Journal of Digital Media & Culture Technology Vol.5, No.2, December (2025), pp.117-127
ISSN 2983-0664(p) 2983-0850(e) *http://dx.doi.org/10.29056/jdmct.2025.12.03*

Digital Biomorphism and the Visualization of Microscopic Life Forms in Media Art

Dong-Jo Kim[1], JungYoon Kim[2]*

Abstract

Traditional biomorphic art, which remained confined to imitating static physical properties, is now entering a new artistic phase through its integration with digital technology, undergoing continuous generation and transformation. This study explores how digital media technologies reconfigure biomorphic art by visualizing the organic rhythms of microscopic life forms that are otherwise imperceptible to the human eye. Centering its inquiry on Kim Dong-jo's exhibition <The Potential Virtual Space of Small Organisms>, this study examines how the movement patterns of butterflies and ants are translated into digital data and reconstructed through generative algorithms and transmedia environments. The analysis demonstrates that digital biomorphism moves beyond static imitation of natural forms toward the simulation of generative principles such as variability, interaction, and vitality. Through case analysis, the study shows how virtual space enables microscopic life phenomena to expand into immersive ecosystems that engage audiences as participatory agents rather than passive viewers. These findings suggest that digital technology functions not merely as a representational tool but as an aesthetic medium that extends the ontological scope of life.

Keyword : Biomorphic, microscopic lifeforms, digital visualization, vitality, media art

1. Introduction

Humans have regarded nature as the source of art and an infinite object of inspiration since the dawn of time, continually attempting to reinterpret nature's vitality and organic forms through sculptural language. Emerging within this tradition, biomorphic art-a portmanteau of “bio” (life) and “morphic” (form)-represents an artistic trend that visualizes vitality through the organic curves and irregular shapes of natural objects, contrasting with mechanical and geometric abstraction. Particularly within the bleak urban environments and technological coldness of modern society, biomorphic art is seeing its value re-evaluated as a painterly metaphor for vitality that stimulates human instinctive sensibilities and induces psychological stability.

Past biomorphic research and creation primarily focused on mimicking nature's external beauty or

1 Department Image design, Sunchon National University, Sunchon, Korea [Professor]
e-mail: djkim@scnu.ac.kr
2 Department of Game Media, College of Future Industry, Gachon University, Seongnam, Korea [Professor]
e-mail: kjyoon@gachon.ac.kr (Corresponding author)

Received(October 20, 2025), Review Result(1st: November 16, 2025), Accepted(December 12, 2025), Published(December 31, 2025)

structural characteristics through static physical media such as painting, sculpture, furniture, and fashion design. However, with the advent of the Fourth Industrial Revolution, the integration of cutting-edge digital technologies like artificial intelligence (AI) and interactive media, and data-driven visualization systems into art has led to a dramatic expansion of biomorphic expression. Artists now go beyond merely reproducing nature's forms in fixed physical materials. They utilize generative AI to create ever-changing, living images or construct new ecosystems within virtual spaces that interact with audiences.

This technological advancement has become a decisive catalyst for bringing the world of microscopic life-difficult to observe with the naked eye-into the realm of art. Minute life phenomena, such as the fluttering of butterfly wings or the swarming activity of ants, are transformed into digital data and reborn as new visual experiences within virtual spaces. This forms a Potential Virtual Space that transcends the limitations of physical reality, offering audiences an immersive experience where they become part of the ecosystem, moving beyond mere observation. However, existing studies have primarily analyzed biomorphic formative characteristics as physical design elements or focused on early-stage digital image generation. Consequently, in-depth research on how the movements of microscopic lifeforms, combined with transmedia technology, are visualized into unique virtual ecosystems remains scarce.

