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Exploring Processes and New Constructs in Art: the missing link in the history of Generative Art**Topic: Art****Author:**

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Abstract:

This paper explores the history of generative interactive art and its contribution to the broader field of art history from the late 1960s to the present. The history is exemplified in the creative work of British artist Ernest Edmonds (b.1942) in which the invention of new concepts, new tools and new forms took place in parallel and operated in an interdependent way.

The paper develops the themes within Edmonds' art and shows his connections with the Systems Artists and their forebears. In particular, the paper concentrates on the encounter of Edmonds with artistic thinking about systems and process in the broad sense, as well as digital and interactive work developed from the 1970s until the present time. As my paper will demonstrate, connections between Constructivism, Systems art and Generative art have been strong and at the same time considerably overlooked. The aim of this paper is therefore to present one of the missing histories of generative art through the analysis of a specific artist and his role in re-shaping the notion of interaction well before the advent of the World Wide Web.

By combining the analysis of the computer-based art collection held at the Victoria & Albert Museum, London, and a series of interviews conducted by the author with the artist in the past two years, this article will shed light on an original aspect of generative art and its consequences in contemporary art.

Biographical note: Francesca Franco is Senior Research Fellow at De Montfort University, Leicester, where she is studying the Edmonds Archive of computational art held at the Victoria & Albert Museum, London. In 2009–10 she was Research Fellow on the AHRC funded project Computer Art and Technocultures at Birkbeck, University of London, and the V&A Museum. She holds a PhD in the History of Art and MA in Digital Art History (Birkbeck). She is an Associate Editor of *Media-N*, Journal of the New Media Caucus.

Francesca's most recent publications include "The First Computer Art Show at the 1970 Venice Biennale. An Experiment or Product of the Bourgeois Culture?" *Relive: Media Art Histories*, Cubitt and Thomas, eds., MIT Press (2013); "Exploring Intersections: Ernest Edmonds and his time-based generative art," *Digital Creativity*, 24:3 (2013). Her first monograph on the history of generative and interactive art is contracted with Ashgate: *Ernest Edmonds - Generative Systems Artist* (forthcoming 2016).

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Keywords:

Ernest Edmonds (b.1942), Generative art, Systems art, interaction, influence, process, time-based art.

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Abstract

This paper explores the history of generative interactive art and its contribution to the broader field of art history from the late 1960s to the present. The history is exemplified in the creative work of British artist Ernest Edmonds (b.1942) in which the invention of new concepts, new tools and new forms took place in parallel and operated in an interdependent way.

This paper first examines the artist's background, context and key works engaged with the notions of structure, time and colour. The paper will then concentrate on two important, but often overlooked, works he created: *Fifty One & Fifty Two* (1980) and *Four Shaped Forms, Venice* (2015). The paper poses a number of questions about the origins and development of these works. How were these works created and what inspired their creation? How are they connected? Based upon an analysis of material held in Ernest Edmonds's Archive, the National Archive of Computer Based Art and Design at the Victoria & Albert Museum, London, and a series of interviews conducted with Edmonds by the author, the paper provides answers to these questions.

In this paper, the term "time-based art" is used meaning that the artwork exists *through time*, in the same way as film and music do. The term "generative art" is used according to the definition by Margaret Boden and Edmonds in their 2009 article "What is generative art?" according to which the term indicates art "wherein the artwork results from some computer program being left to run by itself, with minimal or zero interference from a human being."ⁱ This definition expands the original notion of generative art applied to architecture that Celestino Soddu proposed in his *Città Aleatorie* in 1989.ⁱⁱ

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Introduction

Today, it is almost impossible to list all the variations and nuances that have been explored in interactive art since its origins. The rapid advances in computer technology, especially from the early 1980s onwards, have accelerated exponentially the growth and ramification of such field. It is equally challenging to understand which were the roots from which it all originated. An example that helps in tracing the history – or one of the histories – of this subject is the work of British artist, Ernest Edmonds, who has been active in the field of interactive generative art since the late 1960s.

