Designing Generative Art.
Mosaic concept, Creativity, and Idea in Generative Design
(Paper and artworks)
Topic: (Generative Art approach, architectural design)
Author:
Celestino Soddu
Italy,
Generative Design Lab, Politecnico di Milano
Generative Art Lab, Argenia Ass.
www.generativedesign.com

How to Design a Generating Event. I would like to take advantage of the fact that we are in Ravenna, the capital of the mosaic, to make some considerations on my approach to generative art. As the mosaic involves, as parallel fields, the small scale of each tile and the large scale of the image, so my generative approach works simultaneously on the small and the large scale.

This parallelism and strong correlation between detail and total space have always been one of my creative matrices, even in my oil paintings of the 1960s/1980s.

Since 1985, in my generative works, the progressive transformations of the basic elements and the spatial evolution of the whole space have always been intimately connected and were made through the same algorithms that mirrored my vision of architecture.

It was therefore easy, this year, to perform, for this meeting in Ravenna, the generation of mosaic-architectures able to focus a possibility to reinforce Ravenna's in-process identity with this strong relationship between mosaic, architecture and the urban space.

These generated architectures are, however, a three-dimensional mosaic. Every single tile is a three-dimensional event able to spatially reflect the light becoming an integral part of the total architectural image. This interchange between 3D events at small and large scale lights up a recognizable identity and, in my intentions, is strongly representative of futuring Ravenna identity.

2 Oil Paintings, NYC Guggenheim Museum and NYC Brodway/5th ave, C.Soddu 1985 - Mosaic Architectures for Ravenna Identity in front of MAR - 4 Mosaic-Architectures details C.Soddu 2017

celestino@soddu.it

Keywords: mosaic, generative approach, architecture
Main References:
[1] www.generativedesign.com
[2] www.futuringpast.com

Designing Generative Art.

Mosaic concept, Creativity, and Idea in Generative Design

Prof. Celestino Soddu, architect.
Argenia Association,
Generative Design Lab, Politecnico di Milano
www.generativedesign.com
e-mail: celestino.soddu@generativeart.com

The ancient harbor of Ravenna

Abstract

We are in Ravenna and I would like to suggest some reflections on the generative approach starting from the art of mosaic. Also in relation to my last work about the urban identity of Ravenna, I like to face the Generative Architectural Design to the mosaic structure. The occasion is the XX Generative Art conference and the aim of my last generative work was to make Ravenna more Ravenna than before focusing the mosaic structure of futuring architectures.

The relationship is that the structure of the mosaic tiles as ***repeated parts in variations*** and the structure of the set doesn't belong only to the mosaic feature but also focus the characteristics and organizational structure of my creative work since the sixties. This structural feature is explicitly present in my oil painting works since the sixties as well as in the structure of my generative approach to architecture, art, design, and music that I developed since the eighties.

The pictorial approach was to represent the single tile as a plan element that was born from a brush stroke. But it was performed by transforming its geometry as related to the three-dimensional spatial structure of the whole event.
Each basic rectangle was represented, after a transformation in a circular field, as a curved element, circular point, and so on, by maintaining, on one side, its basic element

identity, that is achievable with a unique and un-repeatable brush strokes and, on the other side, by strongly alluding to its role in the entire space of the set. The shape of the element and its color/light indicated both the uniqueness of the event and its layout in three-dimensional space.