Therefore, this study aims primarily to meticulously analyze the process by which biomorphic formative characteristics are fused with contemporary digital visualization and computational media technologies to materialize as visualizations of microscopic life forms, and to clarify its aesthetic significance. Specifically, it selects Kim Dong-jo's solo exhibition <The Potential Virtual Space of Small Organisms> as the core case study. First, this study analyzes how the elegant movements and cooperative patterns of small organisms like butterflies and ants are reinterpreted through digital algorithms and AI technology. Second, it traces the process by which an ecological narrative originating in physical space expands into virtual space via media technology, examining the transmedia characteristics emerging during this process.

By demonstrating how the microscopic world of nature acquires artistic vitality through the convergence of biomorphic aesthetics, digital visualization, and data-driven processes, this study aims to propose a future direction for biomorphic art. This constitutes an important academic endeavor to confirm the potential for a new convergent art form where technology, art, and natural ecosystems coexist, and to redefine the meaning of vitality in the digital age.

2. Biomorphic Formative Characteristics

The term biomorphic is a compound word derived from the Greek bios, meaning life, and morphe, meaning form. It collectively refers to an artistic tendency that evokes biological forms or images of living organisms. This concept contrasts with the coldness imparted by geometric and mechanical abstract art, focusing on visualizing vitality through nature's organic curves and irregular shapes. Biomorphic art does not merely mimic natural objects as they are (mimesis). Its purpose lies in abstractly transforming or reconstructing the generative principles of nature and the dynamism felt in life phenomena to express them. In other words, even if a form does not explicitly resemble a specific animal or plant, it can fall within the biomorphic category if it evokes the writhing energy of life, cell division, or biological processes like growth [1].

Art-historically, the biomorphic art movement began with the organic ornamentation of the early 20th-century Art Nouveau style and was concretized by Dadaist and Surrealist artists. In the 1930s, Alfred H. Barr formalized the term by introducing biomorphic abstraction as a concept contrasting with geometric abstraction in his exhibitions of Cubism and abstract art. Artists like Jean Arp and Joan Miró actively incorporated fluid forms reminiscent of amoebas or embryos into their work to express the unconscious world beyond rational control and the primal vitality of nature [2]. In the modern era, this biomorphic concept has expanded and been applied across diverse visual art fields, including architecture, fashion, furniture design, and digital media art.

The most prominent formal characteristic of biomorphic art is its exclusion of straight lines and sharp angles, favoring the use of soft curves. Most living organisms in nature are composed of curves, and these organic curves provide visual comfort and psychological stability. Biomorphic curves possess a fluidity, not fixed but flowing, evoking sensations akin to liquid movement or cellular activity. This lends a sense of temporality and dynamism to static forms [3]. Such fluid shapes represent the ever-changing, growing nature of life, serving as a medium that stimulates boundless imagination in viewers.

Furthermore, while artificial sculptures emphasize symmetry and regularity, biomorphic art pursues irregularity and asymmetrical forms. Living organisms in nature grow irregularly, adapting to their environment rather than achieving perfect symmetry. Biomorphic art embraces this natural spontaneity and freedom as its sculptural language. Non-standardized forms aim for open structures rather than closed ones, breaking down boundaries with external spaces and opening possibilities for interaction [4].

Particularly in digital media environments, this irregularity offers the advantage of being easily realized as variable images that change in real-time based on data variables.

Biomorphic images metaphorically embody vitality through their very form. Their expansive and contracting volumes, along with their intertwined organic structures, visually evoke the breathing or pulsing of living organisms. This transcends mere formal aesthetics, stimulating the innate human instinctive sense of life (Biophilia) latent within us. In contemporary art, biomorphic art performs a healing function by countering the coldness of technological civilization and restoring humanity, serving as a vital aesthetic tool that awakens ecological sensitivity.

