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Ensayo Académico

Can a Robot Become a Dancer? Perspectives on Dance, Art, Technology, and Electromechanical Autonomous Machines

¿Puede un robot convertirse en bailarín? Perspectivas sobre danza, arte, tecnología y máquinas electromecánicas autónomas

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Abstract: This essay examines whether humanoid robots are truly capable of dancing, as claimed by high-tech robotics companies, or whether what is presented is merely the mechanical execution of steps and codified stereotyped movements lacking the historical, cultural, and expressive dimensions that characterize artistic practice. Drawing on a historical-critical perspective, the essay discusses how the reduction of movement to technical performance tends to reinforce a highly limited model closely associated with physical and sports training. These reflections incorporate contributions from authors such as Isadora Duncan, Marcel Mauss, E. H. Gombrich, and the contemporary French dancer and essayist Dominique Dupuy in order to argue that dance is fundamentally rooted in lived experience, imagination, embodiment, and traditions transmitted through the human body and the vivid presence of the master. Ultimately, the essay questions the limits of artificial intelligence and robotics in the creation of artworks in general, and in dance performance and choreography in particular, while emphasizing the irreducibly human dimensions of dance as a poetic language.

Keywords: Dance, robotics, artificial intelligence, human body, technology

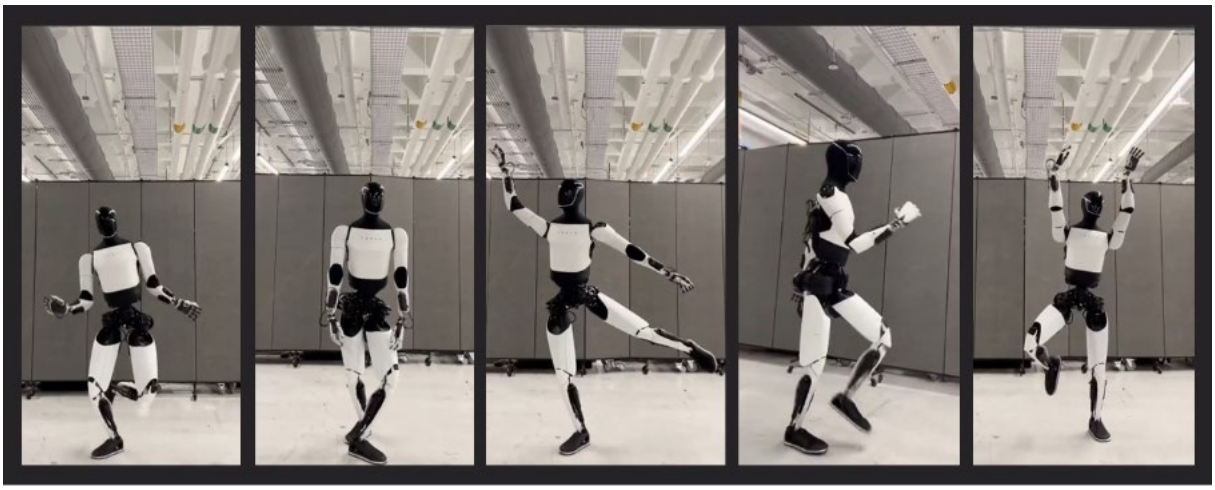
Resumen: Este ensayo examina si los robots humanoides son realmente capaces de danzar, como afirman las compañías de robótica de alta tecnología, o si lo que se presenta no es más que la ejecución mecánica de pasos y movimientos codificados y estereotipados, desprovistos de las dimensiones históricas, culturales y expresivas que caracterizan toda práctica artística. A partir de una perspectiva histórico-crítica, el ensayo discute cómo la reducción del movimiento al rendimiento técnico tiende a reforzar un modelo extremadamente limitado, asociado al entrenamiento físico-deportivo. Estas reflexiones incorporan aportes de autores como Isadora Duncan, Marcel Mauss, E. H. Gombrich y el bailarín y ensayista francés Dominique Dupuy, con el fin de sostener que la danza se encuentra fundamentalmente arraigada en la experiencia vivida, la imaginación, la corporeidad y las tradiciones transmitidas a través del cuerpo humano y de la presencia viva del maestro. Finalmente, el ensayo cuestiona los límites de la inteligencia artificial y de la robótica en la creación de obras de arte en general, y en la performance y composición coreográfica en particular, al tiempo que subraya las dimensiones irreductiblemente humanas de la danza como lenguaje poético.