The geometric control system of the totality has always been, since the early years of my creative activity, strongly ***oriented towards the non-Euclidean representations of the 3D space where it was possible to identify multiple observation points with progressive dynamic rotations*** but also multiple vanishing points of single bundles of parallel lines.
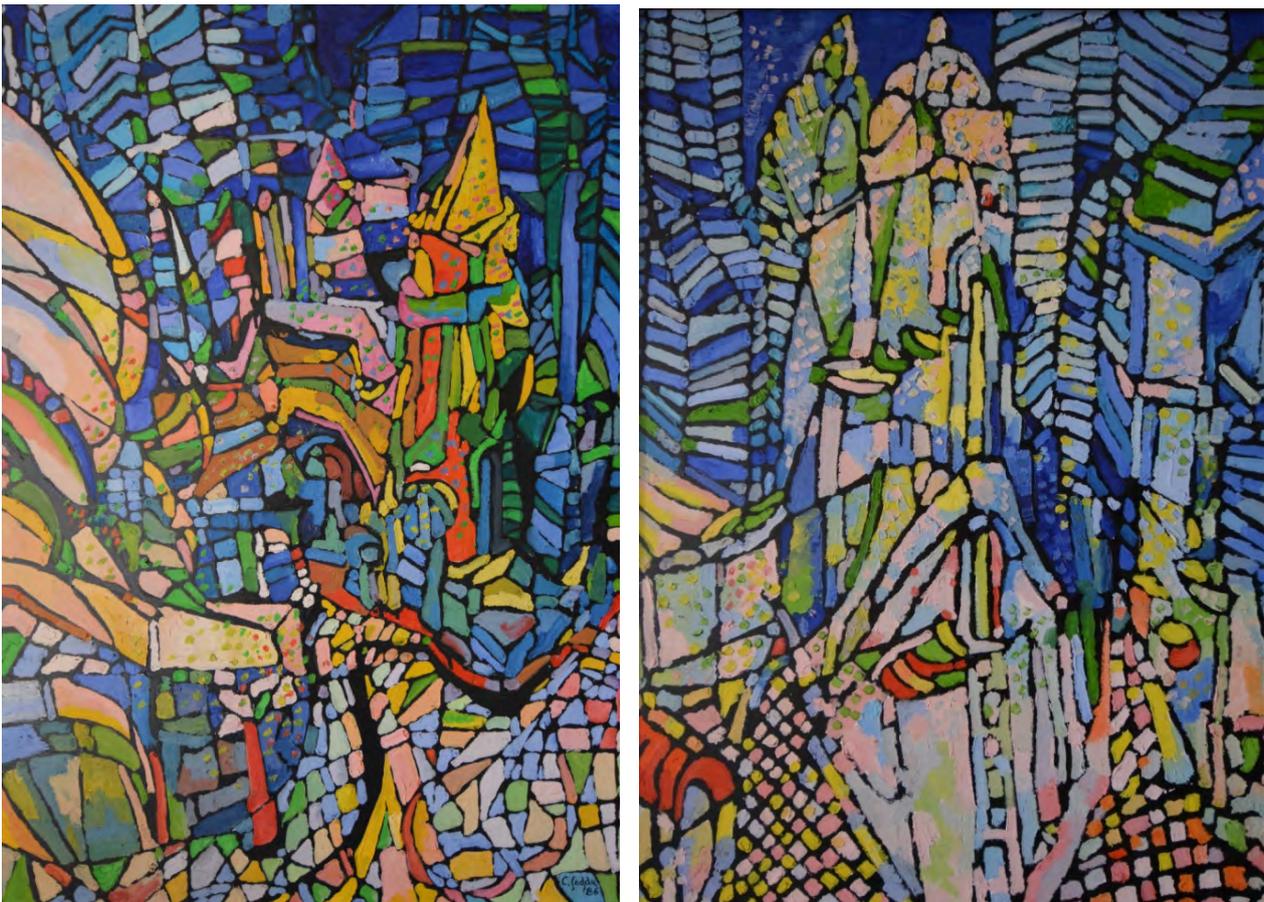
Two oil paintings, NYC, the Guggenheim Museum and Broadway crossing 5th ave. C.Soddu 1986. The like-mosaic structure and the curved space representation is explicit and it is a constant of my work.

The geometric arrangement of the tiles and the geometric arrangement of the totality are therefore two aspects of the same idea developed with different geometric logic. The aim is to establish a relationship between the two dimensions of the painting and the three dimensions of the space. This happens through different geometric transformations: in the tiles through the transformation and the ***progressive characterization*** of the base rectangle, the brushstroke; in the totality through the ***curvature of the space*** represented to pursue the progressive dynamics of the vision that can ***wrap the space around the observer***.

In the sixties I was a jazz player and this creative approach is performed like a jam session. The fragmented structure of small-scale elements is the rhythm of the piece ever changing and with no repetition. A mix of drums and bass that cannot be understood as an

accompaniment but an essential part of the music. It's not a case that, in the sixties, I played not only the clarinet but also the contrabass. **The rhythm is a continue interpretation of the theme, structured with subsequent variations.** My main reference was the Modern Jazz quartet where the drums of Connie Kay and the bass of Percy Heath play with a sequence of "generative" variations, ever unpredictable, and had the same importance as John Lewis and Milt Jackson variations. Looking at my oil paintings of that period, as the image of Guggenheim museum in NYC, the structure is the same and the spirals of the museum of Frank Lloyd Wright is like a solo of Coltrane playing with the Modern Jazz Quartet. Or I followed this vision when painting it.

