THE INTERFACE OF ARTIFICIAL INTELLIGENCE AND DANCE

HIGA, PAULA
DEPARTMENT OF THEATRE AND DANCE
THE UNIVERSITY OF VERMONT
BURLINGTON, VERMONT

The Interface of Artificial Intelligence and Dance

Topics/Areas: Arts, Dance, and Technology, Film, Performing Arts, Visual Arts, Artificial Intelligence, Digital Arts, Digital Performance

By

Prof. Paula Higa

_____

ABSTRACT

This paper examines technology through the interface of artificial intelligence and dance by addressing certain questions many artists ask themselves when integrating these two. How much technology is too much technology? How might we balance digital technologies as an integral artificial element in organic works while not overwhelming the integrity of a choreographic performance? Primarily, the focus of this document is to discuss digital art through the application of artificial intelligence in dance performance, more specifically through the processes and results of Machine Learning and Genetic Algorithms. The paper will also address historical references in digital performances.

1. Introduction

The turn of the twenty-first century solidified the relationship between humans and machines. And digital technologies have been lively in the performing arts field. Over the last decades, dance makers have been implementing technological capabilities to support creation, production, and overall performance enhancement. It is possible to find a myriad of computer software systems on the market such as Isadora, Dance Forms, and Style GAN (the latter will be discussed in this paper.) These programs offer artistic tools for creation, kinesthetic comprehension, virtual interaction, 3-D mapping, and so on. Choreographers like Merce Cunningham, Andonis

Foniadakis, Dawn Stoppiello, Yacov Sharir, Willian Forsythe, Karine Ponties are just a few artists within the vast scope of dance makers who took advantage of these new digital resources to bring together dance and cyberspace. Studies on the interface of organic (dance) and inorganic (technology) have been unraveling the nature of dance into other levels of performance experience, for both audiences and artists.

It is no surprise that the demand for and dependency on computer technologies have been increasing progressively over the last decades. Therefore, how is digital technology being received by the performing arts community? What is the position of art makers when technology versus "naturally" becomes a controversial debate? What can one say when creativity is no longer exclusive to human imagination? What happens when artificial intelligence becomes the art maker? Different opinions have been causing tension among art makers, choreographers, dance critics, and scholars.

Digital advances have helped humankind in the most diverse ways. Nevertheless, there are still concerns about this cybernetic evolution applied to the arts. Some of these discomforts reflect upon how art techniques are taught to machines and related questions regarding authorship. Who is the artist—the computer, or the person imputing the data into the program? Another point that is crucial within the digital art discussion is precision. Let's bring up the phrase coined by Alexander Pope 'To err is human, to forgive divine.' We know perfection is subjective, but what is the percentage of error when the artwork is generated through artificial intelligence? The reality is that in algorithmic programming the error can be practically null, which makes the creation extremely precise. Overall, this ongoing conversation on digital art validation will remain a dialog that may never end. The critical question here should not be the tension between machines and humans or if digital art is really art. Instead, I believe that we might focus on two

questions: who has the power to define what art is, and what are possible ways to humanize artificial intelligence's creation. An important strategy might be to develop artistic reasoning where both digital and non-digital artistries are equally subordinate to each other in the performance. This line of thought will be presented to the reader in the following pages of this paper through the examination of dance film where artificial intelligence and dance interface without overriding one another. Therefore, it is necessary to revisit the past to understand the cybernetic space where artificial intelligence and dance interface.

2. *Digital Performances: Past and Present*

Although the concept of cross-disciplinarity seems to be a contemporary trend in the global society, history shows that it is not that recent. This practice was already embedded in earlier societies through the interdisciplinarity of music and dance. In choreography, the ancestry of cross-disciplinary collaborations leads us back to the end of the nineteenth century. A pioneer in mixing dance and technology was the American choreographer, dancer, and scientist Loie Fuller, 1862 – 1928.

