance stimuli were associated with greater activity within the AON. Specifically, brain regions such as the nucleus accumbens, parts of the thalamus, bilateral superior temporal, and right middle temporal gyri showed heightened activation when participants rated movements as most aesthetically pleasing. Similarly, Cross et al. (2011) reported increased activity in the parietal portions of the AON corresponding with greater enjoyment during observation of dance.

One study investigating this question asked non-dancer participants to watch videos of dance performance and rate their enjoyment of the piece and their ability to perform the movements. Participants reported higher enjoyment of movements that they rated as more difficult for them to perform, compared to movements they rated as easier (Cross et al., 2011). Essentially, the *less* the observer could perform the action being performed, the *more* they enjoyed watching it. This finding, nicknamed the 'Cirque du Soleil Effect,' stems from the idea that we enjoy watching awe-inspiring, difficult movements because they are impressive. High physical skill made seemingly effortless is an ability few can achieve, and many like to watch. Employing findings about the AON would remind us that in the instant we watch other people perform an action, the same action is simulated in our own minds. Therefore, when we watch dance being performed, our minds simulate that same mesmerizing, awe-inspiring, beautiful movement.

Decades before the discovery of a human mirror-neuron system, *The New York Times* dance critic John Martin wrote this on the experience of watching dance: "We shall cease to be mere spectators and become participants in the movement that is presented to us, and though to all outward appearances we shall be sitting quietly in our chairs, we shall nonetheless be dancing synthetically with all our musculature" (Martin 1939/1965).

His notion of "dancing synthetically" has inspired thinkers to come up with a new term: *kinesthetic empathy* (Reynolds & Reason, 2012). It refers to the feeling many experience while watching dance: that they themselves are participating in the dance, feeling movement sensations and emotions (Jola et al., 2012). In one study investigating this, Jola and colleagues connected kinesthetic empathy with spectators' pleasure in watching dance. They combined participants' subjective reports of dance performance with measures of cortical excitability, and found increased enjoyment of a dance piece associated with greater kinesthetic and empathetic engagement (Jola et al., 2012).

Aesthetics and Expertise

Similar to the context of movement production, plasticity plays a role in movement perception– our understanding and appraisal of art is influenced by our expertise and training. In addition to the previously discussed motor and mirror system regions (premotor cortex, intraparietal sulcus, superior parietal lobe, and posterior superior temporal sulcus), the Calvo-Merino et al. (2005) study also reported activations in areas more traditionally associated with emotion, reward, and social cognition. The ventromedial frontal lobe, anterior/middle and posterior cingulate, and parahippocampal gyrus were also found to be influenced by dance expertise, with heightened activity when expert dancers observed movements in the style they'd been trained in (Calvo-Merino et al., 2005). The activity in the ventromedial frontal cortex is routinely associated with emotional processing, particularly with rewarding or pleasurable stimuli (Steele & Lawrie, 2007; O'Doherty et al., 2003). It stands to reason that expert dancers might derive increased enjoyment from observing their own dance style compared to non-experts. When observers perceive actions as "meaningful" rather than meaningless, the parahippocampal gyrus exhibits heightened activity (Decety et al., 1997). Moreover, the parahippocampal gyrus has been implicated in regulating social behavior/engagement (Decety & Chaminade, 2003, as cited in Calvo-Merino et al., 2005). This suggests that expert dancers derive increased social resonance and a more personal relevance when watching movement from their own stylistic repertoire.

These dance expertise effects on observation also extend to the visual system. When viewing a dance film, the eye movement fixation time of dance experts were much shorter than non-dancer observers, suggesting an enhanced visual processing speed as a result of experience (Stevens et al., 2010).

Methodological Challenges; Future Directions

It is essential to acknowledge the inherent complexities and nuances involved in studying the intersection of dance, neuroscience, and aesthetics. There are significant challenges in studying the experience of dance viewers, as modern neuroimaging does not yet allow for comprehensive study during real-life dance events. The way many researchers have studied the observation of dance involves showing participants sequences of abstract clips of movement that only last a couple seconds, and it can be argued that this is merely a snapshot of the dance viewing experience (Jola et al., 2012). In actual practice, a dance

Additionally, there is a complication of "liveness" in dance– no two performances are ever the same and that is part of the beauty of the art form. Examining the experiential, ephemeral aspect of observing dance in a naturalistic setting presents significant challenges. How will researchers reconcile the nature of subjective dance viewership experience with current methodology limitations for studying underlying neurophysiological changes? Future research could explore this through new methodological approaches, including the use of real-time neuroimaging techniques during live performance. This could provide insight into real-time neural responses while overcoming some of the spatial limitations of traditional brain imaging. Integrating wearable devices could also address this limitation, including ones that measure heart rate variability, skin conductance, etc. This could provide a more holistic view of the observers' physiological responses, a complement to neuroimaging data. The devices could be comfortably worn by participants, allowing researchers to take continuous measurements without disrupting the flow of live performance. As real world performance can be difficult to replicate in a lab setting, integrating immersive technologies, like virtual reality, could allow researchers to create more realistic dance viewing experiences. Variables could be manipulated within a virtual reality world, such as dancer-audience proximity and audience interaction.

Finally, with the rise of artificial intelligence, there is interest in exploring authentic biological motion in non-biological agents, to enhance the naturalness of humanoid robots. Robots are being increasingly tasked with human interaction in complex fields, including healthcare and education. Achieving authentic biological motion will help robots feel more natural and approachable. As robots become more integrated into human life, the aesthetics of their movement could shape the landscape of human-robot interactions.

Conclusion

Dance offers a unique vantage point on the profound impact of movement and aesthetics on our cognitive and emotional faculties. The brains of dancers are altered from years of expert training, demonstrating changes in cognition, motor control, somatosensation, learning, memory, perception, and motor simulation. Based on the research reviewed here, there are compelling new insights in the field of dance-neuroscience and neuroaesthetics. This research will encourage multidisciplinary research across neuroscience, psychology, and the arts. It will bolster our understanding of the cognitive and emotional dimensions of the artistic experience, promoting a deeper appreciation of dance and related art forms. Additionally, it may support the exploration of dance as a therapeutic modality, offering insights into dance's neurological and psychological benefits. For dancers and choreographers, these findings could enrich their understanding of how audiences perceive and respond to movement. Ultimately, this line of research promotes a more comprehensive understanding of how our moving bodies and brains work together to shape human artistic expression. Further developments in this field will not only enrich appreciation of dance as an art form, but provide broader insights into the human mind and its profound ability to create art that moves people.
available to children in their environment and their language acquisition (Rivero, 2012).

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