

# Artificial Life Expression in Interaction Design by the Esthetics and Historical Analysis

Shiho Hasegawa\*

*\* Graduate School of Cultural Science, Saitama University, s.hase14@gmail.com*

**Abstract:** This paper describes and analyzes the emergence of Artificial Life in the fields of art and design by means of digital technology, with a particular focus on Media Arts (New Media Art). This investigation of conceptual issues in interaction design draws on Cybernetic Theory (Norbert Wiener, 1894-1964 ) as well as on the Affordance Theory of Ecological Psychology (J.J. Gibson, 1904-1979). In a second step the paper describes actual design-strategies and processes of creating “Artificial Life (A-Life)” throughout New Media Art History. Genetic codes generated and illustrated by a specific computer software are brought into interaction with the physical entity of a robot, which embodies the artificial intelligence in order to form the so called A-Life Expression. This responsive machine is able to mimic movements and functions of a human body and its organs, eventually making bodily information visual. Then, finally works of the A-Life art after 1980s are focused which can be categorized into five classes as follows: 1) Evolution and Self-increase, 2) Virtual Space and Interaction, 3) Robotics Interaction, 4) Expanding Body, 5) Taking data of Human Body.

**Key words:** *Artificial Life, Interaction Design, Media Arts*

## 1. Introduction

The purpose of this paper is to describe and analyze the esthetics possibility of the Artificial Life expression of art and design by the digital technology. I am emphasizing the importance of new trends in the field of media arts. Digital technology has fundamentally changed everyday life, our perception and way of thinking. Natural science and information research had a immense impact on the fields of design and art. Since the second half of the 20th century progressive artists and designers introduced experiments in interaction design to the field of media arts using Artificial Life technology. Over the past 10 years a considerable number of studies have been made on Artificial Life in connection to design and works of art, yet only few papers took a critical approach from an esthetic or art historical perspective.

Media arts as a discipline of art appeared in the early 1980s [1], one of its most remarkable features is the interactivity of works due to their use of complex systems such as the Artificial Life and the Artificial Intelligence, new engineering technologies like virtual reality (VR), and telecommunication systems such as the internet. As Dieter Daniels said art and design works have gained interactivity through the following changes because of the further development of technology from the 80s to the 90s; 1) Interaction in video story using multi-option, 2) Interaction in closed information space - virtual space in which an Appreciation person can operate has been extended, 3) Interaction by body interface, 4) Possibility of artificial intelligence, 5) Change of the Appreciation Person's Role - from Appreciation Person to Performer [2].

Through blending this new knowledge and findings in kinetic art after the 1950s, the Artificial Life object as synthetic modeling with form and movement appeared in design and art. Not only imitation and creation of the static life form in pictures and sculptures, but the expression of animate life as a dynamic process have been enabled by introducing these technologies, concerned neither with the analog nor the digital. Especially, the concept and research in Artificial Life as proposed in 1987 had a huge impact on the above mentioned fields.

## **2. Interaction Design in Media Arts**

First of all, it has to be underlined that this investigation of interaction design is made from the viewpoint of Cybernetics (Norbert Wiener), and the Affordance Theory of Ecological Psychology (J.J. Gibson). Media Arts mainly focus on relational perception and communication in an informational environment or network. Therefore a purely esthetic consideration of design in terms of form, color and texture is not sufficient, all the more it has to be understood as a function of *Interaction Design* generating Media Art works.

### **2.1 Relation with the Cybernetics Theory**

The introduction of the Cybernetic theory by Norbert Wiener to the art theory was a turning point for interactive design in Media Arts. Proposing that recognized by the integration of control and communication between animal/men and machine, researchers as Wiener were interested in telecommunication technology and its concepts, as well as in the field of design and art. The cybernetic “feedback-model” was introduced in artistic practice and ways of expression with the support of cutting-edge technology. Cybernetic theory is setting up a model of control or governance of communication processes in animals and machines, including physiology, mechanical engineering, telecommunications engineering and so on. The core idea is to map the performance of automatic control by recording and integrating feedback information [3].