Palabras clave: Danza, robótica, inteligencia artificial, cuerpo humano, tecnología.

PROLOGUE

On 14 May 2025, Tesla's YouTube channel released a short video featuring the humanoid robot Optimus Gen 2, mimicking dance steps drawn from ballet, tap dance, and disco — a 41-second clip composed of six direct cuts (figure 1). We cannot be certain whether the footage is real or computer-generated imagery (CGI), but this uncertainty is ultimately irrelevant. The very prospect of a robot mimicking dance raises a series of unsettling questions: Can a robot learn to dance? Can a robot become a dancer? Is it possible for a robotics engineer to create — or program — a choreography? Can a robotics engineer who codes a robot to dance be regarded as an artist? Can a robot teach the subtleties of dance? Is dancing merely a mechanical combination of steps that high-tech machines can easily reproduce? Moreover, more fundamentally, what is the purpose of the art of dancing? Let us investigate.

Figure 1 – Tesla's Optimus Gen 2 mimicking dance steps



Note. Screenshot from Tesla's YouTube Shorts video Me in my room at 3am (Tesla, 2025).

On the Uncertain Origins of Robotics

Humanity has always been fascinated by technology and machines. In Western tradition, the Greek Pythagorean philosopher and mathematician Archytas of Tarentum (around 430 BCE) designed what is considered the first prototype of a mechanical being: a steam-powered pigeon that supposedly flew up to 200 meters, propelled by a pressurized air jet (Huffman, 2005).

Eighteen centuries later, Leonardo da Vinci, among his numerous and remarkable projects, designed a mechanical knight in armor with freely movable joints — ankles, knees, hips, fists, elbows, shoulders, neck, and jaw — which modern robotics engineers have since explored with great enthusiasm (Bucolo et al., 2020).

Two earlier inventions also deserve mention: Jacques de Vaucanson's celebrated Flûteur mécanique [The Mechanical Flute Player] (1737), an automaton capable of simulating human breathing and instrumental performance, and the mechanical soldier attributed to Friedrich Kaufmann (c. 1810), a clockwork automaton designed to reproduce disciplined martial movement.

Despite the brilliance of these machines, the desire to build something more alive, and endowed with a degree of autonomy, was satisfied only in fictional literature, most notably in Karel Čapek's play R.U.R.

(Rossum's Universal Robots), in which the term robot — from the Czech robota, literally "forced labor" or "forced worker" — entered world literature for the first time.

The play portrays a futuristic society in which robots become central to economic and industrial production, until they eventually revolt against humans and exterminate almost all of them. Only the architect, Mr. Alquist — a stout, kindly old man who has spent his entire life as head of the Works Department at the R.U.R. factory and whom the robots hold in special regard — is spared; the engineer, the psychologist, and the scientist (a physicist) are killed without mercy.

It appears that a deep-seated fear — still very present and powerful — accompanies this fascination with technology and machines: the fear of being annihilated by our own creations, particularly by "manufactured workmen, living automata, without souls, desires, or feelings." (Čapek, 1923, p. 3).

This deep-seated fear does not come from any unconscious ancestral memory of early Homo sapiens struggling to survive in a hostile and ferocious prehistoric environment. Instead, it has been culturally manufactured by the modern film industry, from Fritz Lang's iconic Metropolis (1927) to Ridley Scott's cult classic Blade Runner (1982).

Between these two landmarks, at a considerably lower aesthetic level, Hollywood consolidated the trope through productions such as The Day the Earth Stood Still (Robert Wise, 1951) and Forbidden Planet (Fred M. Wilcox, 1956), followed by countless commercially driven blockbusters built upon the familiar formula of technological menace, extreme violence, and spectacular destruction.[1]

More than a century after Čapek's play was first staged at the National Theatre in Prague, the idea of humans and living automatons coexisting on the planet no longer belongs to the realm of speculative fiction and is on the verge of becoming a historical reality. This process began forty years ago with Honda Motor's foundational research and development in humanoid robotics, aimed at creating an autonomous bipedal walking machine capable of assisting individuals and serving practical functions in society (Hirose & Ogawa, 2007).