But Music and painting are not my main field of expression. I am an architect and music and two-dimensional images are only paradigms of my space vision.

My generative approach

In the early eighties, I defined my aim: representing my vision in architecture with codes, following the Renaissance cultural approach: art and science together as a logical interpretation of existing and possible worlds. This changed my design approach from forming to transforming, from shapes to processes, from drawings to algorithms. But I didn't change the structure of my creativity that continues to follow the structure of mosaic: rhythm, riffs, and melody.

This approach had a chance: ***the possibility to directly design my vision, my idea of architecture and Ideal cities before carrying out any possible result, together with the possibility to directly managing the complexity***. The Idea is performed by constructing something like an artificial DNA, a generative code able to generate endless variations of 3D models of cities and architectures, all characterized by my vision but all different, unique and unpredictable, as in Nature.

Each code is one of my operative interpretation of my favorite cities, able to perform a character. Altogether the codes are a system, like a logical labyrinth, able to generate a sequence of events belonging to my vision. Each generated species of cities is identifiable and recognizable as belonging to a peculiar Idea, an interpretation of the Past.

As DNA in Nature, these generative codes are executable logical processes able to manage subsequent transformations toward the complexity. If the base is the interpretation of the Past, as I am doing now for Ravenna, the codes can perform the progressive transformations toward the Future. (www.futuringpast.com) This is the second aim of my work: ***designing the Identity of architectures and cities***. The Generative Codes identify and manage each city identity, each Ideal City, as transforming process toward the Future. The results are sequences of architectures, objects, and cities all different, really complex and recognizable as belonging to my architectural and urban vision. They are not simple images but fully performed 3D models, with exterior and interior spaces and fully performed 3D details. Each generated file is ready to be printed with 3D printers.

Mosaic and generative approach

The experiences in music and oil painting were an important starting point for my generative approach because they helped me in a progressive acquiring geometric complexity and strong recognizable characters. The recognition of details, their strong rhythmical unpredictable sequence, and their progressive generation was kept alive going from a brushstroke to a generated 3d "tile" event. The connection system of the totality remains in its multiple relationships structures. The paradigm representing the idea through a complex topological structure that appears, often, curved was made by using

anamorphic prospective representations.

This curvature, this anamorphic bending of right lines was, and is, really important for me because of its strong ability to join the entire space around the observer, and constructing a geometry directly interacting with him. ***The bending space was, for me, one of the generative tools for joining the rhythm and the melody***. The waves of the rhythm create the interface between "tiles" and their flowing into unique events.
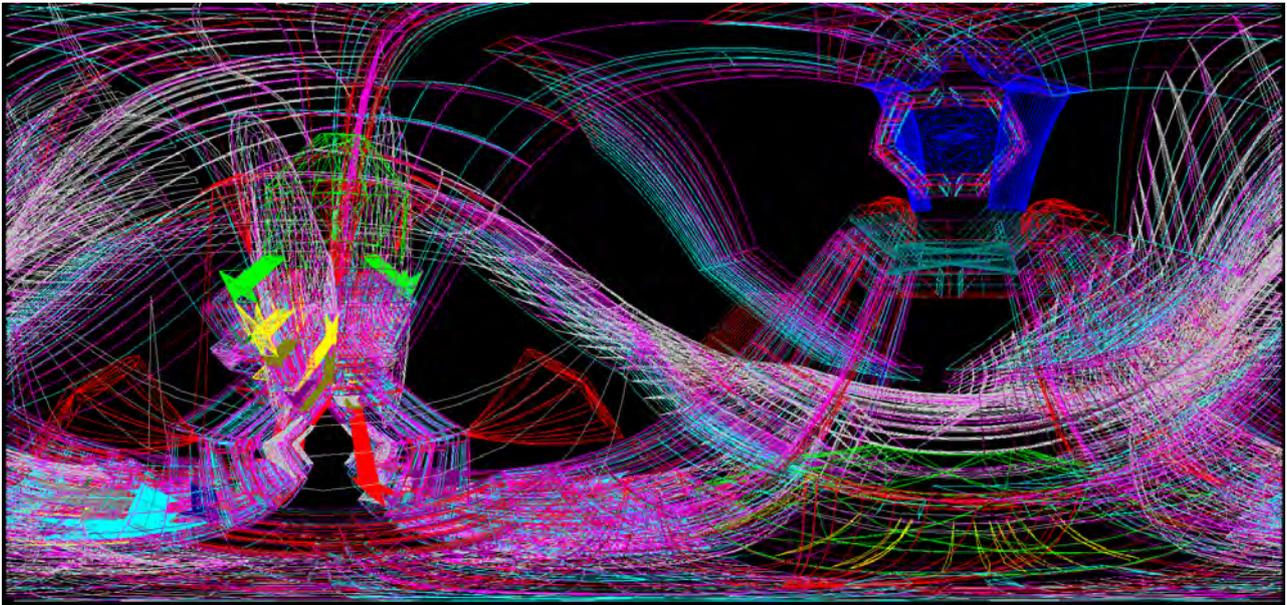
Curved not-Euclidean representation of "Mosaic Gallery" generated space. C.Soddu