Although kinetic art works (moving sculpture and moving image) first appeared in the 1920s, new types of moving art integrating the feedback-system made it possible to create an encompassing environment by transforming elements such as light, sound, and wind into the electric information, and to integrate it directly to the process of interaction.

The described merging of findings from art and information science enhanced the possibilities of direct physical interaction design, artworks imposed itself as new media to express and explore these relations. It follows from what has been said that this possibility – “the possibility of expression using a machine which carries out auto-control by introducing the theory of cybernetics” and “the possibility of creation of the animate life by producing the others who do a personal reaction” - leads to the deployment of the Artificial Life expression.

### **2.2 Relation with the Affordance Theory**

Establishing feedback between a spectator and a work, i.e. participation, interaction design is not only a substantial element in media arts, but also in commercial design, and therefore this paper also introduces James. J. Gibson's affordance theory. In the design study, the affordance theory, which was a worth and perceptual method provided animals by environment, was referred by a lot of prior researches. And in context of Artificial Life expression, affordance theory applies as follows since it says that the consciousness of the human being, who receives the information of an object as moving perceives not only motion, but also assumes it to be animate, a life existence.

According to the affordance theory, we - human beings - measure distance in relation to objects and the environment surrounding ourselves, and then we act. If motion is added to such an object or environment, we will recognize an existence of life. Gibson distinguishes between inanimate object and a living one depending on whether the movement is shown from both, internal and external factors. He insists that the most complicated object of perception is an animal [4]. Actions by animals affect perception on various levels of social interaction such as sexual, motherhood, competitive and coordinative relationship to another animals that are seeing; for example, a grooming between monkeys and a conversation of human being [5].

On the other hand, according to the theory of animacy perception, it is important to point out, the possibility to recognize an inanimate object as a living thing by adding movement [6]. While animals - especially human beings - recognize living things through direct interaction it becomes clear that the perception of vitality is reinforced by physical motion coming from the inside.

### **3. History of Artificial Life Expression in Media Arts Exhibition and Journal**

Secondly, I propose that the thought and history of creating the A-Life. The “Artificial Life” is realized not only by genetic simulation systems displayed by computer graphics, but also by the use of a robot showing a physical entity incorporating artificial intelligence. My paper therefore includes an examination of technologically animated objects, such as robots and androids. Since they can replace the functions of a human body and visualize our bodily information. Lately the integration of sophisticated devices, which have only recently been developed in mechanics, electronics, and computer science, increased their interactive potential.

#### **3.1 Birth of the Concept of the Artificial Life**

The concept of Artificial Life was widely advocated by Christopher Langton, at the 1st conference of Artificial Life (United States, Los Alamos) held in September in 1987. Although it has been a challenging question for science to realize the idea of artificial life throughout the 1980s, the blending of approaches from computer science, information engineering, biology, ecology, robotics engineering and so on, became a more attractive field of investigation only through Langton’s proposal, and by straddling it into another domain [7]. In Langton’s concept, Artificial Life is the research, which bundles up computer simulation software and the robotics as hardware. Early Artificial Life was developed by computer simulations only, without restrictions from an actual analog world [8].

So it is natural that the strong connection between the computer science and the early Artificial Life research, the modeling only retrieved data from numerical operations of a computer and the setup of various parameters, in order to graph them on a screen. That is, emergence of Artificial Life was only possible in a virtual space, utopian and separated space.

#### **3.2 Deployment of the Artificial Life Expression as Art Works in Ars Electronica**

Art and design had an interest in Artificial Life or Artificial Intelligence since the early days of computer science. Many works were created from the beginning of the 90s, and many theme exhibitions about Artificial Life art and cyborg have been organized, especially in the field of Media Arts.

