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*Paper: Programmed life vo.1: Birth*



**Abstract:**

This paper describes how the generative art represents aesthetic and emotional values of biologically concerned thoughts to a derivative of Genetic Algorithm theory. A series of Programmed Life is a visualization artwork that automatically generates random abstract images by variation, selection, mutation etc. to be used the concept of evolution. The artist gets the motivation from the origin of evolutionary art's field. Aesthetics matter in this work, the evolutionary visualization is created emotional moods by self- developed, assembled, designed, generated inspired by Color Filed Painting. According to the abstract expressionism that Color Filed Painting involved in, the self-generated images transfer the emotional message to the significant of space. This paper is an attempt to contextualize the notion of the artist by providing a histories and theories. Additionally, it gives an overview of 'Programmed Life vo1: Birth' which is mostly focused on creating analog abstraction like digital visualization.

**Topic: Art**

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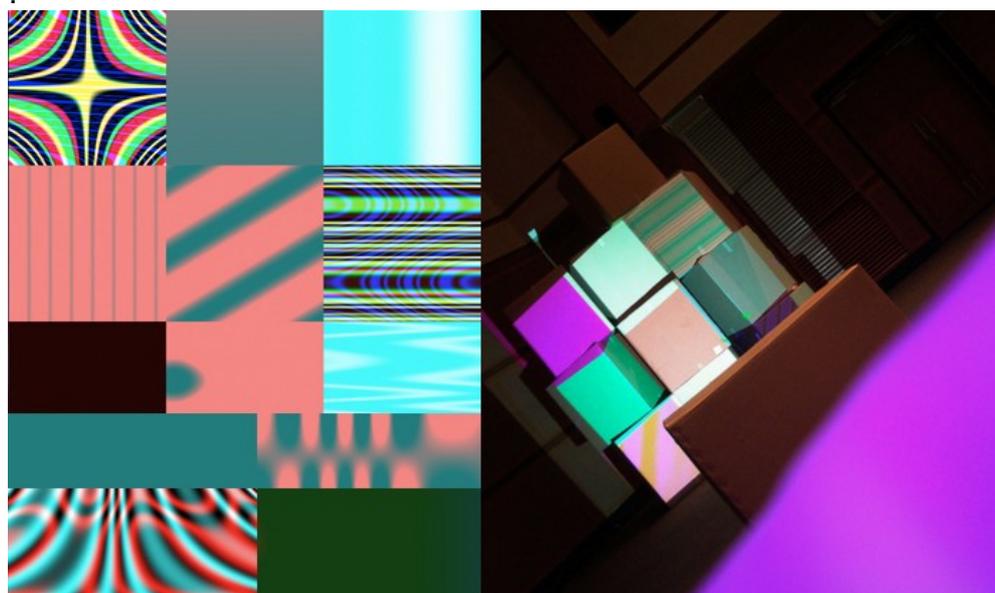
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University of Minnesota  
Press, 2007



*Left; generated images from Programmed Life*

*Right; "Programmed Life vo1: Birth" at LIFT Asia 2008 by Hyeri Rhee*

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## Programmed Life

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### Abstract

This paper describes a work of generative art called “Programmed Life” which automatically generates abstract images by means of evolutionary operations such as variation, mutation, and selection. The aesthetics of this work is described in terms of *Color Field Painting* and self-generated images are considered to be color painting that transfers emotional message.

### 1. Introduction

This paper describes an experimental work of evolutionary generative art that generates abstract images by genetic algorithm. It automatically generates unpredictable images. The main artistic sources of this work are *Color Field Painting*, data visualization, visual abstraction, and color construction, spatial composition. Abstract artist, Mark Rothko, often used abstract images to give an idea of the world. In this paper, we use evolutionary generative art for a similar purpose. The processes used in evolutionary generative art, e.g. variation, mutation, reproduction, and selection are considered as new ways of color construction and formation for visual abstraction.

We first review our works of evolving images produced by a genetic algorithm. Then we try to provide aesthetics for it. At the end, future work related to the present one will be discussed.

