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Circulation in and for Artificial Life: Identity at the Zenith of Audiovisual Collapse

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Abstract

Circulation in and for Artificial Life is an audiovisual work that investigates the emergence and persistence of identity within a computational environment that never reaches a stable state. Multiple artificial-life entities exist within an abstract ray-marched world whose visual parameters are continuously rewritten by scripts. Each frame is further transformed through a process of UV collapse driven by the electroacoustic sound composition. In particular, high-frequency cello material, especially during moments of increasing intensity toward the electroacoustic climax, activates a turbulence-based transformation that violently tears and displaces the UV coordinates of the rendered image.

The artificial entities analyze the final rendered result of every frame, including the effects of UV collapse, and modify their scale, color, and shape through a genetic-algorithm-based process in an attempt to maintain visual identity. However, during the most intense moments of UV collapse, the distinction between artificial life and its surrounding environment becomes temporarily impossible to perceive. At this zenith of audiovisual instability, the organism and world visually lose their separability.

The work therefore approaches identity not as a stable property but as an ongoing attempt at persistence under conditions in which the environment continuously transforms the very field through which identity becomes perceptible. Combining artificial life, evolutionary computation, ray-marched rendering, electroacoustic composition, and recursive image analysis, the project proposes simulation itself as an aesthetic process in which sound, rendering, environment, and identity circulate without a stable origin.

Keywords: artificial life; audiovisual art; genetic algorithm; electroacoustic music; simulation; ray marching; turbulence; identity

1. Introduction

Circulation in and for Artificial Life explores the possibility of identity within a computational environment in which neither the world nor the entities within it remain stable. The visual space is never static, even for a single frame. Its parameters are continuously rewritten by scripts, while numerous abstract forms rotate rapidly around both the world and the artificial-life entities. These forms and the surrounding environment are rendered through ray marching implemented in HLSL.

The work therefore begins from instability rather than introducing instability into an otherwise stable world. Spatial relations, visual boundaries, scale, and orientation are continuously transformed. An entity cannot simply occupy a fixed position within a neutral environment because the conditions through which that entity becomes visible are themselves changing.

Within this environment, multiple artificial entities attempt to maintain a degree of visual identity. Their persistence is not defined as the preservation of an original shape. Rather, identity emerges through continuous transformation and adaptation.

The system draws on a broader history of evolutionary computation and artificial-life approaches in which populations can change through processes of variation and selection (Holland, 1975). It also relates to artistic and computational explorations in which virtual creatures evolve through genetic processes (Sims, 1994). However, the present work does not use evolution to discover an optimal body or behavior for a predetermined task. Instead, evolutionary transformation becomes an aesthetic mechanism through which an entity attempts to remain distinguishable within an environment that continuously threatens to erase the distinction between entity and world.

2. Computational Environment and Artificial Life

2.1. An Environment That Is Never Stable

The world surrounding the artificial life is produced through ray-marched rendering in HLSL. Its parameters are continuously rewritten by scripts, causing the environment itself to undergo constant transformation. Numerous abstract objects move and rotate rapidly around the world and around the artificial entities, producing a spatial field in which conventional perspective and stable relations of containment become difficult to establish.

This instability is fundamental to the work. The environment is not a background against which the organism can be objectively evaluated. Instead, it continuously participates in determining what can be perceived as an entity.

The distinction between figure and ground is therefore always provisional. At one moment, an artificial entity may appear visually distinct from the surrounding space. At another, rapid changes in form, scale, movement, and environmental parameters may weaken this distinction.

The work consequently asks whether identity can exist as something other than a fixed property. If the conditions of perception are themselves unstable, identity cannot depend exclusively on visual sameness. It must instead be understood as an ongoing process of persistence under transformation.

2.2. Artificial Life and Recursive Image Analysis

Each artificial life entity is defined by parameters associated with visual properties including scale, color, and shape. These parameters can mutate and change through a genetic-algorithm-based process based on principles of variation, selection, and adaptation (Holland, 1975).

