

EXPLORING BIOMORPHIC ART: A VENTURE INTO ORGANIC ABSTRACTION

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Abstract: The relationship between art, nature, and biology has many facets that reflect the complex interplay between morphological domains, themes, and interpretations throughout history. The aim is to bridge the gap between predictable (human-made) and unpredictable (natural) patterns by experimenting with different techniques and natural materials. The research question resides as, 'How do 20th - century biomorphic experiments in art reveal the relationship between art and biology, through formal and semiotic frameworks?'. Within qualitative research methodology, a comparative analysis guided by Edmund Burke Feldman's four-step systematic theory for art criticism and analysis, consisting of description, analysis, interpretation, and evaluation, is employed. The expansion of Feldman's theory by Lee Emery includes key interpretive frameworks encompassing formalist, and semiotic. This theory is chosen as a tool to help art education students understand and interpret works of art in a systematic and step-by-step manner. Findings indicate that combining formalist art analysis, which analyzes visual elements in artworks, and semiotic art analysis in symbols and meaning, is most effective for bridging a deeper meaning in interpreting works of art. Supported by photographic documentation of biomorphic experiment, the research emphasizes movements such as Biomorphic Art, Environmental Art, and BioArt, demonstrating how biomorphic art morphs and mimics nature into different forms and structures.

Keywords: Art Analysis, Bioart, Biomorphic art, Biosemiotics, Environmental Art, Organic forms.

Introduction

The biomorphic approach is a design philosophy that embodies the principle that art reflects dynamism found in nature, emphasizing growth, change, and connection. Artists such as, Hilma af Klint, Andy Goldsworthy, Eduardo Kac, Oron Catts and Ionat Zurr, and emerging artists such as Nergiz Yeşil, Dilay Kocogullari, and Sevda Orr have increasingly collaborated with scientists, ecologists, and biologists, resulting in interdisciplinary practices that merge art and science. (Grba, Todorovic, 2021).

Historically, this collaboration between biology and artistic expression evolved through distinct movements such as Surrealism (1920s-1950s), Biomorphism (1930s-1940s), Environmental art (1960s-1970s), and Bioart (1990s-2000s). Across these eras, artists have shifted from mimicking organic forms to directly collaborating with science. According to Andre Breton theories, while surrealism is focused on the subconscious, nature of dreams, and imagination, artists were also concerned with the morphological study of forms. This allowed surrealists to play with the idea of biological and non-biological forms (Breton, 1969).

Organic and subconscious forms bear a connection to the notion of morphology. Morphology provides the scientific and theoretical basis for understanding and analyzing the forms that Biomorphism mimics. The idea of Biomorphism was popularized by artists such as Jean Arp and Henry Moore (Read, 1968, p.72). These artists used abstract, curvilinear forms that had biological connotations, suggesting an element of the subconscious.

Arnold Berleant's idea of inclusiveness, in which the environment becomes an extension of oneself, brings into question the boundaries between art and life and emphasizes the need for participation in nature (Erzen, 2022). With the evolution of art from purely aesthetic representation to biotechnological intervention, a new pedagogical challenge emerges within art education. A simple method within the framework of formalism analysis was created by Feldman (1970). The basic four-stage analysis allows art education students to analyse artworks based only on their visual features, such as lines, shapes, colours, composition, and techniques used by artists.

Despite the evident progression towards interdisciplinary art, there is a deficiency in the research on the teaching methodology of art education. Although conventional approaches to art education may seem integrated, it fails to provide students with the means to comprehend the connection between morphological aspects of artworks and their scientific components. Feldman's theoretical concepts have been successfully applied to create new multi-layered, interpretative frameworks of art.

However, very few studies have shown how these theories could be combined with biosemiotics to explore representational, environmental, and biological art. The study develops a research justification that is focused on narrowing the gap between visual literacy and scientific interpretation. According to Lee Emery, section 3 of chapter 17, the expansion of art educator Edmund Burke Feldman's 1970 theory mentions seven multi-layered interpretive frameworks. The research carefully selects formalist and semiotic interpretive frameworks to analyse the works of representational artists of Biomorphhic Art, Environmental Art, and BioArt. These frameworks are essential tools in helping art education students examine beyond formalist aspects of art (Emery, 2002).

a) Formal Interpretative Frameworks - analyzes visual elements and techniques in artwork, including shape, line, texture, and structure.

Application to artists

Hilma af Klint: Biomorphhic Art

Explores the abstract organic forms, geometric and microscopic forms, bright colour palette, and textures in her work. Her work is often biomorphhic in nature, focusing on the spiritual or biological.