3. Aesthetic Reinterpretation of the Microscopic World

The microscopic world of nature is a realm too minute for human eyes to perceive, yet within it, the fundamental energy of life circulates ceaselessly. Traditional biomorphic art has focused on abstracting the forms of visible natural objects, such as plant stems or animal bones. However, advances in science and technology have elevated invisible realms-such as cell division, the swimming of microorganisms, and the minute fluttering of insect wings-into new artistic subjects. These movements and patterns of microscopic life forms most dramatically embody the fluidity and amorphousness pursued by biomorphic art. Visualizing them through digital technology demands an aesthetic reinterpretation that transcends mere observation and reproduction. In particular, contemporary media art translates the rhythms and order of life, previously unrecognized by us, into visual language by converting biological data observed under microscopes into artistic algorithms [5]. This goes beyond merely mimicking nature's outward appearance; it is an attempt to embody nature's generative principles themselves within digital space. In this process, the microscopic world ceases to be a hidden realm and transforms into a new aesthetic experience that extends human senses.

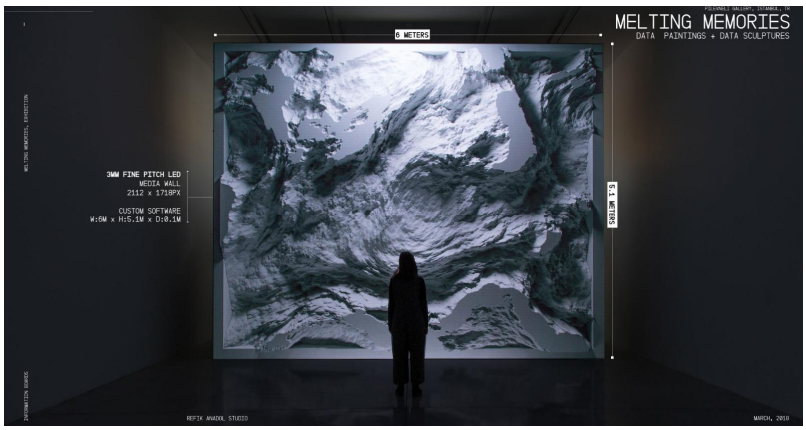
The reinterpretation of the microscopic world within the digital media environment shows an evolution from the imitation of form to the generation of vitality. Whereas past art expressed the image of living organisms as if taxidermied onto fixed media like canvas or sculpture, digital media art mimics the growth algorithms of living organisms and creates infinitely changing images in real-time through advanced technologies like generative AI. Generative AI learns the irregular variables of the natural world to produce unpredictable organic forms. This enables the perfect digital realization of the essential characteristic of microscopic life-its variability, which is not fixed but constantly transforms through interaction with its environment. Thus, biomorphic images reinterpreted digitally acquire the status of

digital lifeforms that appear to live and move according to the flow of data, rather than being static images [6]. These digital lifeforms, freed from the biological constraints of reality, undergo independent evolution within virtual space, delivering to the audience an unfamiliar and mysterious visual impact unlike anything previously experienced.

Furthermore, immersive technologies like extended reality expand the microscopic world into a macroscopic space, opening a potential virtual space into which the audience can enter. When the collective activities of minuscule insects or cells are projected into vast digital spaces, audiences experience wonder transcending everyday scales. Within this space, the movements of lifeforms are reduced to data, then reconverted into sensory signals like light, sound, and vibration. The synesthetic experience arising from this process directly transmits the energy of microscopic life to the audience [7]. This inversion of physical scale allows the audience to step outside anthropocentric thinking and embody the perspective of small life forms once dismissed as insignificant, serving as a mechanism that maximizes ecological imagination. Technology serves not merely as a tool for enlarging subjects, but as a medium enabling the audience to become part of the microscopic ecosystem and immerse themselves in its narrative.

Particularly, the interactivity where digital lifeforms respond to the audience's movements or reactions transforms the artwork from a mere object of appreciation into an organic ecosystem that breathes with the audience [8]. The moment the audience enters the virtual space, their position and actions become variables within the system, influencing the movements of the digital lifeforms. This provides an experience akin to the process by which organisms adapt and respond to their environment in nature. Such interaction transforms the work's completeness into an open-ended conclusion, where the audience, rather than passive observers, actively participates as agents driving the ecosystem's changes, thereby completing the work. The communion between microscopic lifeforms and humans transcends the limitations of non-contact through digital technology, forming emotional bonds via virtual contact.

