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**Paper-Installation: AN EVOLVING MUSICAL PAINTING ON THE  
BOUNDARY BETWEEN PERMANENCE AND CHANGE**



**Topic: Audio-Visual  
Generative Art**

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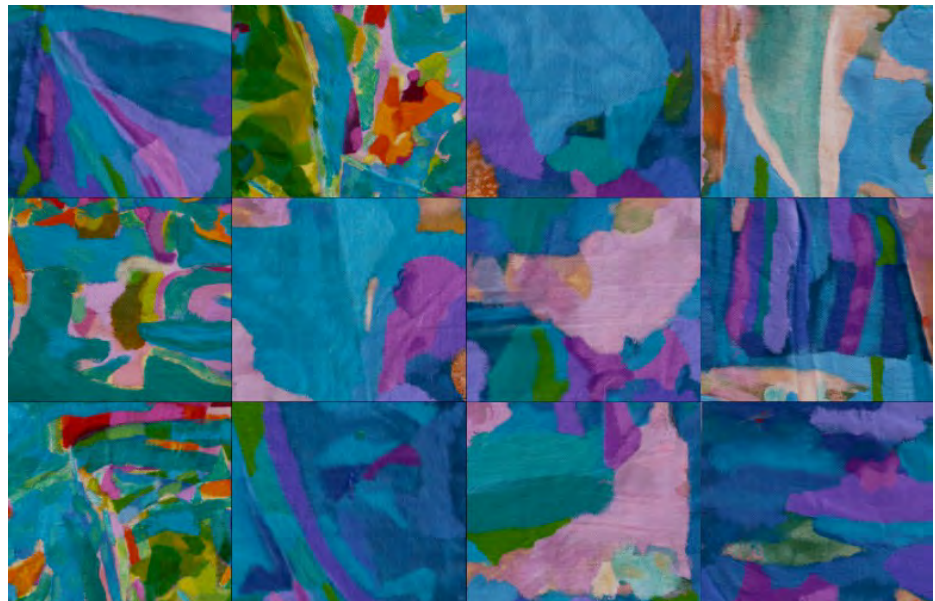
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**Abstract:** Works of art, whether representational or abstract, are typically fixed in time by the artist and remain permanent thereafter. In this work, we depart from this model by defining the “art object” as a multi-dimensional artistic design landscape that can be eternally travelled each time in a different and unique way using computers.

Roberto Bono has painted 12 double-sided abstract panels which, when put together in a 4x3 lattice, create an abstract painting. The number of paintings that could be produced potentially by rotating, flipping or repositioning the twelve panels are in the order of quintillions. One could imagine these paintings as points in a vast artistic landscape that can be explored in the form of a random and unique each time slideshow or by using evolutionary algorithms that start from arbitrary positions within this landscape and move towards those paintings in which the transition of colours between panels has been optimally harmonised. Musicians Alberti and Salmieri have added base music to match the ambience of this visual landscape and accompanying harmonic sounds to individual panels which when played together create variants of the same piece as the audio and visual design spaces of this evolving musical painting are being explored simultaneously.

There is a pervasive feeling of “everything changes and stays the same” in the experience of this art. Indeed, this work can be seen as an experiment on the edge between movement and stillness, stability and instability, permanence and change. This is a boundary that is both intriguing and fascinating and one that has been the subject of deeply significant philosophical and artistic work in the past, from the elegant theories of Zeno of Elea, Heraclitus of Ephesus and Hegel to the beauty of the artistic works by Myron of Eleutherae, Leonardo and Vermeer. Journeys through this musical painting can be experienced at [generativeart.net.dcs.hull.ac.uk](http://generativeart.net.dcs.hull.ac.uk)



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# An Evolving Musical Painting on the Boundary Between Permanence and Change

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## Abstract

This paper discusses an evolving musical painting that bridges manual and generative art. The painting is neither a still image, nor a fixed sequence of images and sounds; it is instead an audio-visual design space defined by artists and explored by computers — a vast landscape of musical panels through which a different visual and musical journey is taken each time the artwork is experienced. The painting is part of a portfolio of hybrid art in which panels and painted sculptures are virtualised, enhanced with music, and explored through technology. In this paper, we discuss the conception, birth, and possible future of this art project.