Figure 1. Hilma af Klint, The Ten Largest, No 7, Adulthood, Group IV, 1907. Photo: Albin Dahlström / Moderna Museet. Retrieved from Modernamuseet. Source: <https://guide.modernamuseet.se/stockholm/en/collection/hilma-af-klint/>

Andy Goldsworthy: Environmental Art

Explores the natural materials used in his work. The dialogue between the textures of the materials he selects, such as leaves, stones, or ice, is examined in relation to the environment.

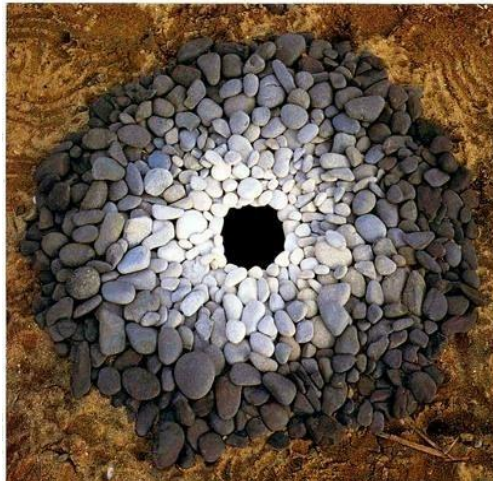


Figure 2. Pebbles around a hole by Andy Goldsworthy, Kiinagashima-Cho, Japan 1987. Retrieved from Alanyliu. Source: <https://alanyliu.org/research/Goldsworthy/goldsworthy-photos/collaboration4.jpg>

Eduardo Kac: BioArt

Discusses the organic forms and the use of light in his work. His renowned GFP Bunny, (Alba), Figure 3, questioned issues surrounding genetic engineering, ethics, and life (Kac, 2000).



Figure 3. GFP Bunny at 20 by Eduardo Kac. Retrieved from Ekac. Source: <https://www.ekac.org/gfpbunny.html>

b) Semiotic Interpretative Frameworks - interprets the symbols and meanings in art.

However, Feldman also recommends that art education students seek to obtain more information about artworks. Art education students should investigate such aspects as artist backgrounds, historical periods, cultural context, as well as message or themes of works of art.

Application to artists

Hilma af Klint: Biomorphie Art

The abstract and organic forms in the work are seen as symbols of spiritual evolution and the connection to nature and the unknown forces of life. The forms act as signs of metaphysical and biological connections.

Andy Goldsworthy: Environmental Art

The nature of his work is seen as a symbol of the ephemeral nature of life. The use of natural materials in the work acts as a sign of human connection to nature.

Eduardo Kac: BioArt

The transgenic GFP Bunny is a symbol of genetic modification. The biological form acts as a sign of scientific intervention and human reflection on the matter. These group of artists highlights how biomorphie experimentation is considered an essential conceptual basis for artists who desire to explore life. The study further examines relevant domains of morphology, the study of form and structure, expressed in the biomorphie experiment.

These include Isomorphie structures that share similar forms, such as curly or spiral plants that imitate the structure of DNA molecules. Biomorphie structures highlight visual elements such as shape, texture, and line. Henry Moore creates biomorphie works that reveal the skill of manipulating visual elements. These examples show the great diversity of forms studied within morphology (Suler & Zakia, 2018).

Role of Semiotics in Morphology

Semiotics, the study of signs, symbols, and interpretation, relies heavily on morphology, holding unique significance in both the physical world and the realm of the mind. Af Klint and Goldsworthy demonstrate how form and meaning are connected and how symbols interact to create a word's overall meaning.

In the early 20th century, scientific advances in biology and psychology reinforced the idea of interconnectedness and the organic nature of life, inspiring artists to incorporate microscopic and biological motifs into their work (López, 2016). For instance, the complex microscopic visuals or a formalist analysis depicted in Klint's artworks unveil single-celled organisms to cellular compositions, which are integrated into abstract patterns.

Biosemiotics

In relation to a semiotic framework, biosemiotics is a method of studying living systems that considers the production, exchange, and interpretation of signs and genetic codes as essential to life. The idea that life processes, based on delicately structured patterns of chemical interactions, have been a challenge to biological theory for centuries, due to the clear function of living beings. Af Klint's work exemplifies morphology that serves as isomorphic structures reflecting comparable patterns across different scales and contexts, whether in nature or in her spiritual and symbolic compositions (Hoffmeyer, 2010).