Looking at how some of Edmond's works have been created, this paper investigates how they disrupt the formal systems of art perception, particularly through interactivity and audience participation. From the late 1960s through the following two decades, most of Edmonds' work has been either concerned with the implications of the notion of computation, exemplified by his seminal work *Nineteen* (1968-9). Nonetheless, in the early 1980s, Edmonds carried out a parallel experimentation in art concerned with the organization and structure of surfaces and colours, both in terms of process and execution. The results, analyzed in this paper in detail, included two important works, *Fifty One & Fifty Two* (1980) and *Four Shaped Forms, Venice* (2015). As the paper will demonstrate, despite the thirty-five year gap that separates these works, the way they were created and similarities that connect them, help us understand one of the key developments of generative art from its very early stages as well as its evolution up to the present time.

Artist's background

Ernest Edmonds is a pioneer of computational art whose work has been engaged with the notions of colour, structure, time, and interaction from the late 1960s. As demonstrated by a number of recent studies and art exhibitions, his work has contributed to establishing a link, often overlooked, with the structural research conducted in the late nineteenth century by Paul Cézanne and the subsequent developments carried out by constructivist artists in the 20th century.ⁱⁱⁱ

His background is in mathematics, philosophy, and logic. These studies provided opportunities for interdisciplinary exchanges that have had a strong impact on the nature of his art. They also enabled Edmonds to explore new ideas in art through the use of technology that have become a constant stimulus in his creative research.

As an artist, he has been influenced by a variety of interests, such as concrete poetry, film, music, mathematical logic and computing. His work is rooted in Constructivism, the art movement established in Russia in the late 1910s that aimed to design objects with a new, revolutionary, and functional approach. Inspired by such ideas, Edmonds soon developed his own artistic language based on an ongoing dialogue around colour, structure, time, and interaction.

From the early 1960s, Edmonds began experimenting with structure in his work, in his painting, drawing, and poetry. His early watercolours, his drawings in china black ink from the early 1960s, and later paintings created between 1974 and 1982 using acrylic paint, depict geometrical abstract shapes. These works reference the iconic colour structures of the Dutch artist Piet Mondrian and the experimental American artist Charles Joseph Biederman's evolution of constructivism. A work such as *Nineteen* (1968–1969), which will be described below, provides a link to Edmonds's early experiments in structure using a computer.

In the early 1980s, Edmonds's work evolved towards a praxis increasingly engaged with the notion of time. This was made possible in part by the introduction and availability of the personal computer. This represents a pivotal moment in the artist's career: when he realized there was a way in which he could combine his research into structure and add time to it, making time-based art.

Edmonds' insight was that logic programming, one of the four main computer programming paradigms, based on axioms and goal statements, could be applied in art to make generative work integrated with the notion of time. As the artist explained in 2012, logic programming can be used as a method for handling structures in time by visually representing the internal search process within a computer. Time can be used to make generative work in which the rules, specified in logic, control the form and order of a sequence of images. The sequence can go on forever without loops, depending on the rules. The logic specifies how the work unfolds;

both the structure of each individual image and its structure in time. The details of this depend on a particular way of using logic in computer systems known as logic programs. In this method, a set of logical statements (in this case about the design of images) is interpreted as a program that instructs the computer to search for some specific goal or state (in this case of the image). An important element of logic programming is that it includes “backtracking,” where, when certain rules have been tried and fail to get to the goal, the computer goes back and looks for alternative ways of using the rules. In what Edmonds calls his video constructs, a series of works created in the early 1980s, this process of backtracking is used to generate an unfolding search and the artwork, the image sequence, is a trace of this search.

***Nineteen* (1968-1969)**

Nineteen (1968–1969) (Figure 1) represents Edmonds’s first use of a computer program in his art. *Nineteen* was exhibited for the first time in the Invention of Problems exhibition at the Leicester Polytechnic in 1970. It was a large panel, which consisted of twenty squared reliefs attached to a white supporting structure and arranged in a grid of five pieces wide by four high. Each piece shows a number of abstract shapes delineated by vibrant colours.