Contemporary media art combines scientific data and digital technology to expand the microscopic world, invisible to the naked eye, into a macroscopic artistic space. Particularly within the context of biomorphic art, these attempts are evolving beyond simple imitation of natural forms to algorithmically reproduce movement and interaction-the very essence of life activity. This chapter examines representative cases that elevate microscopic life phenomena into original aesthetics through data visualization and interactive technology.



[Fig. 1] teamLab, Melting Memories, Installation, Public Art, Istanbul, TR, 2018

[Fig. 1] shows Refik Anadol's <Melting Memories>, a prime example of artistically visualizing the human inner world-specifically, the microscopic neural activity within the brain. Through collaboration with the University of California, San Francisco's Neuroscience Institute, Anadol collected minute brainwave data generated during memory recall and analyzed it using AI algorithms. Instead of reducing this vast data to static charts or graphs, he introduced the concept of data pigments, transforming it into waves of particles that constantly flow and collide [9]. The movements of particles boiling or swirling on the massive LED screen are realized through fluid dynamics algorithms, perfectly reproducing the organic fluidity-a core characteristic of biomorphic forms-within the digital space. This visual representation, reminiscent of cell division observed under a microscope or the exchange of electrical signals in a neural network, allows the audience to experience the abstract and invisible concept of memory as if it were a tangible living entity. It demonstrates how technology can function as an aesthetic medium, extending human cognitive capabilities into the microscopic realm.

[Fig. 2] teamLab, Resonating Life in the Acorn Forest, Musashino Woods Park, Higashi-Tokorozawa, Saitama, 2020

Looking at [Fig. 2], unlike Anadol, who focused on inner data visualization, TeamLab's <Resonating Microcosms - Liquified Light Color> implements the communication methods and environmental adaptation abilities of microscopic lifeforms within a physical space, encouraging interaction with the audience. As the title “Resonating Microcosms” suggests, this exhibition space features oval-shaped objects resembling cells or eggs, which exist by emitting their own light. These objects demonstrate elasticity, swaying in response to external physical stimuli-such as wind or a visitor's touch-yet regaining their center like a roly-poly toy. This mimics the biological trait of organisms adapting to environmental changes and maintaining homeostasis [10].

Particularly noteworthy is the resonance system applied to this work. When a visitor influences one object, it responds with its own unique light and sound, and this signal propagates sequentially to adjacent objects. This borrows the interaction methods of microscopic organisms, such as nerve cells transmitting signals through synapses or bacterial colonies communicating organically via chemical signals. To achieve this, teamLab introduced a new concept: the color of liquefied light, rather than fixed hues, to express the texture of constantly changing, flowing light. Consequently, visitors experience how their small actions transform the color and sound of the entire space, becoming aware that they function as part of this digital ecosystem.

Thus, the cases of Refik Anadol and TeamLab share the commonality of visualizing the invisible microscopic world through data algorithms and interactive technology, respectively. While Anadol transformed the fluid energy of neural networks into visual spectacles via AI, TeamLab expanded the organic communication methods of living organisms into experiential spaces through sensor technology. Both cases effectively transplanted biomorphic characteristics-amorphousness, fluidity, and vitality-into digital media. This provides a crucial technical and aesthetic foundation for analyzing the digitally visualized interaction between butterflies and ants in Kim Dong-jo's work, the subject of this study.

Ultimately, the aesthetic reinterpretation of the microscopic world is an attempt to restore and extend nature's vitality through technology, going beyond visualization techniques that make the invisible visible. This is the realization of digital biomorphism, breathing nature's warmth into cold digital technology, and it becomes an opportunity to awaken a new ecological sensibility within hybrid spaces where physical entities and virtual images coexist. In modern society, technology is often perceived as diametrically opposed to nature. However, media art utilizing biomorphic forms demonstrates that technology can instead rediscover nature's profound beauty and serve as a bridge reconnecting humans and nature. The digital visualization of microscopic life forms holds significant artistic value. It demonstrates that technology does not dominate or replace nature, but rather explores nature's hidden order and maximizes

its vitality, presenting a future vision where humans, nature, and technology coexist.