From 2018 onward, Honda redirected its efforts toward more pragmatic robotics and mobility solutions with commercially viable applications, thereby leaving room for other companies to dominate this field. It is interesting to note that ASIMO, Honda's most emblematic robotic project, after eighteen years of captivating public demonstrations, was forcibly retired (Shigemi, 2019).

Dance and Digital Technology

Art is not science; an artist is not a scientist. Nevertheless, like scientists, artists are constantly seeking analytical — though different — ways to refine their poetic language. Likewise, artists are deeply engaged in forms of research that involve the exploration of new materials, new tools, new methodologies, as well as new possibilities for data collection, energy management, and control systems.
Polymaths such as Leonardo da Vinci, Buckminster Fuller, Ernst Haeckel, and Goethe never established a rigid boundary between art, science, and technology, because, in a fundamental sense, such a separation is neither possible nor fruitful. Briefly, artists and scientists have historically maintained a profound — sometimes even obsessive — relationship with technology.

It is worth recalling that *technology*, according to The Oxford English Dictionary (1966), derives from the ancient Greek *techné* (art, craft) and *lógos* or *logía* (word, study). In its original sense, *technology* designates a

[1] For instance, *The Terminator* (James Cameron, 1984), *I, Robot* (Alex Proyas, 2004), the remake of *The Day the Earth Stood Still* (Scott Derrickson, 2008), *Ex Machina* (Alex Garland, 2014), and *Subservience* (S. K. Dale, 2024).

"scientific study of the arts" (The Oxford, 1966, p. 906) or "a systematic treatment of an art, craft, or technique" (Etymonline, 2025). In summary, *technology* refers to the reflective knowledge and processes involved in creating objects or artifacts for practical or aesthetic purposes.

In dance historiography, this *systematic treatment* is widely evident, from Bharatanatyam to classical ballet, from Martha Graham's technique to Ankoku Butoh, and throughout the diverse field of contemporary dance. This idea links to the notion of "techniques of the body" conceived by the French anthropologist Marcel Mauss in the mid-1930s. This notion refers to the culturally learned, socially transmitted, and historically situated ways in which human beings use their bodies. For Mauss ([1936] 1973), the body is humanity's first technical object, and its primary means of technical expression.

On the other hand, if we intend to discuss dance technology — or dance techniques — beyond the logic of artisanal production, and to examine its relationship with digital and computerized technologies in contemporary stage creation and their influence on bodily gesture and movement, we must turn to key figures of contemporary dance. Among them, Merce Cunningham occupies a decisive position: since the late 1980s, he was among the first choreographers to employ digital technology as a direct creative tool for the generation of movement itself.

Throughout his career, Cunningham has consistently incorporated technology into his work, from early experiments with television and video to the use of computers, body sensors, and motion capture technology (Randel, 2019). As reported by Thecla Schiphorst (1997), one of Cunningham's major collaborators, one of these tools — the *LifeForms* software, which she co-developed — enabled him to sculpt, animate, and choreograph dance in entirely new ways.[2]

With *LifeForms* (later renamed *DanceForms*), Cunningham reimagined his understanding of the human body and pioneered the use of computers as choreographic tools, as evident in his work BIPED[3], premiered in 1999. This software could model and animate the human form, allowing Cunningham to visualize sequences and phrasing of dance directly on the screen and then translate them into a dancer's body.

From Digital Simulation to Robotic Performance

Cunningham's works opened new horizons for many artists and choreographers, including Philippe Decouflé, who developed a close relationship with this world of computer-generated human figures on the screen. As he himself stated: "Technically, it was Merce Cunningham who taught me the most about dance. In New York, I attended his video workshops — fascinating" (Decouflé, 2025). However, a new conceptual shift was already in gestation: the idea of bringing machines onto the stage to interact directly with human dancers.