For example, in 1986 Ars Electronica, which is the greatest Media Art conference and exhibition, invited Yoichiro Kawaguchi, who is a pioneer of the Artificial Life CG animation, showed his work <Ocean> (1986), and in 1991, not only computer animations appeared (ex. Karl Sims’s <Panspermia> (1991) and Yoichiro Kawaguchi’s

<Eggy> (1990) got the award-winning of computer animation section), but also interactive robotic artworks (ex. Chico McMurtri & Rick Sayre <The Tumbling Man> (1990) won the award of the interactive art section). Then, the festival was held on the theme of "Artificial Life - Genetic Art" in 1993, Christopher Langton was invited to give a lecture. Of course, though the various type of Artificial Life art works were exhibited in this year, especially Ulrike Gabriel's small robotic installation, <Terrain > (1993) and Christa Sommerer & Laurent Mignonneau's < Interactive Plant Growing > (1992) having interaction with VR got a reputation [9].

Moreover, as the concern about a human being or the ecology of an animal, and about the phenomenon of evolution continued, a related exhibition was held after that; "Life Science" in 1999, "Next Sex" in 2000, "Hybrid Living in Paradox" in 2005, "Human Nature" in 2009.

### 3.3 Analysis of the Change of Journal Articles about the Artificial Life Expression

And next, I investigate articles of the most famous international journal of arts, sciences and technology, *Journal of Leonardo* (the MIT Press.), and consider the interest of Artificial Life art. *Leonardo* has been published since 1968 and from early era on artists and researchers were interested in the relationship of the human being and nature, but only in 1989 collected for first time papers dealing with emergence; "Art and the New Biology: Biological Forms and Patterns". However this special edition didn't touch the issue of the Artificial Life and creating new creatures, they were only debating about the way of using a computer as medium of creation and Application of the laws of nature to art.

It was around 2000 that announcement and analysis advanced in the field of artworks called A-Life art and Robot Art. The first and biggest special edition about Artificial Life arts published in 1998; "Artificial Life Art" suggested the state of the A-Life art in a large sense including robot modeling [10]. In 2002, the special edition "A-Life in Art, Design, Edutainment, Games and Research" showed that the A-Life had permeated the large social domain not only in connection with art but as visual modeling [11]. In addition, after 2000, the number of articles related to bio obviously increased [12].

Judging from this chapter, we would notice the some trend. The concept of Artificial Life was born in 1987, and if I describe the work of art, they can be divided roughly into three groups; "A-Life art by Computer Graphics", "A-Life art by Robotics", and "Bio Art by real life form", and by the used technology they can be classified in detail ;Table 1.

Table 1. Classification of Style and Feature in the Artificial Life Works

Style	Features (Using Technology and method)	
CG Art	CG Animation	
	Virtual Reality Technology and Interaction Design	
Robotics Art	Robot	
	Device connecting with human being	>Body Expansion
		>Living Date
Bio Art	Organization (Real Animal and Plant etc.), Genes	

#### 4. Relationship the Interaction Design and the Artistic Expression — 5 Case Studies

Using the classification of Table 1., we could recognize the Feature of Artificial Life Expressions, and the problem is what is the esthetics of Artificial Life Expression. In this chapter, I will propose five types of esthetic value of the unique Artificial Life Expression as follows; 1) Evolution and Self-increase, 2) Virtual Space and Interaction, 3) Robotics Interaction, 4) Expanding Body, 5) Taking data of Human Body. So by comparison with the previous classification (Table 1.), we can associate a representation method and content in terms of a new esthetic value (Table 2.).

Table 2. Classification of Style and Feature, Expression in the Artificial Life Works

Style	Features (Using Technology and method)		Expression
CG Art	CG Animation		=Evolution and Self-increase
	Virtual Reality Technology and Interaction Design		=Virtual Space and Interaction
Robotics Art	Robot		=Robotics Interaction
	Device connecting with human being	>Body Expansion	=Expanding Body
		>Living Date	=Taking data of Human Body

##### 4.1 Evolution and Self-increase

The first type of the Artificial Life arts is treating life systems of growing and self-increasing, category of “evolution and self-increase”. In this category the creator of works were interested in generation, evolution and degeneration. The works concerned have brought about a new time-axis into animate life expression. It is possible to express their time-axis as different from ours. Although interaction is not necessarily included in this design-method, it clearly shows the possibility of the various patterns by parameter settings, especially in the artist’s manufacturing process.