## Main

This art project was conceived during a dinner party in discussions between the authors very much in the same way that many literary, artistic and philosophical works were conceived in ancient Greek symposia (σμπόσιον — a drinking party in Greek).

Roberto Bono is an abstract painter who experiments with double-sided paintings and panels that can be joined together in different ways, creating a three dimensional space that crosses the boundary between painting and sculpture. On this occasion, he had painted 12 double-sided abstract panels which, when put together in a 4x3 lattice, form an abstract composition. Figure 1 shows an example of such a painting. Upon viewing this work, it occurred to Yiannis that the number of paintings that could potentially be produced by rotating, flipping or repositioning these twelve square panels is surprisingly large — in the order of quintillions, in fact.

It was calculated that a slide show that displays each painting for a minute would last longer than the age of Universe. At this point, awed by the magnitude of this realisation, our imaginations took over.

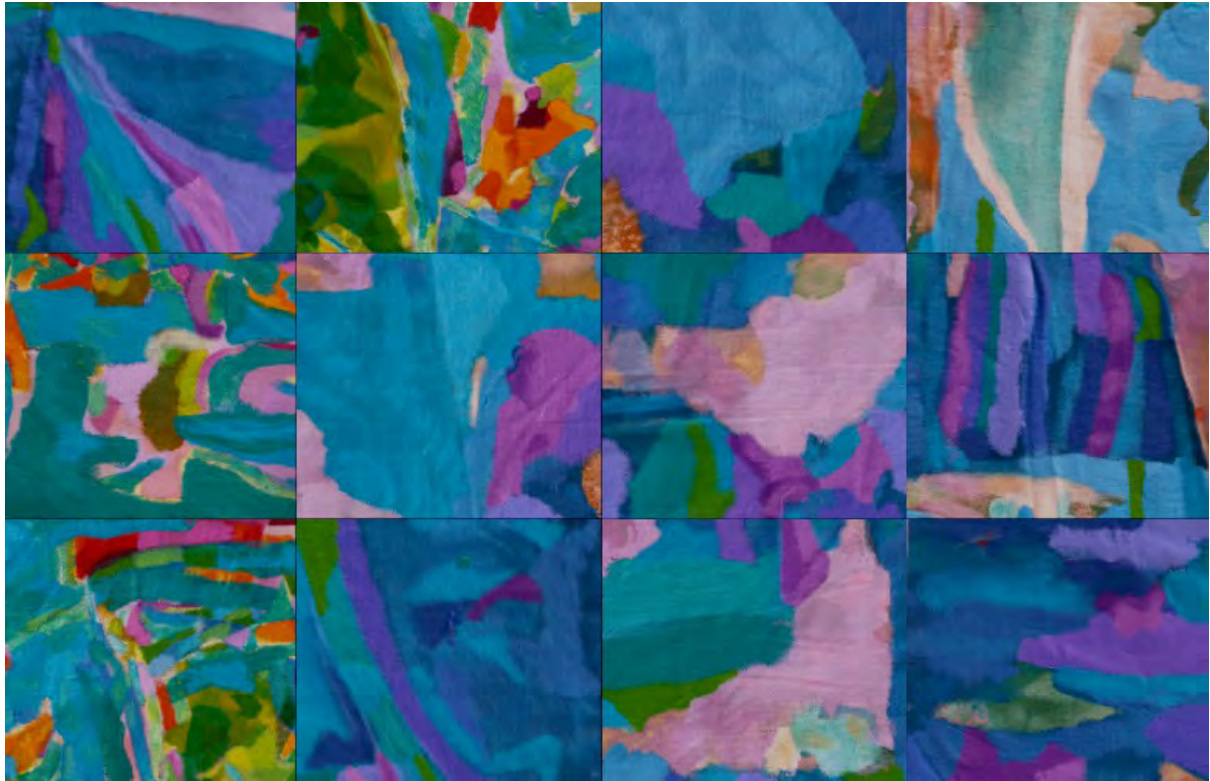


Figure 1: A 4x3 configuration of panels creating an abstract painting

Yiannis imagined these many potential paintings as points in a vast artistic landscape, like wild flowers in a Mediterranean field in the spring. Roberto's paintings are bright and colourful, so the metaphor of the flower meadow was effortlessly evoked and worked well as a concept to inspire this art project. Like flowers in this meadow, the paintings that could be put together from Roberto's panels are similar looking, but also individual in pattern, shape, and composition, each one worthwhile admiring in its own right but also aesthetically pleasing to see collectively as a group. Figure 2 illustrates the concept of a landscape of paintings potentially created by the many different combinations of panels.