Crucially, the artificial life is not evaluated against an ideal image prepared outside the system. The system analyzes the final rendering of every frame. This final rendering already includes the effects of ray-marched environmental transformation, the rapid circulation of abstract objects, and the UV-collapse process described below.

The artificial life therefore does not respond to a stable representation of its world. It encounters only a computationally transformed result.

Based on this analysis, the entities alter their own scale, color, and shape in an attempt to maintain a degree of visual persistence. Yet this adaptation cannot establish permanent equilibrium. A transformation that increases distinguishability at one moment may produce different environmental relations in subsequent frames. The conditions of survival are

consequently recursive: adaptation changes the visible situation, and the changed situation becomes the condition for further adaptation.

In this sense, the genetic algorithm is not employed primarily as an optimization tool. It becomes a mechanism for negotiating the possibility of identity under continuous instability. The entities persist only by changing, but every change also risks producing further indiscernibility.

3. Sonic Transformation and UV Collapse

3.1. Cello and Electroacoustic Transformation

The sonic material of the work originates in cello performance. Live cello improvisation is first subjected to intense real-time transformation. This material is subsequently edited in a digital audio workstation into a completed electroacoustic composition.

The completed composition does not function as an independent soundtrack added after the visual system has been constructed. Its spectral and temporal behavior directly participates in the transformation of the image.

Turbulence-Based UV Collapse

A central visual process is continuous UV collapse. In particular, high-frequency components of the cello activate the most intense transformations. As the electroacoustic composition approaches moments of climax, high cello sounds become increasingly forceful and dense. These sounds drive a turbulence algorithm that violently displaces, tears, and destabilizes the UV coordinates of the visual field.

Thus, UV collapse has a specifically sonic structure. It is not simply a random visual distortion. The increasing intensity of the electroacoustic cello creates moments in which the rendered image is subjected to progressively more violent turbulence.

The process may be summarized as follows:

cello improvisation → real-time transformation → electroacoustic composition → high-frequency cello intensity → turbulence-based UV displacement → UV collapse → final rendering → recursive visual analysis → artificial-life adaptation

The chain does not establish a simple one-to-one visualization of sound. Instead, the sonic material intervenes directly in the conditions through which the artificial life becomes visible. The organism must therefore negotiate not only a continuously changing computational environment but also moments when the environment is violently torn apart by the spectral intensity of the composition.

This relationship also resonates with approaches to sound that understand listening and composition as inseparable from environments rather than treating sound as an isolated object (Westerkamp, 2002). In the present work, however, the environment is not a pre-existing acoustic landscape. It is an artificial computational field continuously transformed by the circulation of sound, rendering, and evolutionary behavior.

4. The Zenith of Audiovisual Collapse

4.1. Indiscernibility

The most critical moment of the system occurs at the zenith of UV collapse.

The artificial life is already attempting to maintain its identity within a ray-marched environment whose parameters are continuously rewritten. Its surrounding world is never stable, and numerous abstract forms circulate rapidly around it. Under these conditions, the entity continually changes its scale, color, and shape in response to the final rendered image.

At moments when the high-frequency cello material reaches particular intensity, however, the turbulence-based UV transformation becomes extreme. The coordinates of the visual field are violently displaced and torn. The distinction between the artificial life and its environment progressively weakens.

At the zenith of collapse, this distinction may temporarily become impossible to perceive.

This is not simply the disappearance of an object caused by an external visual effect. The artificial life and the environment become visually indiscernible precisely because the field through which their difference is perceived has itself collapsed. The organism can no longer be clearly separated from the world surrounding it.

4.2. Re-emergence

The zenith represents the most radical condition of instability within the work. The artificial life attempts to maintain identity through continuous adaptation, but the environment periodically reaches a state in which distinguishability itself becomes unavailable.

Nevertheless, this state is not permanent. Following the peak of collapse, new differences may gradually emerge. The entity may again become distinguishable through further changes in scale, color, and shape. Identity is therefore neither fully preserved nor completely destroyed.