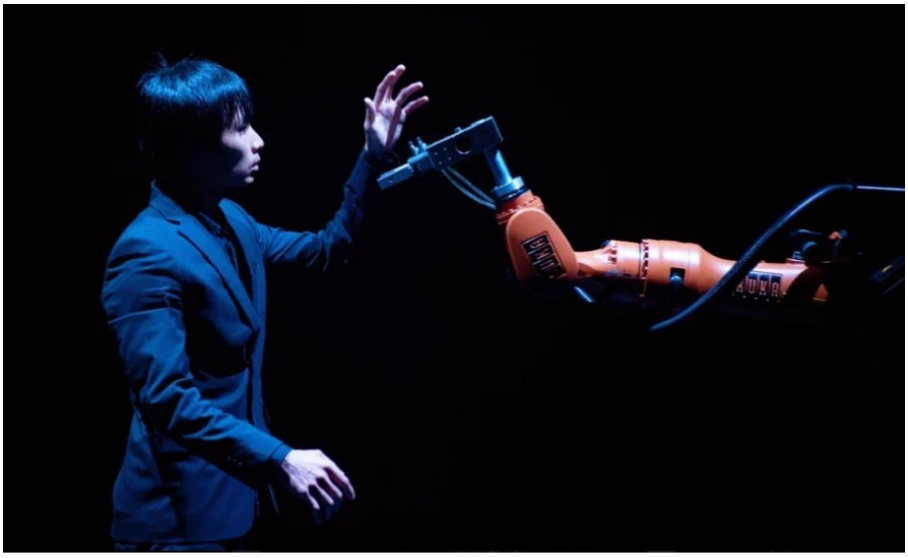
A milestone in this process can be identified in *Huang Yi & KUKA* (2015), an iconic duet between a human performer — embodied by the Taiwanese choreographer, dancer, and visual artist Huang Yi —, and an industrial robotic arm developed by KUKA, a German company specialized in industrial robotics (figure 2). In his remarkably precise performance, Huang Yi succeeds in humanizing the machine, figuratively speaking, by unfolding multiple layers of expressivity and emotion, and by exploring the full choreological potential of the KUKA robotic arm.[4]

[2] Almost thirty years ago, in 1997, we had the opportunity to participate in a roundtable in France, where Thecla Schiphorst, together with her collaborator Susan Kozel, explored the limits and possibilities arising at the intersection of dance, the body, and technology (Group Bernard Tapie, 1997).

[3] A detailed review of this work is available in Abouaf (1999).

[4] An excerpt from the performance can be viewed in Huang Yi (2016) as well as in TED (2017).

Figure 2 – Scene of the performance *Huang Yi & KUKA*



Note: Screenshot from TED video A human-robot dance duet (TED, 2019)

The idea of considering the robot as the central figure of an artistic performance finds a powerful expression in the kinetic sculpture *Can't Help Myself* (2016), created by the Chinese conceptual artists Sun Yuan and Peng Yu and commissioned by the Guggenheim Museum (Figure 3). This work consists of a robotic installation in which an industrial arm obsessively attempts to contain a spreading pool of red liquid, evoking themes of control, labor, violence, and the tragic futility of automated discipline.

Figure 3 - The kinetic sculpture *Can't Help Myself*



Note: Guggenheim Museum (2017).

Within the evolution of robotics engineering, humanoid robots have begun to materialize the human imaginary first seeded by Čapek's R.U.R. and, unexpectedly, have even started to execute dance-like movements.

Dancing Humanoid Machines for Sale

During the global lockdowns brought about by the COVID-19 pandemic, several high-tech companies intensified their investment in research on humanoid robotics. Tesla (USA), Figure AI (USA), 1X Technologies (Norway/USA), Apptronik (USA), Agility Robotics (USA), Unitree Robotics (China), and UBTech (China) have since emerged as leading companies in this field.

Among the projects that combine artificial intelligence with advanced autonomous capabilities, one may single out Apollo (Apptronik), Unitree H1 and Unitree G1 (Unitree), Figure 3 (Figure AI), Digit (Agility Robotics), Walker S (UBTech), and — most prominently for the present discussion — Optimus Gen 2 (Tesla).