In my generative approach to architecture, ***the tiles became three-dimensional events***. From the single triangle, that is the basic event in the construction of a three-dimensional space, the tile becomes a volume that assumes the shape resulting from a spatial transformation oriented to being part of the whole generated space, but also from an orientation that defines its character and peculiarity.

The ***geometric control system of the totality***, starting from a topological paradigm of an architectural space, ***is performed as a geometric transformation-deformation system*** that abandons the Cartesian orthogonal grid for systems that reconnect the parallel bundles of curves, and dynamically find the possibility of complex topologies.
These ***topological paradigms and transforming not-Euclidean systems*** are not constructed in static shapes but build in a reference system for the progressive generation of architectures that explicitly refer to my performing design concept before it has come into the formal choice.

Bending the space topology

Of course, in these transformations of the original Cartesian design, the structure of basic relationships remains fundamental, although the progressive interconnections generated by space folds increase the topological wealth of the architectural space event. This creates and improves the relationships and interfaces between the parties.
Following that the details can be able to assume importance and character. My references were the Middle Ages images of cities, the Renaissance and, above all, the Baroque, ending to my main master, Gaudi.

For the Baroque, particularly, this paradigm of geometric transformations was born from my interpretation of Borromini that, in his work, used the transformation of the classical geometric structures by performing new spatial relations systems. These transformations did not change the classical geometric canons but integrated them with new relationships that were originated from the curvature of the architectural space.

Details drawn by Borromini are curved events able to fix and act a progressive construction following a spatial concept and improving the character of his architectural vision.

What I did, building the generation of contemporary baroque spaces, was born from the rereading and interpretations of these progressive transformations, these curves of the Cartesian pattern of the paradigm that Borromini had begun to use.

My further experimentations went ahead because the generative approach, with the possibility of experimenting with multiple geometric algorithms and their possible mutual contamination, gave me the possibility of controlling the complexity of possible variations. It was, for me, the only possibility of reviving Baroque thought in contemporary time. The Baroque thought, in my interpretation, is never a casual approach to the forms but a conscious approach to the potential of geometric structures and of innovative spatial topologies. This progressive approach gives the possibility to explain an idea of complex-recognizable architecture.

In the same years, I went ahead experimenting a generative music approach by constructing my software "musicablu". This is structured with the same vision. The results are based on my interpretation of "my favorite things": Coltrane, Modern Jazz Quartet, the Bach Fugues variations and Beatles sequence of harmonies that I interpreted as spatial moving, an increasing variation from an accord to another sliding from a fixed tonality to a dynamic harmonic sequence.

Ravenna experiments

In the experiment I did for Ravenna in these months starting from the ancient images of this city as peculiar paradigm, I tried to develop this generative approach from detail to totality with the aim to construct elements for the identity of Ravenna. Or, at least, discovering how increasing and communicating this identity could be possible through generative architectures that I call Mosiac-Architectures.

Mosaics are very important for Ravenna. The greatest difficulty in finding the mosaic as a feature of the architecture, therefore of the spatiality of events, is that the mosaic is naturally highly readable on a small scale. More, this becomes only a surface treatment in the scale of the building. My first attempts were developed by inserting mosaics into the generated surfaces and volumes but this was not a feature of architectural and urban identity, it did not seem enough to strongly identify Ravenna. In other words, Ravenna, with such architectures, did not increase its own identity and recognisability, as it was in my vision. Especially when we considered not only the detail scale but the urban scale.