Known as *Fairy Electricity*, Fuller astonished Parisian audiences in 1892 by performing her famous *Serpentine Dance*. At that time, the use of visual art projections onto a dancer's body was ground-breaking. Fuller expanded her knowledge of electricity using a combination of lights and abstract movement in her performances. She transformed a huge silk skirt into a theatrical projection screen, manipulated by rods. She offered the viewer a multi-dimensional experience by projecting a constant play of Indigenous symbols or colors as part of the lighting effects. In an era when the dance was moving away from the aesthetics of ballet, Fuller's work was seen as innovative as well as one of the first digital performances of her time (Albright).

Fuller's avant-garde experimentation opened doors for possible ways to use technology in dance. Her influence still resonates over the centuries. In the early twentieth century, choreographer Alwin Nikolais, known as the "Father of Mixed-Media" worked toward new paths to integrate technology and dance (Louis and Nikolais X). In his early digital works, technology is used as a supplementary layer of imagery or as stage/visual effects. The transition from a supportive role to a protagonist (as essential as the dancer) occurred at the beginning of the twenty-first century when we saw choreographers creating more elaborative digital performances and not only using technology to project images. One of the choreographers at the forefront of this intersectionality between digital and dance was Merce Cunningham.

According to dance historian, Roger Copeland, it was in the '90s when the choreographer began to experiment with computer technology as a choreographic tool. "The software Dance Forms could model and animate the human form, allowing Cunningham to visualize sequences and phrases of dance on screen, which he would then translate to a dancer's body" (Cunningham). The use of technology was a powerful choreographic support for his early digital media works. In other words, the Dance Forms software learned how to produce a specific movement, which in this case, helped the dancers to understand Cunningham's ideas since he no longer could demonstrate movements due to aging. He then expands his digital dance research when integrating more motion capture software systems into his creations. The 1999 *Biped* is one of Cunningham's most notable digital works; a result of his collaboration with digital artists Paul Kaiser and Shelley Eshkar. In addition to the choreographer's movement signature, in *Biped*, we see a giant animated dancer sharing the stage with MCDC members. The piece also includes abstract digital images floating across the stage as well as geometrical patterns on the floor.

Some of the movements were digitally generated by DanceForms in a variety of sequences such as solo, duets, and trios (Cunningham).

Another pioneer in integrating technology in dance is the duo of choreographer Dawn Stoppiello and digital designer Mark Coniglio. For more than 25 years, Coniglio and Stoppiello have been creating hybrid performances where dance and technology are both the protagonists. Together, they founded Troika Ranch, a dance company that integrates dance, music, and Coniglio's award-winning interactive media software [Isadora](#)®. Over the years, the dissemination of this software has revolutionized the field of digital performance. There are countless possibilities for applying Isadora in the creative arc. From projection to lighting design to music composition to media playback and in particular as a real-time video interaction between dancers and caption of sound and motion. It is not a simple question of a dancer performing in front of a screen while images are being projected during the choreography. The software gives an agency to choreographers and dancers to create possibilities previously unimaginable, in real-time or not.

3. Generative Adversarial Networks (GAN) and Genetic Algorithms

As mentioned before, digital performances have been compelling contemporary choreographers for years now. This new approach can offer an immersive experience as it surrounds an audience moving around the space, within virtual reality environments, or even within a traditional proscenium theater with a seated audience. What seems to be a promising trend now is the interface between digital art and dance. This integration of natural and artificial creative work will be presented to the reader by examining the award-winning short dance film *The One I Wanted to Be* - USA version, which can be found on the Vimeo platform. The film was co-produced by digital media artist Jennifer Karson and me.

In 2020, during an informal meeting at her office, Karson presented her scholarship in Artificial Intelligence. The conversation involved technological languages such as Generative Adversarial Networks (GANs) and Genetic Algorithms. These models are commonly associated with Machine Learning processes and linked to Artificial Intelligence (AI). Overall, these kinds of generative software teach computers how to realize tasks through experience and improvement.