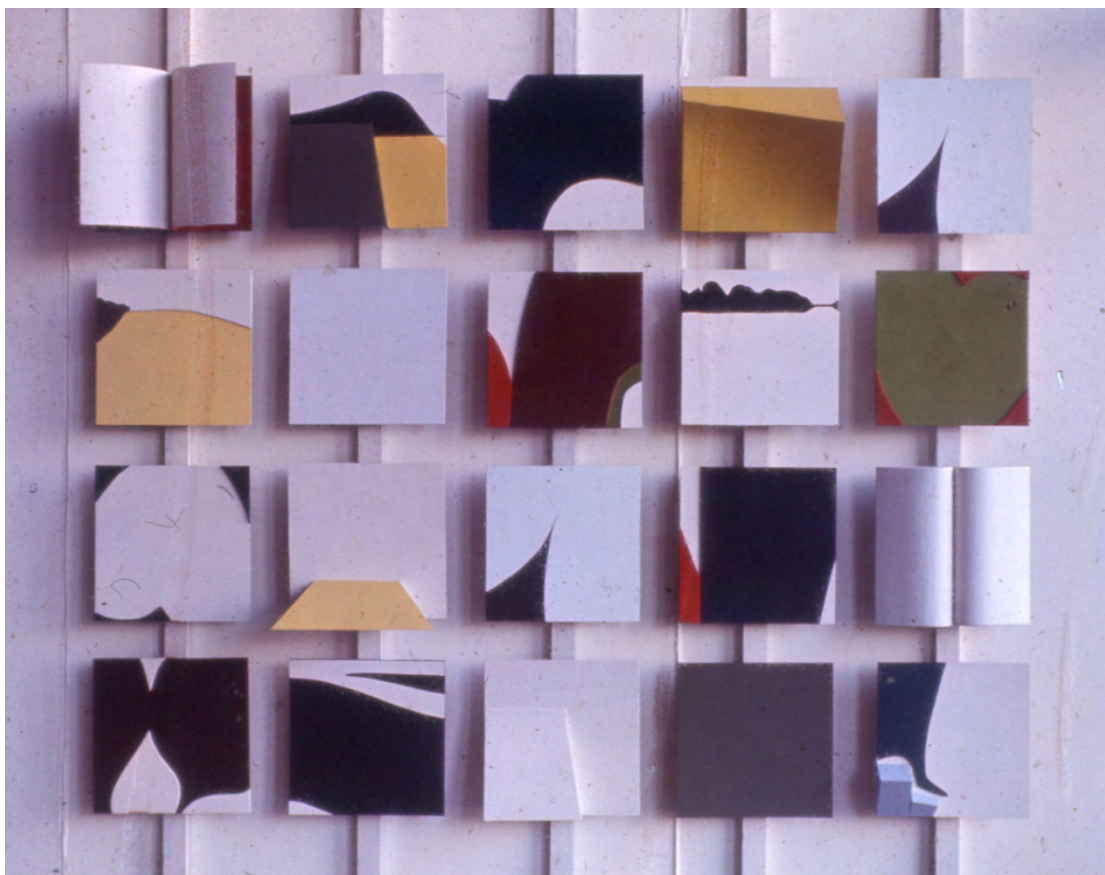


Figure 1: Ernest Edmonds, *Nineteen*, 1968–1969. ©Ernest Edmonds. Image courtesy of the artist.

While working at *Nineteen*, Edmonds – who was at that time a research assistant at

Leicester Polytechnic and had begun a PhD in logic at Nottingham University – had started to program the institutions computer, out of curiosity. He found a use for programming in solving a logic problem and it worked well enough to result in a publication in the *Journal of Symbolic Logic*. In arranging the twenty pieces into a grid he had difficulty finding a satisfactory positioning. On reflection he realised that he could identify a set of rules that, if they were met, would solve his problem. So he started to think about introducing a number of organising principles to the whole composition. The second realisation was that he could compose a computer program, very similar to one that he had written for the logic problem, that could search for the solution. That

helped complete *Nineteen*. But, as we will see, this use of computer programming for *Nineteen* was much more significant and eventually transformed Edmonds' art.

The computer became a tool used by the artist to search for an aesthetic problem's solution. However, the consequence of this development had far wider implications. It caused Edmonds to realize the significance of using more formal processes and procedures in art-making and raised the question in his mind of what the implications for art of computer programming might be.

***Fifty One & Fifty Two* (1980)**

Fifty One & Fifty Two (Figure 2) are part of a series of acrylic paintings on canvas created by Edmonds, when exploring new ways of structuring and executing an artwork by using rules as organizing principles. This was a direct consequence of the discovery of the value of the computer in organizing the structure of an artwork Edmonds made in 1968 when he created *Nineteen*. This discovery also taught Edmonds that the computational process was of interest to the making process of an artwork.