Rather than producing dancing machines in an artistic sense, these companies seem primarily interested in using dance as a powerful marketing device. When companies such as Tesla showcase a general-purpose humanoid robot mechanically reproducing dance steps, this functions primarily as a marketing strategy, since dance is widely recognized as a highly sophisticated art form grounded in the mastery of movement. For a machine to execute dance steps with even minimal grace, coordination, and expressivity, it would have to attain an extraordinary level of technical and computational sophistication.

In fact, to produce a more spectacular impact on the public, companies are now increasingly focused on showcasing their humanoid robots executing basic movements drawn from sports, martial arts, and acrobatics. In any case, Optimus Gen 2 was not the first humanoid robot to mimic dance steps.

On the Chinese Lunar New Year's Eve broadcast on 28 January 2025 (Spring Festival Gala), sixteen Unitree H1 appeared on stage and mimicked a synchronized performance of a traditional Chinese folk dance known as yangge, alongside human dancers (Wong, 2025). The humanoid robots were received by the live audience with enthusiastic applause while executing leg-kicking movements, waist twists, and even spinning and tossing handkerchiefs — a signature and physically demanding element of yangge dance.

Some television journalists who commented live on the festival described the robots as "amazing dancers performing a kind of miracle [...] making huge advances in cultural and artistic arenas [...] they can follow the rhythms, they can move just like humans and are also capable of entertaining people as well" (CGTN, 2025). These statements, however, are highly exaggerated and lack any serious technical or aesthetic validation. Indeed, beyond the television spectacle — the high production values, costumes, lighting, and music — what we actually witness is a highly synchronized display of mechanically programmed movement patterns that remains far removed from the artistic expressivity traditionally associated with yangge dance.

From the perspective of Laban Movement Analysis (LMA)[5], the only clearly identifiable Effort quality executed by these Unitree H1 robots is the punch, characterized by strong weight, sudden time, direct space, and highly bound flow. It is also worth noting that the human dancers — all of them young women — appeared highly "robotic" as well, their movement closer to a rhythmic gymnastics routine than to a traditional folk dance. This kind of stylized treatment is quite common in contemporary folklorized reinterpretations of original traditional dances.

Only a few days after the beginning of the Spring Festival Gala, on 14 February 2025, Unitree's YouTube channel uploaded a video presenting its new generation of humanoid robots — the Unitree G1 — mimicking 1970s-1980s disco steps with noticeably more relaxed movements and a considerable increase in movement

[5] For a comprehensive introduction to LMA, see Bartenieff and Lewis (1980) and McCaw (2006).

plasticity when compared with Tesla's Optimus Gen 2 video discussed in the prologue. In this case, the Chinese company and several media outlets published a range of visual and analytical materials attesting that the footage was not generated through CGI. However, this search for such validation is ultimately as irrelevant as the uncertainty surrounding Tesla's video, released exactly ninety days after the Chinese company had published its own dancing humanoid footage.

All this discussion about robots pretending to dance by mimicking dance steps leads us to an emblematic statement by Isadora Duncan that almost every modern dancer has fully internalized:

> For me the dance is not only the art that gives expression to the human soul through movement, but also the foundation of a complete conception of life, more free, more harmonious, more natural. It is not, as is too generally believed, a composition of steps, arbitrary and growing out of mechanical combinations — which even if they serve well as technical exercises cannot pretend that they constitute an art. This is the means, not the end. (Duncan, p. 101, [1928] 1969, emphasis added).

Dance, like any other artistic language, is not an arbitrary assemblage of poetic material generated through mechanical combinations. However, contrary to Duncan's epiphany, many dancers and choreographers outside theatrical and academic environments still tend to understand dance simply as a mechanical composition of steps, framed within the metrical logic of counts — 1, 2, 3, 4, 5, 6, 7, 8 — which can easily be programmed by a robotics engineer, as we saw in the recent Chinese Spring Festival Gala, or by any AI dance tutor currently for rent. [6]

The Revival of the *Maître de Danse*

A considerable share of the responsibility for this historical misdirection of dance — which separates ordinary people from the immense potential of dance as a way of rethinking life and society — can be traced back to Louis XIV, the so-called "Sun King" and "king-dancer". He personally patronized the most notable maîtres de danse of his kingdom, Pierre Beauchamp and Raoul-Auger Feuillet, who systematized Baroque dances into an imaginatively impoverished and strictly codified technique. The resulting style often resembles robotic movements, far removed from the sense of expressive truth traditionally associated with dance [7]and carefully designed to conform to the social rules of the court — a world in which almost everything was, in fact, a staged illusion (Elias, 1983).