Two generated "Mosaic Galleries" in front of MAR, Ravenna. C.Soddu 2017.

A generative idea *ad hoc* and, following, a generative focused technique was needed to build the recognizability that I was searching for. A creative path able to unveil the character based on my interpretation of Ravenna's urban identity and able to represent this idea.

Two mirroring variations of Mosaic Galleries in Piazza del Popolo, Ravenna. CS2017

There are many references to the use of mosaics in the characterization of architecture. In addition to the Byzantine mosaics, my favorite one is the use of mosaics in Gaudi's architectures that I always considered one of my reference masters for my architecture. I found in these mosaics the same relationship between rhythms, riffs and melody variations that performs my creative approach.

Details of mosaic-architectures designed for Ravenna. Generated "galleries" C.Soddu 2017.

But my idea of architecture is based on **a three-dimensional space identity running progressively from details to the whole** building. For me, **the mosaic is a set of events whose diversity and identity is based on a strongly three-dimensional relationship with space**. So, after several attempts, I chose a different but allusive way to of *unveiling the potential identity Ravenna*. I chose to create algorithms that perform the individual tiles so that they are sensitive to their location and spatial orientation. At the same time, I followed the concept of the mutual importance of rhythms, riffs and exceptional sequences in performing the space. I have done that for fitting my vision of architecture.

To achieve that I worked on the **morphogenetic definition of each 3D tile**. I built three-dimensional events based on the orientation of each face of the skin surfaces by using the normals, that are the spatial orientation of each face. Every single event is therefore

generated to be sensitive to light and thus to communicate its orientation. Each "tile", precisely because of the space-light relationship that is highlighted, is such that it can improve, as mosaic do, the relationship between detail and the whole, and to the possibility of being, even visually, identifiable and able to characterize the whole building. These "tiles" become an important part of the urban context in which they are inserted.

I privileged the relationship between geometry and light on geometry and color. In architecture, the relationship between geometry and light has strongly characterized the history of Italian architecture, much more than, for example, the relationship between geometry and color, which has strongly characterized other cultural identities.

My final images seem to be, I know, a little dark. But the shadows are essential to communicate the space structure. I like Caravaggio for the smell of infinite space around the lighted images, also if I like Giotto too, with no shadows, for his strong visionary way to show his medieval cities by using non-linear sequences of dynamic points of view. (the book "L'immagine non Euclidea", C.Soddu, Gangemi Publ. 1986)

Two mirroring generated mosaic-architectures with a central paradigm in the Ravenna downtown. C.Soddu 2017.

Following the importance of shadows, the mosaic tiles I have created in my architectures do not have the color as a characterizing element. It is the light that always colors the tiles differently and, through the refractions, defines the orientation and the space relationship with the whole. And this, in the architectural image, does not only involve detail, as if it was to read the color of each tile, but also involves the larger architectural and urban image, just because the tiles amplify the role of the same light in the communication of the

architectural space event, even on an urban scale.

*Generated mosaic-architectures in the downtown of Ravenna. C.Soddu 2017.*

Mosaic and Generative Design

My opinion is that this type of approach reinforces an important aspect of Generative Design. ***The generative approach expresses a possibility that characterizes and distinguishes it: the possibility of setting up a personal tool capable of reflecting and amplifying the subjective idea, the design creativity of each artist***.
The generative approach, building tools (algorithms) in harmony with one's own creativity, amplifies the identity of the artworks, and also, for the artist, **the knowledge of himself and his vision**.
Building own instrument, own algorithms, each artist builds his visionary vision, his uniqueness.