### 2. Genetic Algorithms and Generative Art

Genetic Algorithm or Evolutionary Algorithm was designed to solve the problem of complex physical world by simulating the process of natural evolution in virtual world. The concept of genetic algorithm was initiated from the pure curiosity of the

passionate scientists. In 1975, John Holland, American scientist and the father of genetic algorithm, introduced evolutionary computation based on the notion of natural evolution [4]. British ethnologist and evolutionary biologist, Richard Dawkins built an evolutionary algorithm called 'Biomorph'. Biomorph is a mathematically designed organism whose shape is defined by its genome [5]. It was designed to show that an evolutionary process can produce things that look like intentionally designed. This work has had a great impact on Karl Sims who used Genetic Programming to evolve a population of images. In Genetic Programming, the genetic code of each individual 'genotype' is a program represented in tree structure. When programs in the form of tree structure are evaluated, they become 'phenotypes', images in this case. The better suited genotypes have higher probabilities of being selected to form the next generation, which is generated by recombination and mutation of the genetic codes of the selected individuals [6,7]. To begin evolution, this technique randomly generates images which are represented by tree structures where the terminal nodes are the captured images, and the non-terminal nodes are functions which transform the images represented by the children nodes. These trees are called image trees. In each generation, 100 new image trees for the next generation are generated by mutating and crossing over members of the 100 image trees. A tree is mutated by selecting a node in it randomly and replacing it with a new random tree. The cross-over exchanges a subtree of one tree and a subtree of another tree, creating two new trees. When trees are selected for mutation and cross-over, those with higher fitness are selected with more probability.

We have experimented with the following setting. The functions used as non-terminal nodes in the tree are selected from the function set  $F$ :  $F = \{\text{"mul"}, \text{"add"}, \text{"sine"}, \text{"cosine"}, \text{"avg"}, \text{"add2"}, \text{"sine2"}, \text{"cosine2"}, \text{"avg2"}\}$ . The terminal nodes are selected from the terminal set  $T$ :  $T = \{\text{"varX"}, \text{"varY"}, \text{"max"}, \text{"max2"}, \text{"div"}, \text{"divT"}, \text{"velT"}, \text{"timT"}, \text{"basic_img1"}, \text{"basic_img2"}, \text{"basic_img3"}, \text{"basic_img4"}\}$ . The number of nodes in the tree is 9. The number of generations used is 20. The program is written in *Processing* [11]. Examples of generated images are shown in Fig. 1.

The work typically produces a large scale of informal shape. The viewer is fully immersed in the color environment and feels the space. The work is installed on the edges of the unframed canvas; it blurs borders and represents the infinite by means of emotional unconsciousness. This technique of spatial composition is expressive and moody and reveals a rich range and delicate color variation. In this piece, the artist displays images on irregularly stacked boxes (Fig 2). The ten boxes suggest the sense of boundlessness. The viewer continuously appreciates newly generated images. Therefore, he/she could feel the significance of space where unique images are shown. Like Rothko's huge paintings, the unlimited composition represents an unknown space.



*Fig 1. Resulting images*



*Fig 2. Programmed Life vo1. : Birth, at 2008 LIFT Asia conference*

### **3. The Aesthetics of Generated Images**

Generated images from our system look interesting. However, the aesthetic value of evolutionary art has been frequently questioned; it is rather depreciated because it has been considered just as a mixture of the various interdisciplinary studies: art, computer science, and biology etc. The absence of aesthetics for evolutionary art makes it less appreciated as an art piece. Finding an appropriate aesthetic value and establishing its background theory for evolutionary art is an open problem [8]. This paper tries to address the problem by comparing this work with Color Field Painting.

### 3.1 Mark Rothko and Color Filed Painting

*Abstract Expressionism* was an American movement that has had a great influence. The movement refers to all types of non-geometric abstraction with emotional intensity and anti-figurative aesthetics. There have been various styles of abstract expressionism; however, two distinct styles are prominent: irregular, idiosyncratic constructions of energetic action paintings and informal formation with deep concern with color. Especially, gestural, action painters have utilized surrealistic techniques of automatic art and *Color Filed* artists have worked with simple, unified blocks of color [1].

*Color Field Painting*, which emerged in New York City during the 1940s and 1950s, pursues the field of flat, simple color spread across the canvas. During the late 1950s and 1960s, *Color Filed* painters spread all around world various formats of stripes, targets, simple geometric patterns and references to landscape imagery to nature (Fig 3,4,5).



Fig.3 Left > Mark Rothko, *Untitled (Violet, Black, Orange, Yellow on White and Red)*, 1949. Oil on canvas, Solomon R. Guggenheim Museum

Right > Mark Rothko, *No.3 (Magenta, Black, Green on Orange)*, oil on canvas, 1949, Bequest of Mrs. Mark Rothko through The Mark Rothko Foundation, Inc.