4. Research on Visualization Works of Microscopic Life Forms

While previous chapters examined the formative characteristics of biomorphic design and cases of digital reinterpretation of the microscopic world, this chapter empirically studies these through concrete work analysis. The subject of this research, Kim Dong-jo's solo exhibition <The Potential Virtual Space of Small Creatures>, is a work that utilizes transmedia technology to digitize the movements and transformations of microscopic organisms like butterflies and ants, thereby exploring an ecosystem expanded into virtual space. This exhibition exemplifies the characteristics of digital biomorphism discussed earlier, as it extends a narrative originating in physical space into virtual space and realizes an ever-changing narrative through audience participation and interaction.

The core subjects of the work, butterflies and ants, are microscopic beings whose intricate structures and patterns are difficult for the human eye to fully grasp. The artist captures the delicate nature and ecological harmony embodied in the butterfly's graceful movements and the ant's cooperative patterns, reinterpreting them through digital media.

[Fig. 3] Dongjo Kim, Virtual Space of Butterfly Movement, ARK Gallery, Kwangju, Republic of Korea, 2025

Images like <Virtual Space of Butterfly Movement> presented in [Fig. 3] demonstrate that they do not merely replicate the physical forms of actual organisms. Instead, they transform the trajectories and energy generated by their life activities into abstract digital forms resembling neon signs or light waves. This can be seen as a biomorphic attempt to maximize microscopic vitality by reducing the organic forms of living beings into invisible data and then re-visualizing them.

Technologically, this work actively incorporates the fusion of AI technology and art. Generative AI and transmedia techniques learn and transform the movement data of ants and butterflies to construct an unpredictable virtual ecosystem.

[Fig. 4] Dongjo Kim, Transformed Ant and Butterfly Virtual Space, ARK Gallery, Kwangju, Republic of Korea, 2025

As seen in [Fig. 4]'s <Transformed Ant and Butterfly Virtual Space>, images of transformed insects transcend the constraints of physical reality, acquiring new forms and textures within the virtual space. This expansion is further amplified through extended reality technology, where the exploration of potential virtual spaces beyond the limitations of physical space offers the audience an experience transcending mere visual amusement into a new dimension. Rather than merely viewing the work, the audience experiences the grand movements of microscopic creatures within a space where physical reality and virtual reality overlap. This experience encourages them to move beyond anthropocentric thinking and form ecological empathy.

Consequently, Kim Dong-jo's work prompts reflection on the relationship between the natural ecosystem, humans, and digital technology. While the technical complexity and narrative obscurity may pose a challenge to some viewers, this serves as a device that rejects fixed meaning and enables open interpretation. The virtual space realized within the work is not a mere illusion but another ecosystem where the potential of microscopic life forms manifests. Here, technology functions not as a tool to dominate nature, but as a medium that extends and connects nature's vitality. Therefore, <Potential Virtual Space of Small Organisms> can be evaluated as an important attempt that presents the possibilities and future direction of media art utilizing virtual space, providing a practical model for research in digital visualization using biomorphic forms.

5. Conclusion

This study examines how biomorphic formative characteristics, when fused with digital media technology in the era of the Fourth Industrial Revolution, expand into the visualization of microscopic lifeforms. Through an empirical analysis of Kim Dong-jo's solo exhibition, <The Potential Virtual Space of Small Organisms>, the study demonstrates that contemporary digital biomorphism moves beyond the imitation of natural forms on fixed physical media. Instead, it reveals a paradigm shift in which the

generative principles of life-such as variability, rhythm, and interaction-are algorithmically simulated through generative AI and digital systems. This finding contributes theoretically to biomorphic art discourse by reframing biomorphism not as a formal metaphor, but as a process-oriented aesthetic grounded in digital vitality.