It is interesting to observe that this vast artistic landscape is one of unrealised possibility; it contains many paintings that have the *potential* to exist, but only if their exact configuration should be discovered. Aristotle was the first to use an artistic analogy for illustrating the relationship between potential and actual [1]. He famously observed that a beautiful marble statue already exists in "potentiality" within a block of stone, but awaits for the sculptor to bring it out in "actuality". Similarly, the artistic vistas defined by Roberto's panels exist in potentiality, but need a transformative tool to bring them out into the actual world so that the aesthetics of these paintings can be appreciated. And what better tool for such a transformation than a computer?

Thus inspired, we digitised these images and created a system that renders the panels in 4x3 configurations, each of which creates a unique painting.

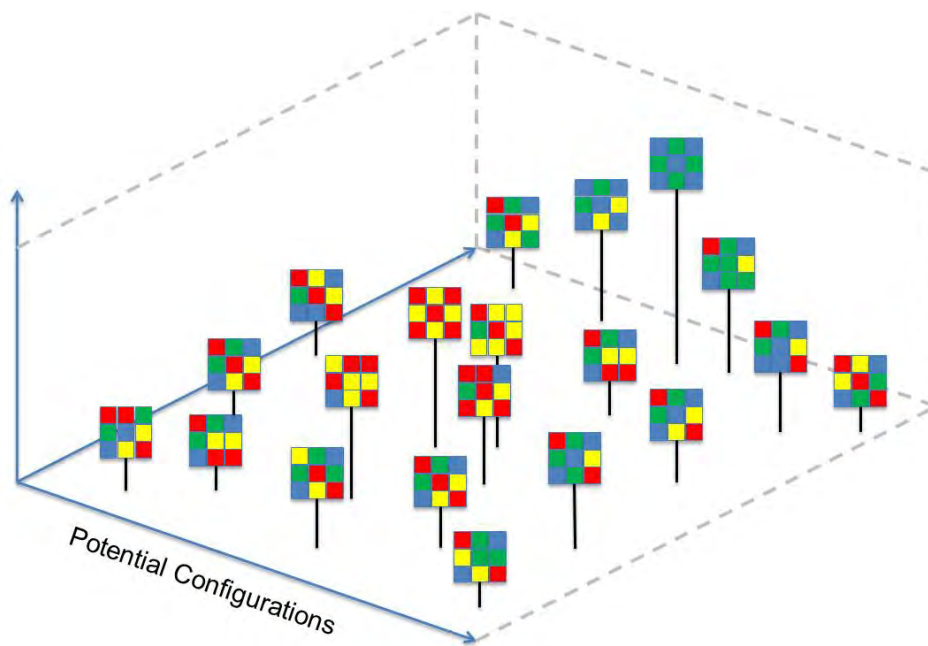


Figure 2: Design space — potential configurations of panels in paintings

In this system, such configurations can be formed manually by a person moving around panels, flipping them, or rotating them, or it can be done automatically by the computer itself and displayed on screen. The latter method allows viewers of the art to experience a computer generated slideshow of paintings that are taken, one by one, out of the potential landscape and brought into actuality. Because of the vast number of possible paintings that can be generated, the chances of seeing the same painting twice are far, far lower than the odds of ever winning any lottery. Thus every new painting is likely to be unique, never viewed before and probably never to be viewed again — a fleeting glimpse into an immeasurable and unexplored artistic realm.