<GROWTH> by Yoichiro Kawaguchi is one of the early CG works about Artificial Life expression (Figure.1). Although it was built using the self-multiplication process program, which was not conventional in CG, it is evaluated as a roaring unexpected animate life expression with wave and a more nearly organic expression of the textures which seem to be soft and are also likely to be elastic.

##### 4.2 Virtual Space and Interaction

Another characteristic expression in the VR space is the following: It is a work dealing with interaction between physical infiniteness and reality. Although experience-based works generally have a pre-dominance as educational works, when it comes to the evaluation of the originality of the work, in this case the importance lies in matching of concept and interface design.

Christa Sommerer & Laurent Mignonneau’s < Interactive Plant Growing > is a pioneering work of this category (Figure.2). This is an installation work, which consists of five realistic potted plants as a big image in the screen, and a fern and a cactus before that. The plant of three-dimensional CG is designed to resemble real plants, which are growing thick on the screen because of the appreciation person’s touch. In order for a human body to be

tinged with electricity, current flows into a plant through the motion of the hand. The artworks system uses information and feedback theory in order to establish a direct interaction thanks to men's physiology index, making a virtual plant raise through a real plant. The point is, that the involved person's experience is translated and brought into existence in a virtual space, because the interaction is evaluated by the set-up system.

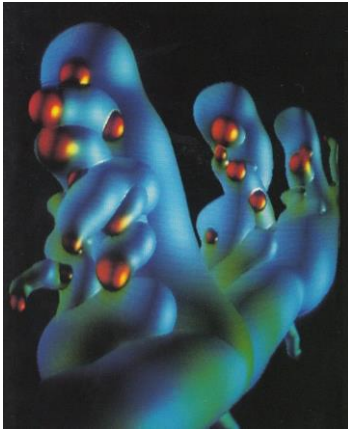


Figure.1\*<Growth>1985



Figure.2\*\*<Interactive Plant Growing>1992

### 4.3 Robotics Interaction

The 3rd feature of expression consists of works that enable interaction with robots. The esthetics of the robot's performance is not necessarily proportional to the standard of the robot's technological features. However, people are interested in the contingency beyond a pre-established harmony made by a "robot" and the fun taking in the expression. In Robot Art, devices imitating an animal - especially human beings, the spectators sympathize or empathize with the robot, considering it human like and able to communicate.

For example, <The Flock> has a form like the robot arm made from the vine of the grape (Figure.3). By setting up two or more sense organs, it reacts to each elements of the circumference environment more intentionally. It has eyes, ears, a mouth and a brain. Because of their voice existing autonomously an individual specificity appears, so they seem to have a sort of own language through their communication.

### 4.4 Expanding Body

"Expanding Body" is another type of expressing Artificial Life. In this case, Life Form is the real human body (nevertheless whole or a part). It raises the state of new feeling and what a body is by not only creating new life forms but also connecting with technologies and real bodies. And the raw body may be impressed strongly again by connecting to technology.

Stelarc's <Third Hand> is the 3rd hand built with aluminum and stainless steel - a motion is controlled by the electrical signal from the muscles of an abdomen and a leg in order to maintain an independence movement, and it can grasp, release and pinch (Figure.4). The intuitive use is possible by establishing habitual use. It functions as an expansion an interactive and commutative extension of the body connecting man and machine. Furthermore, Stelarc made <Fractal Fresh>, which connects the city and the body in the world using the Internet as a form extended the Third Hand. The equipment as the expanding body is connected with big cities of all over the world, such as Melbourne, Paris, and Rotterdam, the performer - Stelarc is required his action (operation of the body) in the way which did not his meant by many and unspecified people who led the Internet.