From an aesthetic and artistic perspective, the analysis shows that transmedia technology functions as a core mechanism for extending ecological narratives from physical space into virtual space. By converting the movements of microscopic organisms such as butterflies and ants into digital data and reinterpreting them through abstract visual media including light and neon, Kim Dong-jo's work sublimates ecological delicacy into a speculative, future-oriented aesthetic. The integration of interactivity further transforms the artwork into an open-ended virtual ecosystem, positioning the audience not as passive viewers but as participants whose actions actively shape the evolving narrative. This underscores the aesthetic significance of data visualization and interaction as means of expanding microscopic phenomena into macroscopic experiential spaces.

At an industrial and cultural level, the study clarifies that digital technology should not be understood as a force that alienates humans from nature, but rather as a mediating tool that redistributes and restores nature's vitality within virtual environments. The examined work thus offers an important reference point for media art practices seeking to integrate ecological reflection into immersive digital spaces, despite potential challenges related to technical complexity or narrative ambiguity.

Finally, this study suggests several directions for future research. Further investigations should explore the extension of biomorphic visualization beyond the visual domain through multisensory interfaces such as sound and touch. In addition, philosophical inquiry into audience receptivity and ethical considerations surrounding digital ecosystems will be essential as media technologies continue to evolve. By articulating these theoretical, aesthetic, and research-oriented implications, this study aims to provide a foundational framework for future scholarship on digital visualization of microscopic life forms through biomorphic approaches.

References

[1] S. Y. Son, “Research on Sustainable Biomorphic Design in the Anthropocene”, Design Research, vol. 9, no. 4, December 2024, pp. 738-748, doi: 10.46248/kidrs.2024.4.738.

[2] J. S. Kim, “Organic Philosophy Background of Biomorphic Architecture”, Journal of The Korea Contents Association, vol. 14, no. 5, May 2014, pp. 436-443, doi: 10.5392/JKCA.2014.14.05.436.

[3] H. J. Kim, J. K. Lee, “Research on spatial interactivity of brand showroom with the application of bio-morphic expression characteristics”, Journal of Korea Institute of Spatial Design, vol. 9, no. 4, September 2014, pp. 199-211, doi: 10.35216/kisd.2014.9.4.199.

[4] M. T. Lim, “A Study on Spatial Design Configuration Using the Biomorphic Characteristics as Concept”, Journal of Korea Institute of Spatial Design, vol. 14, no. 3, June 2019, pp. 75-90, doi: 10.35216/kisd.2019.14.3.75.

[5] S. G. Kwon, Y. M. Kang, “Biomorphic Expression in Contemporary Art Jewelry Using Silicone”, Journal of Basic Design & Art, vol. 25, no. 5, October 2024, pp. 51-62, doi: 10.47294/KSBDA.25.5.4.

[6] C. Y. Lee, “A Study on The Development of Fashion Textile Design Based on Biomorphism Expression Characteristics”, Journal of The Korean Society Design Culture, vol. 27, no. 4, December 2021, pp. 437-449, doi: 10.18208/ksdc.2021.27.4.437.

[7] H. K. Shin, “A Study on the mode of existence and reproduction of digital work of arts”, Journal of Digital Art Engineering & Multimedia, vol. 11, no. 4, September 2024, pp. 549-558, doi: 10.29056/jdaem.2024.12.11.

[8] Y. J. Yoo, J. H. Choi, “The Expressive Characteristics and Internal Meanings of Biomimicry Applied to Contemporary Fashion”, Korean Society of Fashion Design, vol. 19, no. 1, March 2019, pp. 37-54, doi: 10.18652/2019.19.1.3.

[9] Refik Anadol's, “Melting Memories”, refikanadol.com, https://refikanadol.com/works/melting-memories/, (accessed October 10, 2025).

[10] teamLab, “Resonating Microcosms - Liquified Light Color”, teamlab.art, https://www.teamlab.art/ko/ew/resonatinglife_sunrise_sunset_tokorozawa/, (accessed October 10, 2025).