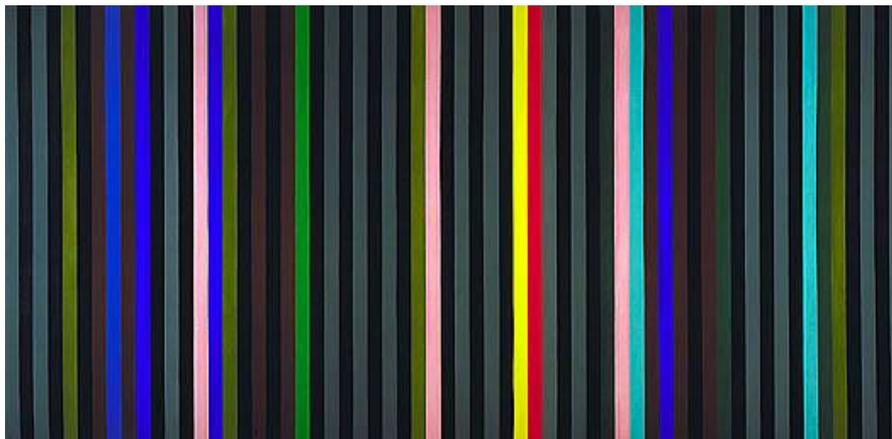
Mark Rothko was a distinguished *Color Filed Artist*. Especially, in his early works during the 1940s and 1950s, he showed bright vivid, vibrant colors, multi-formative and expressive spiritual energy, and ecstasy [2]. He sought the essence of abstract painting in his own ways. His styles emphasized symmetrical rectangular blocks of two or three opposing or contrasting colors. His best-known method of painting was blocked color formation [3]. He always resisted to interpret his paintings and was concerned with the viewer's experience, the merging of work and recipient beyond verbal comprehension:

*“ I am interested only in expressing basic human emotions — tragedy, ecstasy, doom, and so on. And the fact that a lot of people break down and cry when*

*confronted with my pictures shows that I can communicate those basic human emotions . . . The people who weep before my pictures are having the same religious experience I had when I painted them. And if you, as you say, are moved only by their color relationship, then you miss the point.” - Mark Rothko*



*Fig 4. Morris Louis, Where, oil on canvas, 1960, Hirschhorn Museum and Sculpture Garden*



*Fig 5. Gene Davis, Black Grey Beat, 1964, acrylic on canvas, Smithsonian American Art Museum collection*

### **3.2 Digital Color Field Painting**

*“The greatest value of a picture is when it forces us to notice what we never expected to see.” – John Tukey*

*“ ... not a copy or a tracing, but ‘pure’ or ‘absolute’ creation and ‘a work of pure, living art in infinity’....” - Kasimir Malevich, founder of Suprematism [11]*

The aesthetics of generated images can be partially addressed by linking them to color field painting, that is, by treating them as “digital color field painting”. In this

century, visualization has changed from simple graphical information to emotional imageries. Visualization is classically defined as visualizing information data to be easily understood [9]. Symbolic and graphical models are elements of information. Visualization by means of colors and formations to depict unseen, unpredictable information is recognized as a new way of expression and representation. The concept of genetic algorithm can be viewed as a fresh method to create the images of “*basic human emotion*” with regard to this visual abstraction experimentation [2,10]. Freed from facts of accuracy, digital visualization produces enthusiastic and dynamic aesthetic appeal.

Images and paintings are considered as visual forms of human perception of color, form, and line. It is a kind of represented meaning, which is intentionally put by artists. Abstract art uses unique color formation and composition to express emotional intuition. In our work, the generated images produce aesthetic values like hand-paintings do. RGB color model is an additive color model in which red, green, blue light is added together to reproduce colors in electronic system [10]. The generated images are related to the Rothko’s concept of blurring and vanishing boundaries, where two or more colors having similar values in saturation merge seamlessly into one another.

#### **4. Conclusions and Further Research**

This work shows that computer codes can be designed to produce images with aesthetic values and artistic purpose. The aesthetics of generated digital images is provided by the comparison with that of *Color Filed Painting*. But our generated images have no notion of development of phenotypes from genotypes, as in embryological development, but directly map genotypes to phenotypes. One way to incorporate development into evolutionary generative arts is to use the mechanism of cellular automata. When an image is represented as a cellular automata, the image can develop into a new form as each pixel interact with its neighbors in various ways.

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