#### 4.5 Taking data of Human Body

And in the last methodology of “Taking data of Human Body” which can be said also as the unique expression of the age of digital technology, we got the way of visualizing the invisible information of human beings and other animals which had not been realized before, such as brain waves, breathing and cardiac beats.

Ulrike Gabriel’s < Terrain\_01 > is an installation that the small robots attached optical sensors move around by the light of hanging from the top in the shallow circular area (Figure.5). This light is connected with the device of measuring brain waves, and if the alpha-wave of the appreciation person who attached the instrument is registered, a light signal will flash up. But if he/she gets interested in robots, all of light and movement of robots will become worse and stop.

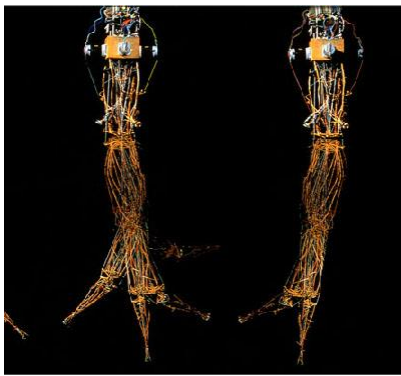


Figure.3\*\*\*  
<The Flock>1993-95



Figure.4\*\*\*\*  
<Third Hand>1984

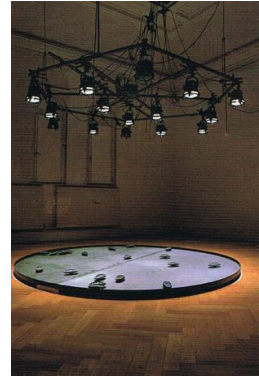


Figure.5\*\*\*\*\*  
<Terrain\_01>1993

#### 5. Conclusion

This paper shows that the development of digital technology has contributed to the expansion of the Artificial Life expression, and that it will bear good prospects to bring up new directions in art and design. The Artificial Life emergence can be described as an autonomous existence with an original time-axis due to the implementation of digital technology. Especially the Artificial Life expression gained the visual and tactile sense through the motion accompanied by a reality and the exquisite picture by the technical development of digital images, such as CG animation. And an appreciation person is engrossed in VR space and it enables communication with a work with substance.

Then the interaction with appreciations raises the presence as animate lives. When people see works with interaction, they might approach and touch them and in A-Life expression they additionally try to communicate, particularly in the case the works have forms and movement like animal. Furthermore, there is a characteristic expression of a digital technology. It is retrieving data of living bodies. By connecting the body with technology, fragments of the body can be visualized and recorded. That is, the human being becomes actualized in virtual life as animate.

The works created in the 80s to the 90s have to be considered today as pioneering works of Artificial Life expression in media art, they serve as actual case studies to show how high technology is efficiently integrated in expression, as well as they show to which extend the manifold concepts and expressions by different artists meet in a common interest to further develop interactive emergence.

Interaction design is important for design, but it is also an essential element for Media Arts which focuses on communication and the relationship between beholder and artwork. It becomes therefore evident that design theory can be applied to create art works.

## 6. References and Citations

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\*Credit for Figure.1: Yoichiro Kawaguchi ed. (2010) *Gemotional Bio-Machine Art*. Kawaguchi Lab, Tokyo University

\*\*Credit for Figure.2: Gerfried Stocker. and Christa Sommerer., Laurent Mignonneau eds. (2009) *Interactive Art Research*, Springer Wien New York

\*\* Credit for Figure.3: T-BRAIN CLUB HUMANMEDIA ed. (1994) *Artificial Life*, Yosensha

\*\*\* Credit for Figure.4: Marquard Smith ed. (2007) *STELARC: THE MONOGRAPH*, The MIT Press

\*\*\*\*\*Credit for Figure.5: NTT Publishing ed. (1994) *Inter Communication*, No.7, NTT Publishing