Biomimetic Forms

In the context of science, biomimetics, as defined by Otto Schmitt in 1969, is a term that originated from the word bios, or life, and mimesis, or imitate. Biomimetic forms, as demonstrated in the biomorphic experiments, are designs inspired by nature, mimicking the structures and functions of living organisms, from nature's patterns, mechanisms, and evolutionary processes (Ivanovic et al., 2018). The term mimicry not only includes physical similarity but also involves other aspects, such as behavioural

mimicry. According to Maran (2017), mimicry has been defined as a sign relationship in which the message is communicated, decoded, and responded to by a receiver. (Maran, 2017, p.101-117).

Biologists such as Lynn Margulis focused on symbiosis and interconnectedness. Her studies reinforced that life is all about interconnectedness. Another example of how these artworks relate to biology is the works of Stephen Jay Gould, who focused on evolution and adaptation, as seen in the works of these artists (Williams, 2013).

Methodology

The study aims to demonstrate the relationship between art, nature, and biology through biomorphic experimentation. Considering the interpretive and contextual nature of qualitative application-oriented research, the experimental results aim to enhance existing knowledge about the dynamic interaction between biomorphic art and biological processes, thus contributing to theoretical discourse in art and biosemiotics. This entails an analysis of the way meaning is produced, understood, and expressed through signs, especially how semiosis creates life forms and their artistic expression.

The research question that guides this study is, 'How do biomorphic experiments in art using organic and inorganic materials reveal the relationship between art, and biology within a Biomorphic art, Environmental art, and BioArt context, analyzed through formal and semiotic frameworks?'. The importance of this research question lies in developing a clear understanding of how the basic character of given materials and systems, such as living and non-living, influences the significance of artworks.

In what ways do living and non-living systems affect artistic meaning?

To answer this question, both systems foster an approach that focuses less on completing a product and more on building a system with a certain behaviour pattern. Bacterial art, or plant-based art, tends to grow or decay, implying that the artist has no control over all aspects (Kudla, 2008). Innovations such as three- dimensional printing and tissue engineering give artists the chance to create art forms that merge living

organisms and non-living organisms. Thus, creating hybrid living forms that bridge biology and technology (Radomska, 2018).

The researcher conducted a comparative analysis, which is guided by Edmund Burke Feldman's Four-Step Systematic Method of Art Criticism expanded by Lee Emery.

Step 1: Description – Identifying the concrete and objective aspects of the work, such as form, composition, and material.

Step 2: Analysis - Analyzing how the visual elements (line, texture, structure) and principles of design interact within the constructed structure.

Step 3: Interpretation - Exploration of symbolic, biological, and conceptual meanings within the framework of biosemiotics and biomimetic principles.

Step 4: Evaluation - Critical assessment of the representation of biological processes in the artistic expression and its importance to Biomorphic Art and BioArt. (Feldman, 1994, p.43)

According to Feldman, these steps help analyse not only the visual aspects but also the semiotic meaning of the artworks, where the two components, inorganic and organic, are integrated into one (Feldman, 1994).

Data was collected through application-based experiments and visual documentation. In these experiments, biomorphic and isomorphic structures were constructed using wood, tree bark, chamotte clay, and moss as a material base to mimic nature. The selection of materials was designed to represent both predictable (human-made) and unpredictable (natural growth) processes. The transformation results were captured through photographic documentation to show different stages, including visual documentation, material behaviour, and form transformation processes.

Phase 1: Below are Figures 4 and 5, a 1 to 3-week representation process of a predictable (human-made).



Figures 4 (left) and 5 (right). Predictable (human-made), wood sticks and tree branches (2023). Image by author.

1. Visual Documentation and Planning - The first step involved documenting ideas and the selection of raw materials such as eco-friendly wooden sticks, fast-drying Multi-Surface Spray Adhesive, and a tree branch. For example, the organic pattern of human veins and arteries is supported by or grows alongside skeletal and muscular structures (Cleveland Clinic, 2022). In this instance, the straight-length tree branch represents the support structure (about 70cm long) with predictable geometry and precise structural engineering. Each thin wood stick is cut to approximately 20cm.

2. Material Behaviour Observation - In this biomorphic process, the wood sticks were prepared, aligned, and cut. The fast-drying Multi-Surface Spray Adhesive's rate of drying, and compatibility allowed the wood sticks to bond in an instant, maintaining alignment along the supporting structure.