Using the flower meadow metaphor, we could say that a slide show of such paintings unfolding in time is the equivalent of a trip through a real meadow wherein a bee flies from one flower to another. In the case of this art project, this trip is in reality a voyage through a *design space* — the set of all possible designs that can be created from a number of individual elements — and it is randomised so that a viewer always takes a different and unique path through this artistic design landscape.

Then sometime later, on a balmy summer evening spent reminiscing about childhoods in the Greek islands and the ancient landscapes of Sicily — and encouraged by a few glasses of Assyrtiko of Santorini and Greco di Tufo, it occurred to us that a landscape is never quiet. Instead, it is alive with subtle, ambient, but always-changing sounds: the songs of birds and the chattering of cicadas, the whispering of trees, the gentle splash of the sea, sometimes the sound of tolling winds meandering through narrow streets — everywhere one can hear the ever-present voice of nature. So we gave the silent artistic landscapes of this project a voice of their own.

Musicians Roberto Salmieri and Andrea Alberti wrote two compositions for two different sets of Roberto's panels. They added background music to match the ambience of the visual landscape and provided each individual panel with accompanying harmonic sounds. When played together, and in rhythmic sequence, this creates an enormous number of variants of the same piece of music. In this way, the audio and visual design spaces of these ever-changing musical paintings are being explored simultaneously, with a different sequence of images and a unique musical piece created during each journey.

Further inspiration for this project came from our interest in evolutionary biology and the way its principles can be applied to evolve not only biological life, but also technological systems. In theory, the brain — i.e., the instrument of human reasoning — is itself the result of an interesting evolutionary voyage through the potentialities that are inherent within the near-limitless design space defined by matter. Humanity, for example, can be seen as the result of a particular path through this space where chemical reactions at low levels and then mutations and recombination of genetic material has gradually given rise to a species with reasoning ability. Imagine taking all the atoms composing the DNA of a human being and throwing them in the air: out of the innumerable possible patterns they may form, there is one that gives rise to intelligent life in the form we know it. Evolution can thus be seen as nothing more than a search — random, but still guided by natural selection — within the design space of organic matter, with the potential to lead to results such as intelligent life.

This evolutionary thinking can also be applied to artistic design spaces. It occurred to us that one option for the exploration of Roberto's painting would be to use evolutionary algorithms that could start from arbitrary starting points within the landscape of paintings and, over the course of many generations, evolve towards the most aesthetically-pleasing regions of the landscape. We chose to define this aesthetic ideal as those paintings in which the transition of colours between panels is optimally harmonised to be as smooth and gentle as possible. In other words, those paintings most likely to evolve further are those in which the colours and patterns at the borders of adjoining panels are most similar. In our computer implementation, we achieve this by measuring the difference between the colours of the pixels along the boundaries of the panels and then trying to minimise that difference.

One can visualise this concept by thinking of the artistic landscape not as being flat, but rather as one that has hills and valleys; the higher the hill, the greater the level of harmonisation between panels in a painting, and the deeper the valley, the greater the level of contrast between the panels. In this type of landscape, paintings lie in valleys and on hills, and the higher one goes, the closer one is to the harmonious ideal. On each hill, we describe the painting that occupies the peak as a *local optimum*: it is the most harmonious painting in its neighbourhood. Perhaps this is a configuration where the painting has been harmonised with regards to a particular colour. Globally, there is also one hill — or mountain — that is taller than all the others, and at its peak is a painting that is *globally optimal*: it has the greatest harmonisation value in the entire landscape. The concept is illustrated in Figure 3.