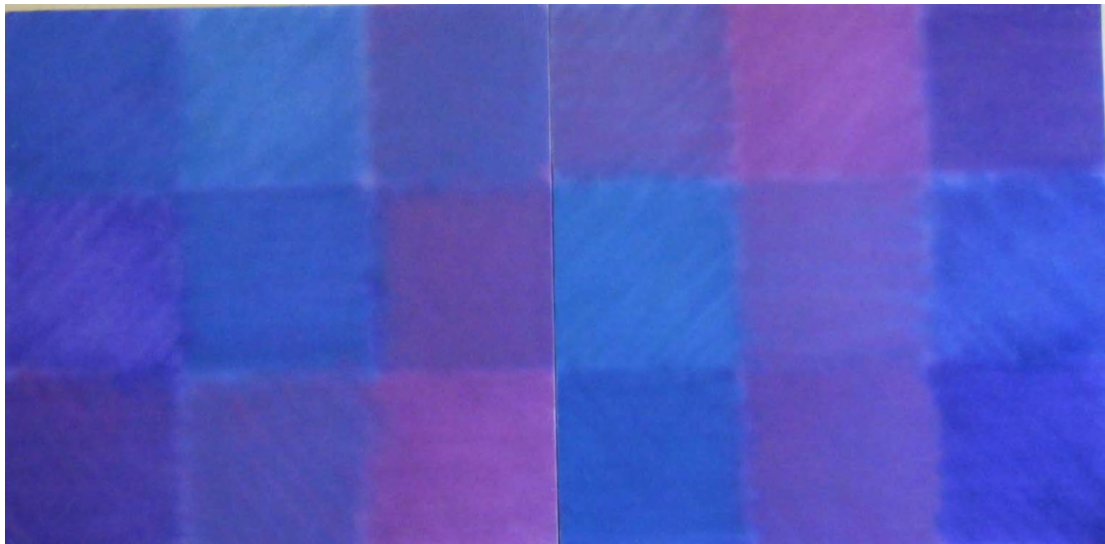


Figure 2: Ernest Edmonds, *Fifty One & Fifty Two*, 1980. ©Ernest Edmonds. Image courtesy of the artist.

Fifty One & Fifty Two were structured in two concurrent respects:

firstly, the organization of the surface and the colours; secondly, the process of execution of the painting. As to the organizational aspect of the artwork, this had no implications on how it was done, whereas the process drove how the painting was made, in what order the paint was applied, and where.

Fifty One & Fifty Two are two separate squared canvases placed side by side and represent two variations of a theme, or structure. Each one uses three basic colours, called "seeds colours." Let us take the first variation, *Fifty One* (Figure 2, on the left), as an example. The first rule specified by the artist is that the image be divided into nine sections of equal area that define a three by three grid. There should be three seeds colours in it; each of those three colours should be allocated a square in the grid where none of them has to appear on the same row or column as another. For ease of explanation, Figure 3 exemplifies the grid; the numbers in it refer to a specific square in the grid. The three seeds colours in *Fifty One* therefore appear in square number 4, 2 and 9.

1	2	3
4	5	6
7	8	9

Figure 3: organizing grid (*Fifty One & Fifty Two*).

The second organizing rule states that when any one of these colours appears in any particular row or column, then such colour has to be in all of that row or column. So for example, the colour in 9 has to appear in 7, 8, 6 and 3; the colour in 2 has to appear in 1,2,3,5 and 8; and the colour in 4 has to appear in 1,7,5 and 6.

As to the process of execution of the painting, this followed other sets of rules. The paint was applied with an electric way control spray gun. As one of the organizing rules implied the presence of two colours in one single square of the grid, the artist decided that, when combining the two colours, they should be sprayed both without mixing them. This created a result that visually recalls the work of Seurat, where the combination of different colours appears unified by the physical process made by the eye of the viewer.

Edmonds decided to make the spraying process obvious, so the colours were intentionally sprayed lightly. This meant that the direction of the spray was made visible. The artist therefore chose three ways of spraying: bottom left to right top, horizontally, and top left bottom right. These three directions formed, similarly to the three seeds colours mentioned before, three different generating squares following the same organizing rules set up for each seed colour. As a result, if square 8 was allocated horizontal spray, then 7, 8, 9, 5 and 2 will have to use horizontal spray, and so on. There are now two overlapping patterns: the pattern of colours and the pattern of spraying. In this way, the artist has defined the structure of the organizational elements of the painting, and the process of making it. The second painting, *Fifty Two* (Figure 2, on the right) is a variation of the same theme, where the allocation of the colours and spraying directions are changed.