At this point, it is worth recalling Marcel Mauss to take a closer look at his arguments against the unnatural forms of ballroom dancing, or the so-called enlaced dances: "Lastly, we should realise that dancing in a partner's arms is a product of modern European civilization. This shows that things we find natural are, in fact, historical. Moreover, they horrify everyone in the world but ourselves" (Mauss, 1973, p. 82-83).

Today's humanoid robotics companies often claim that their machines can be taught to execute almost any dance, under the guidance of a reimagined, now artificial maître de danse. Instead of rehearsing in a real studio, the robot begins its training in a virtual one: a digital double of the machine monitors human dancers

[6] For instance, Dhime, Moveally, Dancio, HILFE AI, DanceSync, STEEZY, and Les Mills Dance, if workout-based movement can indeed be considered a form of dance.

[7] Martha Graham's emblematic statement that "movement never lies" points precisely to this understanding of dance as an embodied form of expressive truth (Graham, 1991).

through motion and video data and tries to imitate them inside a computer simulation. Using platforms such as NVIDIA Omniverse, engineers can test and refine these movements in a realistic, physics-based virtual world long before the robot is built. Only afterwards are these learned behaviors transferred to the physical robot — a process known as sim-to-real (from simulation to reality).

It is indeed a new paradigm for those interested in teaching and motor-learning processes, although it resembles far more a form of sports technical training than art education. However, as Gombrich reminds us, "the whole story of art is not a story of progress in technical proficiency, but a story of changing ideas and requirements" (1995, p. 25).

An approach focused mainly on optimizing physical performance risks forgetting that art, in general, and dance, in particular, are shaped above all by ideas, values, desires, emotions, and cultural demands, not by technique and physical abilities alone, guided by Coubertin's Olympic motto: Citius, Altius, Fortius [faster, higher, stronger] (International Olympic Committee, 2021).

The French dancer and choreographer Dominique Dupuy (1996) argued that, with the industrial revolutions, people lost contact with the land and became "human machines" who "have hardly any active contact with the elements, with matter, or even with gravity. In their daily lives they do less and less of the things that once linked them to the world" (Dupuy, 1996, p. 11). He also suggests that dance can be experienced as a bridge to recover a more humanized relationship with nature and with life itself.

For Dupuy, contrary to the pedagogical means of a maître de danse — whether human, avatar-like, or humanoid — the repository of the dance tradition lies above all in the body. Its knowledge and techniques are "transmitted by one-to-one contact between master and pupil [...] the unique instant of sublime pleasure when the core of a movement is communicated like a secret to a child or an adult" (Dupuy, 1996, p. 12).

A Final Question

All the arguments developed above regarding humanoid robots, dance, embodiment, art, creativity, and technology retain their critical force only to the extent that machines remain incapable of experiencing feelings and truly appreciating works of art. Otherwise, as Ridley Scott prophetically suggested in his masterpiece Blade Runner (1982) — and more recently as Marcus Shenn revisits in his sci-fi short film One Week with Rebecca (2021) — we may be approaching a threshold in which the presence of robots would no longer be confined to industrial or domestic labor, but would extend into the most intimate dimensions of human life, from artistic creation to love itself.

Let us reflect on the last words spoken by the highly advanced, bio-engineered combat-model replicant Roy Batty (Rutger Hauer), the primary antagonist of Ridley Scott's film, moments after compassionately saving the life of his greatest enemy from certain death: "I've seen things you people wouldn't believe. Attack ships on fire off the shoulder of Orion. I watched C-beams glitter in the dark near the Tannhäuser Gate. All those moments will be lost in time, like tears in rain. Time to die" (Movieclips, 2011).

Immediately after uttering his final line — whether consciously or not — the bio-engineered humanoid releases the white dove he had been carefully holding in his left hand, letting it escape upward into a sky thick with smoke and fog, where the light fractures against the city's high towers and the air itself seems to mourn.

Could a machine ever create a montage like this? That remains to be seen...

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