3. Form transformation - The form evolved gradually as the thin wood sticks began to build up to a controlled biomimetic framework resembling a DNA molecule (isomorphic structure) and adjusted accordingly, making the structure easy to manipulate.

Phase 2: Figures 6, 7, and 8 below, are week 3 to 7 representation processes of unpredictable (natural growth) patterns of nature.



Figures 6 (left), 7 (center), and 8 (right). Unpredictable (natural growth), wood sticks, tree barks, and tree branches (2023). Image by author.

Visual Documentation – Bind precise 15cm wood sticks and a handful of tree barks together using fast-drying Multi-Surface Spray Adhesives along a suitable 50cm, 70cm, and 80cm dynamic tree branch.

Material Behaviour - Due to the dynamic support structure, the material build-up resists manipulation and forms an uncontrolled growth process. According to William Myers, a historian and curator, there is an emphasis on the possibility of repetitive patterns. This is evident in biological forms that follow each other in an organic process (Myers, 2015). A good example is a spider web, which is an infinite material composed of natural protein fibres known as silk. The silk produced in the abdominal glands, spin

through nozzle-like spinnerets, creating an infinite, strong material, which can adapt itself in accordance with the needs of its environment. The possibility of creating similar patterns is an indication of biological flexibility (Myers & Hendry, 2020).

Form Transformation – Over time, the built-up wood sticks adapted to the tree branches by creating growth spirals and irregular curving (isomorphic structures) that are uncontrolled.

Phase 3: Below are Figures 9, 10, and 11 of the final form transformation of the unpredictable (natural growth) biomorphic process.



Figures 9 (left), 10 (center), and 11 (right). Final repetitive outcome of unpredictable (natural growth), wood sticks, tree barks, and tree branches (2023). Image by author.

Both the predictable and unpredictable nature of biomorphic processes involve adjustments based on visual feedback, which shows consistent repetitive dynamic patterns. The researcher checked each form against biological references, making corrections and modifications before proceeding to the next stage.

Phase 1 and 2: Below visual photographic documentation of growth resulting in relationship between biological growth and artistic manipulation.



Figures 12 (left), and 13 (right). Ceramic Forms processing, Chamotte clay (2023). Image by author.

Visual documentation - The above ceramic forms were created using the coiling and pinching technique, which involves a build-up of layered rolls of chamotte clay strips and placed in the first Low-fire ($950^{\circ}\text{C} - 1150^{\circ}\text{C}$). Thereafter, the smooth surface is glazed using transparent glaze, except for the textured area to merge the moss, resulting in a second firing at $1150^{\circ}\text{C} - 1280^{\circ}\text{C}$ (Cone 5–10), strengthening durability.



Figures 14 (left), and 15 (right). Ceramic Forms, Chamotte clay combined with moss (2023). Image by author.

Material Behaviour - The moss grows effectively on clay soils, in an environment characterized by consistent moisture, and shade. To maintain soil moisture, the microenvironment was regulated twice a day by spraying lukewarm water (28°C-32°C). Moss requires no deep roots in soil, which allows clay forms for biological processing.

Form Transformation - The smooth surface contrasts with the textured appearance of the vibrant moss, which creates a dialogue between the inorganic and organic. Although these forms are categorized as Biomorphic Art, as they function as non-living imitations of biological structures, in contrast, the presence of sprouts within the moss indicates an active process of life. These are biomorphic themes in BioArt of growth, decay, and symbiotic living.

To evaluate whether the biomorphic nature of the forms was achieved, taking photographs repeatedly became an important aspect of verifying the results of the process, which took 12 dedicated weeks to complete.

The comparison resulted in a table below.

Table 1. Comparison or relationship between Biomorphic Art and Bioart

	Figures 4 and 5. Biomorphic Art, Predictable patterns (2023)	Figures 6, 7, and 8. Biomorphic Art, Unpredictable patterns (2023)	Figure 9 and 15. Environmental Art	Figure 15. BioArt
Material	Wood sticks	Wood sticks and tree bark, tree branch	Tree bark, branch, clay, moss.	Chamotte Clay and Moss
Representation	A predictable human-made pattern with a predetermined outcome.	An unpredictable mimicry of DNA molecule's formation	Representational of Unpredictable nature, decay, environmental change.	Living components of growth, stability and decay.
Primary Focus	Biomorphic art - represents non-living form, often using traditional materials to imitate life processes.	Biomorphic art - Uses a dynamic traditional material (tree branch). Slightly manipulates form.	Engagement with environment, ecological processes, often site-specific.	Bioart incorporates life directly, using living tissue, labs, and technology to manipulate life.