It repeatedly approaches indiscernibility and subsequently re-emerges.

5. Identity and Simulation

5.1. Identity as Persistence Against Indiscernibility

The work approaches identity as neither immutable essence nor complete dissolution. The artificial entities continuously change, but their transformations are organized around an attempt to remain perceptible as entities.

This produces a paradox. To maintain identity, the artificial life cannot remain unchanged. It must alter itself in response to its environment. Yet because the environment is continuously transformed, every attempt at persistence also introduces further instability.

Identity is therefore operational rather than fixed. It is a temporary achievement within a field of continuous transformation.

The zenith of UV collapse makes this condition especially visible. During the most intense moments, even the basic distinction between entity and environment becomes temporarily unavailable. Yet this does not mean that the concept of identity simply disappears from the

work. On the contrary, the temporary loss of distinction reveals the extent to which identity depends on conditions that can never be completely controlled by the entity itself.

The artificial life does not possess a privileged viewpoint outside its environment. It analyzes only the final image produced by the entire computational process, including the transformations that threaten its own visibility.

Identity therefore emerges from an impossible task: to persist within a world while never gaining access to that world's stable form.

5.2. Simulation as an Autonomous Aesthetic Process

The project is an artistic and speculative simulation, but it does not use simulation primarily to represent an external reality. Simulation itself becomes the aesthetic field.

Human performance enters the system through cello improvisation. The improvisation is transformed in real time and subsequently composed into electroacoustic form. The high-frequency intensity of this composition activates turbulence-based UV collapse. The resulting image is analyzed by the artificial life, which then transforms its own visual parameters through evolutionary processes. These transformations produce further changes in the visual field.

There is therefore no single stable point of origin.

The human performer initiates material but does not maintain direct control over its later consequences. The electroacoustic composition transforms the image, but it does not determine a stable visual result. The artificial life adapts to the final rendering, but its adaptation also occurs within conditions produced by processes beyond its control.

Agency is distributed across performance, electroacoustic transformation, rendering, turbulence, environmental parameters, image analysis, and evolutionary adaptation.

The work thus proposes simulation itself as an aesthetic process beyond a simple opposition between representation and reality. It constructs a self-referential field in which sound, image, computation, environment, and identity continuously circulate.

The zenith of UV collapse is the point at which this circulation becomes most perceptually radical. At that moment, the distinction between organism and environment becomes temporarily indiscernible. Yet from this indiscernibility, difference can emerge again.

6. Conclusion

Circulation in and for Artificial Life investigates identity under conditions in which stability is structurally unavailable. The artificial-life entities exist within a ray-marched world whose parameters are continuously rewritten and whose visual field is further destabilized through turbulence-based UV collapse.

The sonic composition plays a central role in this instability. High-frequency cello material, particularly during the movement toward electroacoustic climax, violently transforms the UV coordinates of the rendered image. At the zenith of this process, the distinction between artificial life and environment may become temporarily impossible to perceive.

The entities nevertheless continue their evolutionary attempts at persistence. By analyzing the final rendering of every frame and modifying their scale, color, and shape, they repeatedly negotiate the possibility of remaining distinguishable.

The work therefore proposes identity as a temporary persistence against indiscernibility. It is not an essence protected from transformation but an unstable process that exists only within transformation.

Through the circulation of cello performance, electroacoustic composition, turbulence-based UV collapse, ray-marched rendering, recursive image analysis, and genetic transformation, the project constructs simulation as an autonomous aesthetic environment. Rather than representing a world from outside, the work allows identity and environment to emerge, collapse, and re-emerge within the same recursive field.

Video Documentation

Video documentation of *Circulation in and for Artificial Life* is available at:

https://youtu.be/f2Hz7B3jDhs

The video documents the completed audiovisual work presented in the virtual exhibition *Co-Creativity in Music, Sound, and AI: Improvisation, Interaction, Composition*, University of California, Riverside, June 2026.

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