For Edmonds, this process of creating an artwork derived from two important sources of inspiration. Firstly, as mentioned above, was the process activated by *Nineteen*, which represented to Edmonds the first critical point of change in his art. Secondly, was the work of Charles Biederman.

It was particularly the way Biederman understood art as the solution of a problem to be found in pure observation that connected with Edmonds' research and art practice. As Biederman suggested, "Nature teaches us the methods and structural conditions by which to solve problems."^{iv} The next step for the artist was to abstract from the structural process of nature. This point led to the notion of structural procedure and minimal complexity that excited Edmonds' curiosity.

These two experiences helped Edmonds crystallize the understanding that making the elements of the work simpler added power to his work.

Four Shaped Forms, Venice (2015)

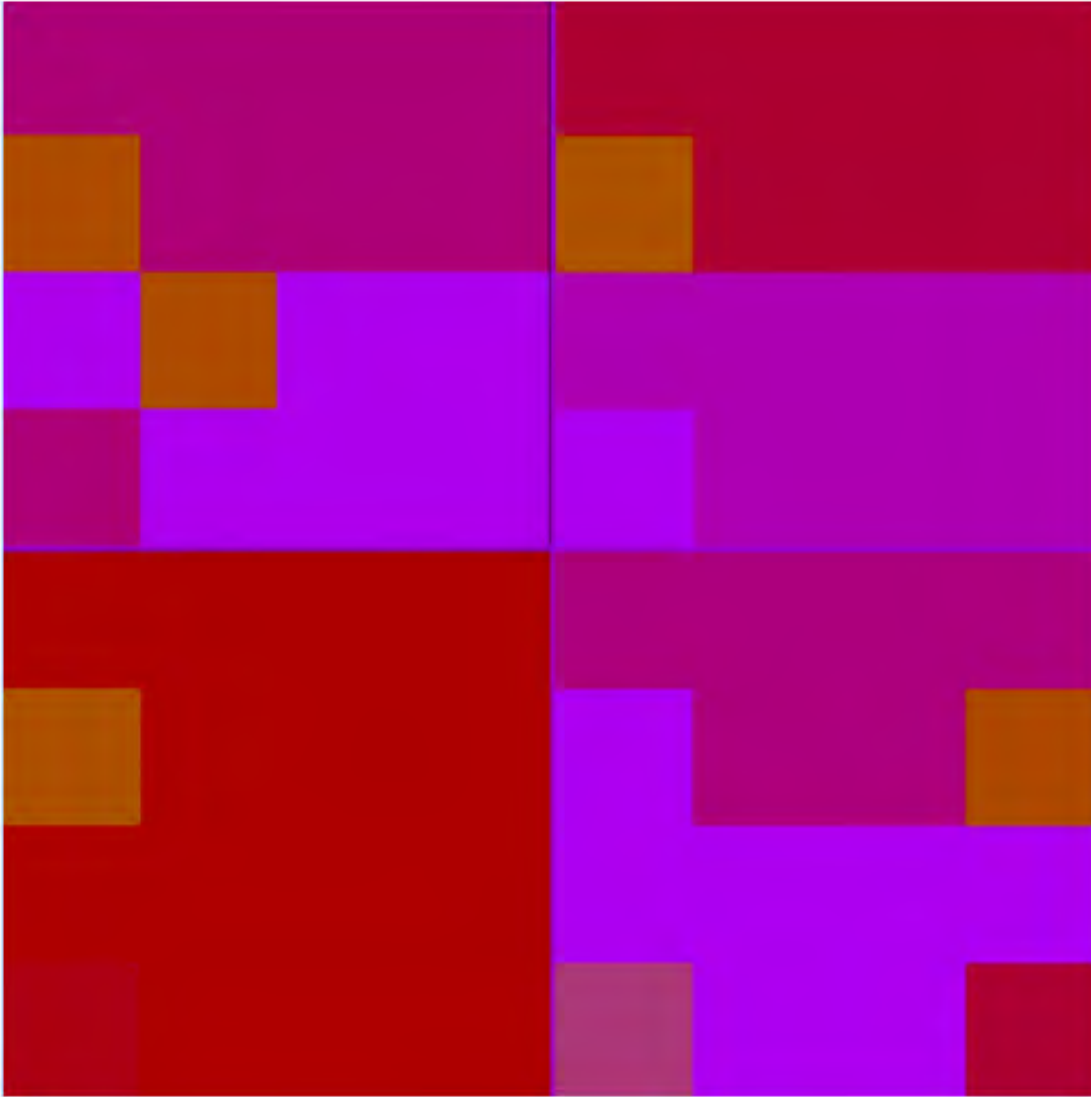


Figure 4: Ernest Edmonds, *Four Shaped Forms, Venice*, 2015. ©Ernest Edmonds. Image courtesy of the artist.