Origins & Historical Context	Emerged in the early 20th century, influenced by Surrealism, Abstract Expressionism, and modernist movements.	Emerged in the early 20th century.	1960s-1970s, emphasizing ecological awareness.	Developed in the late 20th century alongside advances in biotechnology, genetic engineering, and synthetic biology.
Prominent artists	Jean Arp, Henry Moore, and Hilma af Klint. Focused on visual approximation to organic forms.	Emerging artists Nergiz Yeşil, Dilay Kocogullari, and Sevda Orr.	Andy Goldsworthy.	Eduardo Kac, Oron Catts, and Stelarc, often linked to science experiments and ethical debates.

Table 1 highlights the intersection of Biomorphic art and Bioart. Both art forms share common themes of growth, and transformation.

Results

The experimental process successfully showed how natural and artificial, organic and inorganic, unpredictable and predictable materials integrate to establish connections between biology and art. The categories of predictability and unpredictability were developed through the researcher's material experimentation and observational process.

Table 2: Predictability vs. Unpredictability

Aspect	Predictable Patterns	Unpredictable Patterns
Visual & Formal Characteristics	Geometric, symmetrical, and structured forms resembling DNA or cellular frameworks.	Irregular, spiraling, and organically curved forms resembling natural growths- spirals, or decay patterns.
Material Basis	Human-made, engineered structures - precisely cut wood sticks assembled with fast-drying adhesive.	Natural growth elements –tree branch, moss.
Formation Process and Transformation Dynamics	Controlled, predictable evolution based on visual planning, with adjustments made through visual feedback; forms evolve within expected parameters.	Uncontrolled, emergent growth with spirals, irregular curves, and decay patterns that resist precise manipulation.

Observation & Empirical Tracking	Documented via adherence to pre-planned geometric layouts, constant manual measurements, and fixed adhesive drying times.	Documented via unguided changes in branch curvature, non-linear moss propagation tracking, and fluctuating rates of organic decay.
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The table highlights the comparison of Predictability vs. Unpredictability.

Semiotic Outcome and Significance

The structural/predictable forms serve as iconic signs that signify human control and determinism of living things. These signs denote human intentionality, classification according to science, and attempts to impose rationality and calculation on living structures. Unpredictable forms are indexical signs indicating life force, independent growth, and evolutionary adaptation over time. The art piece brings together two contrasting sign systems, thus creating a mixed area where these two types of signs meet. The meaning of the signs is not constructed by the artist but through an interaction between human-made and living structural material.

Discussions

The experiments show how biomorphic art practices contribute to contemporary art. The study recommends that artists and art educators focus on investigating the relationship between the materials and biological systems through which they grow, transform, and decay. The idea behind Biomorphic Art lies in mimicking (mimesis). This form of art concentrates on depicting the beauty or intricacies of nature. Bio-Art requires laboratory work that addresses ontology and ethics issues and raises questions such as "What is life?" and "Is it ethical to modify living beings?".

Environmental art and BioArt practitioners such as Andy Goldsworthy, Stelarc and Oron Catt continue the semiotic practice of biosemiotics through their integration of biological, technological, and ecological processes of living organisms. These artists were selected because they represent different historical and conceptual stages of biomorphic, environmental, and biological art practices. This shows the theoretical

construct whereby biological processes not only serve as material but as signs within the artistic realm.

Semiotic analysis enables us to better understand the meanings associated with symbols and signs that are employed in the biomorphic artwork. In addition, it allows us to identify various metaphorical connections associated with such objects. However, only formal and semiotic analyses can be insufficient for understanding and appreciating the deeper ecological, ethical, and philosophical meaning of employing living systems for creating artwork.

Conclusion

This study aims to demonstrate the contribution of material-based and process-oriented approaches to art production within the context of experimental and interdisciplinary art. The study builds upon the theory developed by Feldman & Emery for art criticism by incorporating biosemiotics within the analysis and art critique. The frameworks follow the metamorphosis of materials in biomorphic art beyond human creativity vs. environmental unpredictability. The empirical focus of this experiment is constrained by its 12-week duration. This interval proved too short for the process of ecological succession or advanced decay.

Moreover, the experiment faced limitations due to its indoor-controlled environment and the material palette that consisted of non-vascular moss placed onto Chamotte clay. Future studies encourage continuous implementation of the experiment and observation of seasons to witness prolonged physical and structural degradation.

Furthermore, researchers are advised to broaden their material matrix by experimenting with various biotic agents such as mycelium or algae.

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