As the conversation continued, Karson suggested an interdisciplinary collaboration between us, in which dance and artificial intelligence could be artistically combined. The first idea was to produce a symposium on dance and technology, which was discarded due to the 2020 Covid-19 pandemic. Later, a new idea came our way. Since I was crafting a new choreography, I suggested a collaboration leading to the production of a dance film based on my aesthetics. Our challenge was to incorporate digital art into the film's narrative.

Karson presented a few digital images generated by artificial intelligence through StyleGan software. The visuals resembled geometric shapes, similar to Asian ideographic writings. The critical question was how could we give an objective or subjective meaning to those images? Could we associate the symbols with a major linguistic process or perhaps codify them? Stretching our critical thinking further, we went back to the origins of how those symbols were generated by StyleGAN. The generator model takes as input (encoder) a point from latent space (compressed data) and AI decodes it into an image. In our project, this input was a photo of one of the towers at the University of Vermont. The next step was to research the symbolism of towers and how digital art could play a dramatic role in film narrative. One of the possibilities was to bring the symbols into the physical realm. Using a 3D-model printing system, Karson created a series of wooden and polyurethane hexagons. Our goal was to humanize or de-objectify the object. The tower photo, metamorphized into an unknown symbol, was now the

P. Higa

representation of restriction of freedom, control, incarceration, and even, patriarchal power. We subjectively developed a relationship between antimatter (digital art) and matter (physical art model).

4. *Organic and Inorganic*

When producing the dance film, our aim was not to create choreography based on digital projections. Instead, the goal was to insert digital art into the film storyline. Karson and I had conversations about how her digital art could exist within an organic/inorganic relationship and not be associated as a scenic element like a prop.

In the European-American contemporary dance cannon, many artists worked with objects in their creation, especially before and after the Second World War period. These experimentalists used objects such as masks, furniture, toys, flags, etc. as a representation of added performers while others saw in them a supplemental physical element for the overall performance. In our collaboration, one of the objects in the scene was Karson's digital art. Nevertheless, she mentioned several times her frustration with the *piece of plastic*, referring to the outcome of AI 3D- printed creation. Her digital media art inverted its polarities shifting from a natural digital state to an artificial object or a mere *thing.*

The critical thinking around the concept of an object and a thing brought to my mind a passage from André Lepecki's book *Singularities – Dance in the Age of Performance (2016).* The scholar vividly presents the philosophical interpretation of objects and things. In chapter two, Lepecki mentions the importance of an object through the lens of French poet Stéphane Mallarmé in which an object like a chandelier stands for "the transcendent and authoritative principle organizing the entire field of appearances under its domain" (Lepecki 64). According to

Mallarmé, the chandelier is fundamentally as important as the dancer or actor on the stage. No light, no visible motion. This does not mean that performance can't happen in the dark. It means that both natural (the body) and artificial (the chandelier) are subordinated to each other. Lepecki continues his discussion on the concept of an object by examining choreography. In his essay, Lepecki mentions that William Forsythe once identified choreography as "an art of command"(Lepecki 40). He asks, who is in command of directing the dancer's movement? The choreographer, right? Subjectively speaking, can we associate the dancer with an object under the control of the choreographer? In this example, the concept of the dancer as an object is quite different from the concept of a thing. Things are subjective; objects can be related to a subject, but once this concept is dismantled and no longer subordinated to each other, then the object becomes a *thing*.

In the dance film, we do present the object as an aesthetic element. However, it is associated with a vital transcendental meaning. The object generated by artificial intelligence expands the viewer's interpretation to other levels of subjectivity. There is not a single definition in the narrative for that object. On the contrary, the plurality of the artificial intelligence's symbols in the film plot is unimaginable. Let's take into consideration the symbolism of a blank sheet of paper. It can be a shape, color, a tree (consider how paper is made), and so on. As Deleuze once said "if the status of the object is profoundly changed, so also is that of the subject" (Colen and Deleuze 19). The object in our film is not a piece of plastic. To my understanding, it is a metaphoric symbol linking the tower image to oppression, manipulation, lack of freedom, and why not to patriarchalism.