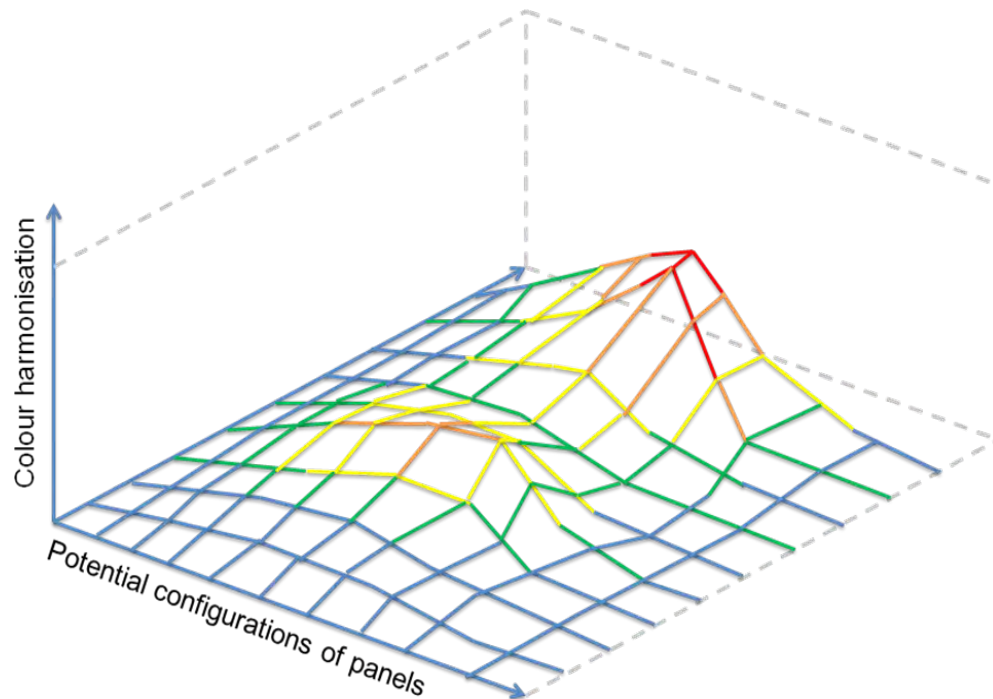


Figure 3: Landscape of paintings with different degrees of colour harmonisation between panels

The evolutionary algorithm we have developed to journey towards the peaks of such landscapes (based on [2]) first creates a random population of paintings by selecting panels and placing them in random positions in the 4x3 lattice. It then evaluates the harmony between panels of each individual painting in this population by calculating the colour difference between the pixels near all edges; we represent this as a Cartesian distance in a three-dimensional colour space. It selects the most harmonised paintings (thus emulating natural selection) and "breeds" those paintings by applying a *crossover operation* to each pair; this produces a new "child" painting that has attributes of both parents — in other words, some panels will be in the same position as one parent, and the rest will be in the same position as the other parent. In addition, to add a further random element, we also create a few *mutations*, which are paintings with one or more randomly altered panels.

The result is a new, improved population of paintings — and thus we move to explore a new, higher region in the landscape. The process is then repeated and the most harmonious painting of each population is displayed in the slideshow. Generation after generation, improved paintings that lie closer to the peaks of the artistic landscape are conjured out of potentiality into the actual world and displayed, while, in parallel, the musical script that corresponds to this journey is being dynamically composed and played.

Manual, randomised, and evolutionary journeys through two evolving musical paintings can be experienced online at [generativeart.net.dcs.hull.ac.uk](http://generativeart.net.dcs.hull.ac.uk). Visual instances of the two paintings are shown in Figures 4 and 5 respectively.



Figure 4: Still instance of an evolving musical painting — Visual artwork by Roberto Bono, Music by Andrea Alberti

There is a pervasive feeling of “everything changes and everything stays the same” in the experience of this art. Indeed, this work can be seen as an experiment on the edge between movement and stillness, stability and instability, permanence and change. This is a boundary that is both intriguing and fascinating, and one that has been the subject of deeply significant philosophical and artistic work in the past. This work includes the thought experiments of Zeno of Elea arguing the implausibility of motion; the philosophy of Heraclitus of Ephesus and Georg Wilhelm Friedrich Hegel, who saw perpetual motion as the essence of nature and history; and the artistic works by Myron of Eleutherae, Leonardo Da Vinci, and Vermeer, who so beautifully and enigmatically captured physical and emotional motion within the absolute stillness of marble or canvas.