Four Shaped Forms, Venice (Figure 4) is a four-piece digital print on aluminium based on a series of acrylic paintings on canvas called *Four Shaped Forms* (Figure 5).

These are strongly connected to *Shaping Forms*, a series of time-based works Edmonds made from 2007 exploring the notion of interaction. Interaction has been one of the focuses of Edmonds' investigations, since the early 1970s. It developed even further in recent years, as demonstrated by his *Shaping Forms* series. Here, interaction is intended as an exploration of "long term influences rather than short term reactions." ^v



Figure 5: Ernest Edmonds, *Four Shaped Forms (Park Hill B)*, 2014.
©Ernest Edmonds. Image courtesy of the artist.

Shaping Forms (Figure 6) are a series of generative and computational works displayed on a square monitor, surrounded by a purpose-designed frame built in plastic and wood by the artist.



Figure 6: Ernest Edmonds, *Shaping Forms*, 2007. ©Ernest Edmonds. Image courtesy of the artist.

Shaping Forms are individual works where images are constantly generated by a computer program that decides which colours, patterns, and timing the work should display at any given moment. The movement in front of each work is detected by a camera and produces changes in the image, shape, and duration, so that the environment, the active spectator, and the work influence each other. Edmonds once described his unique way of perceiving interactivity in his art as an interest in “seeing how computer generated art systems can interact with the most purposeful enquiring systems—human beings.” He continues,

I am interested in how humans react to artworks that behave differently because of their presence and whose form and appearance change over time...The atmosphere, the light, the space, the audience are all part of the experience of a work...In interactive art, the audience is deliberately made a component of the work: the person in the art space becomes an active participant. In participative interaction, the artefact is just one element of the whole experiential space.^{vi}

The four canvases making *Four Shaped Forms*, represent four variations of a theme directly connected to *Shaping Forms*. The selection of colours, in both cases, is generated from a system that uses colour models, where the hues are equidistant according to some rule and the saturation levels are the same or close together according to a system.

In *Four Shaped Forms*, the structure of the elements within the picture organized in a four by four square grid looks similar to the way *Fifty One & Two* were organized. As a matter of fact, its structure is much more complex and less easily explained by geometry, as *Four Shaped Forms* are four moments selected out of a time-based sequence. The way *Four Shaped Forms* is structured is therefore more obscure, but nevertheless it provided Edmonds with a procedure and process for generating the images in a rigorous way, similarly to the earlier experiences of *Nineteen* and *Fifty One & Two*.

The colours and patterns chosen for each canvas of *Four Shaped Forms* are selected by the artist from stills of *Shaping Forms*. The colours are then manipulated and adjusted by eye onto the canvas. The dialogue that this relationship creates between the time-based work and the paintings is strong. In the time-based works, the viewer can only appreciate colours and patterns in one sequence with different lengths of time between them, which generates a kind of rhythm through time. Although this musical quality is lost in the paintings, by looking at the four variations of *Four Shaped Forms*, the viewer is able to experience four different moments of a theme at the same time.

Conclusions

This paper has explored a selection of works by Ernest Edmonds that delineates one of the possible roots of the very complex field of generative art. The mathematical rules applied by the artist to create *Fifty One & Two* and the software work that inspired *Four Shaped Forms* have generated paintings that are in constant dialogue with their computational counterparts, *Nineteen* (1968-9) and *Shaping Forms* (2007). *Fifty One & Two* and *Four Shaped Forms* demonstrate that rules and computation methods can be seen as inventive forces that delineate a new order in the creative process of an artist. Although the computer was not used directly to create such works, these could have not been created without the earlier computational works generated and programmed by Edmonds from the late 1960s onwards. There is a dialogue between the painting works and the software pieces analyzed in this paper, and they represent one of the developments of generative computational art that is in constant evolution.

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