5. *Conclusion*

The intersection of dance and digital performances has been present in the dance world since the beginning of the twentieth century. This technological evolution offers a language that is sparking an intense period of experimentation, curiosity, and risk-taking in which artificial intelligence plays a crucial role in integrating the body in cyberspace. Over time, more choreographers are integrating digital media into their creations. The field of virtual interactive performance produces a plethora of dynamic sensations in movement, sound, and visuals. It also offers opportunities for interdisciplinarity collaboration within different fields of research. More often than not, we see musicians collaborating with engineers, visual artists with computer scientists, and so on. Without a doubt, the interface between arts and technology is one of the vital futures of performance practices. Answering the initial question of how much technology is too much, I am convinced that the answer relies on finding a balance between both forms in all aspects of multidisciplinary collaboration. Over the coming decades, Artificial Intelligence will significantly change the way we interact with our daily actions, as it is already beginning to do. So why not take this possibility into the performing arts field and expand our creative possibilities and futuristic vision for our artmaking?

Works Cited

Alarsan, F.I., Younes, M. Best Selection of Generative Adversarial Networks Hyper-Parameters Using Genetic Algorithm. *SN COMPUT. SCI.* **2,** 283 (2021).

Albright, Ann Cooper. Traces of Light: Absence and Presence in the Work of Loïe Fuller. United Kingdom, Wesleyan University Press, 2007.

Bentkowska-Kafel, Anna, et al. *Digital Art History a Subject in Transition*. Vol. 01, Intellect, 2005.

Conley, Tom, and Deleuze, Gilles. The Fold: Leibniz and the Baroque. The United Kingdom, University of Minnesota Press, 1993.

Copeland, Roger. Merce Cunningham: The Modernizing of Modern Dance. The United Kingdom, Routledge, 2004.

Cunningham, Merce. "The Innovator." *Merce Cunningham Trust*, Barrel/Larson, 2021, www.mercecunningham.org/about/merce-cunningham/.

Dixon, Steven, and Barry Smith. *Digital Performance: A History of New Media in Theater, Dance, Performance Art, and Installation*. The MIT Press, 2015.

Herrera, Aurora, and Giovanni Lista. *Body Stages: The Metamorphosis OF Loïe Fuller*. Skira, 2014.

Hill, Helen. "ART AND AI – OUTBREAKS FROM THE GRID." *MGHPCC*, 5 Nov. 2020, www.mghpcc.org/art-and-ai-outbreaks-from-the-grid/.

Horwitz, Andy. "Talking to Troika Ranch." *Culturebot*, 12 Nov. 2014, www.culturebot.org/2014/07/21972/talking-to-troika-ranch/.

Kaplan, Jerry. Artificial Intelligence: What Everyone Needs to Know. The United Kingdom, Oxford University Press, 2016.

Lepecki, André. *Singularities: Dance in the Age of Performance*. Routledge, 2016.

Louis, Murray, and Nikolais, Alwin. The Nikolais/Louis Dance Technique: A Philosophy and Method of Modern Dance. United Kingdom, Taylor & Francis, 2016.

Naugle, Lise Marie. "Technique/Technology/Technique." *Moving History/ Dancing Cultures - A Dance History Reader,* edited by Ann Cooper Albright, Ann Dils, Wesleyan University Press, 2001, pp. 459–461.

Povall, Richard. "A Little Technology Is a Dangerous Things." *Moving History/ Dancing Cultures - A Dance History Reader*, edited by Ann Cooper Albright, Ann Dils, Wesleyan University Press, 2001, pp. 455–458.

Whatley, Sarah, and Amalia G. Sabiescu. "Interdisciplinary Collaborations in the Creation of Digital Dance and Performance: A Critical Examination." Cultural Heritage in a Changing World (2016): 17–35. Web.