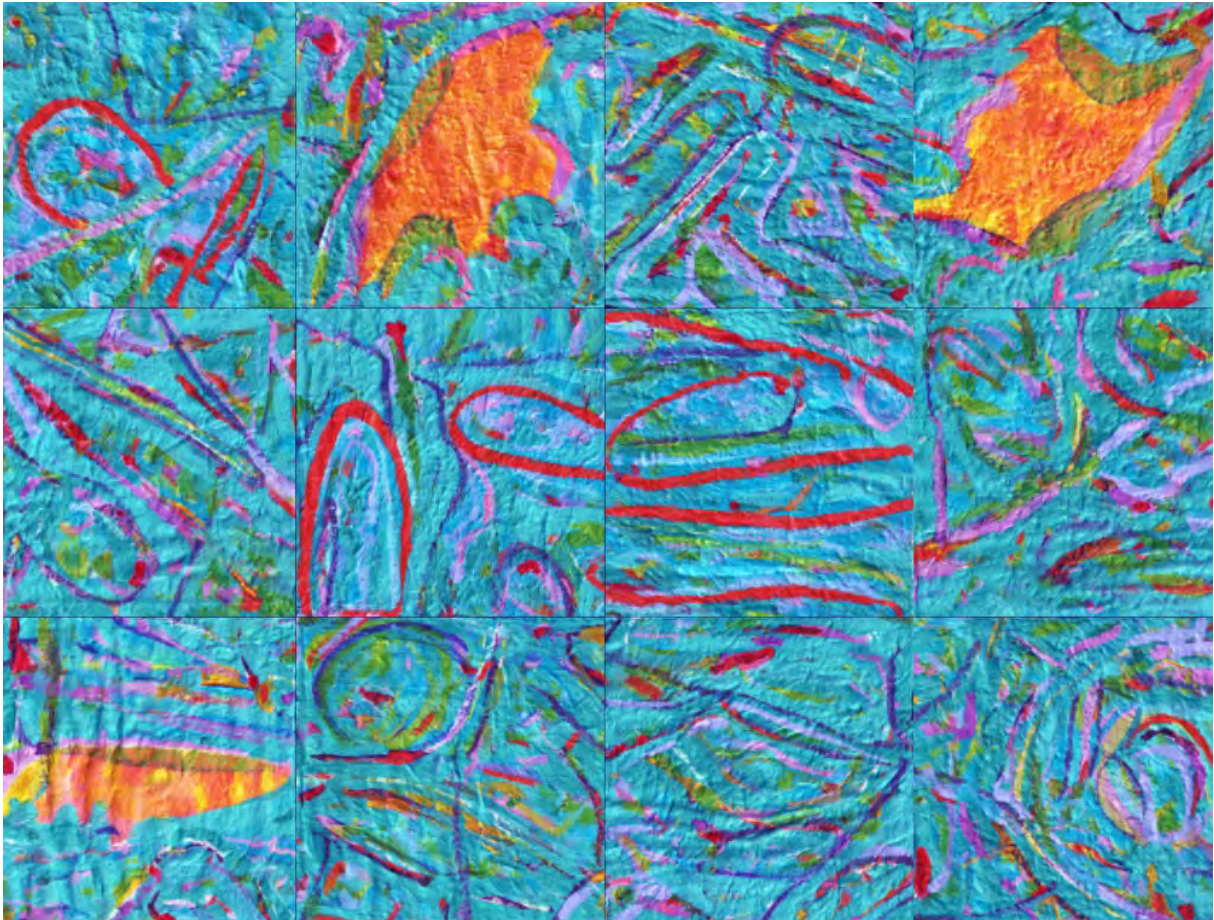


Figure 5: Still instance of an evolving musical painting — Visual artwork by Roberto Bono, Music by Roberto Salmieri

We like to think that there is both artistic merit and potentially useful practical applications in this art project. For example, informal feedback by clinicians who have experienced this artwork — and also from patients who have seen this in public presentations — suggests that it can have a therapeutic effect, e.g. on people with long term conditions like autism, tinnitus, or dementia. We are currently planning research together with clinicians to test this hypothesis. We have also planned a series of musical painting sculptures to take the work into three dimensions, including a musical art sphere and a painted Möbius strip; these can be virtualised and enhanced through technology to create interesting art works which, beyond their artistic merit, can also provide case studies for art therapy. Much of this work could also evolve into a form of educational or artistic game in the future.

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