Surely, without a generative, logical and operational approach, I could never build so complex architectures and so close to the idea I had in mind. But the idea was on the basis of the operational technical path to reach it.
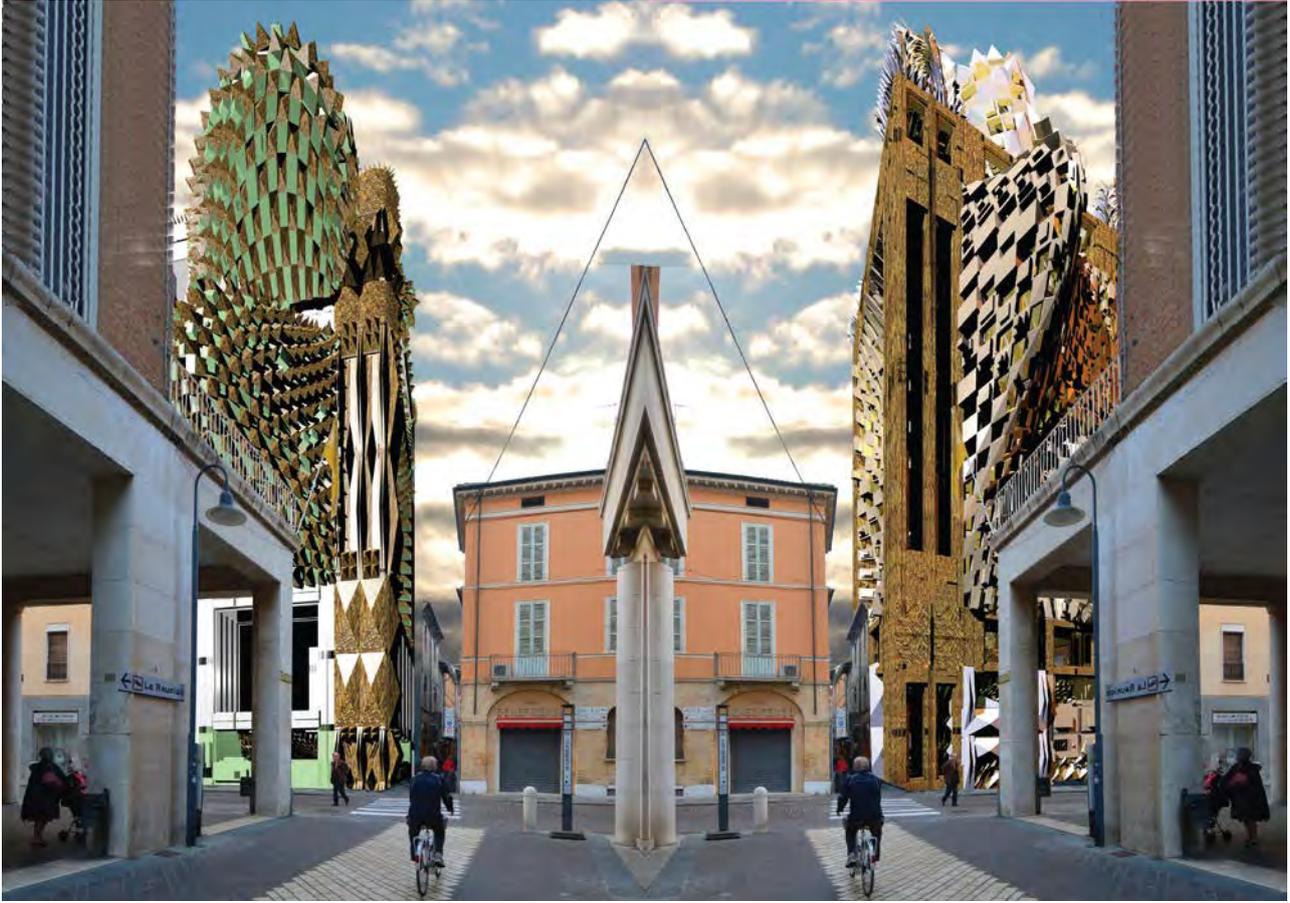
Two mirroring variations of generated architectures in Ravenna downtown. C.Soddu 2017

Idea, Creativity in Generative Design

The idea. Each generative approach must be based on an idea. Performing a new idea is really difficult if we use commercial tools and not tools built on ad hoc. Each artist, along with the idea, also creates the technique to perform it. And generative art follows and amplify this possibility.

In this, it is clear that generative design is not only a technology, a casual search tool for capturing forms, as many people often tend to consider it today. ***Generative Design is a project approach that can enhance own creativity, own designer identity***, the character of own being an architect. It's like having a large team of architects working for us, each of which develops possible variations of every detail and every overall layout. A group of draftsmen designs that think like you and that produces infinite variations of your idea. And we are sure that variations are the best way to communicate an idea. As Bach has taught us with his Fugues.

Generated artificial isle in front of Ravenna, C.Soddu 2017

Two generated mirroring variations of a tower in the ancient harbor of Ravenna. C.Soddu 2017
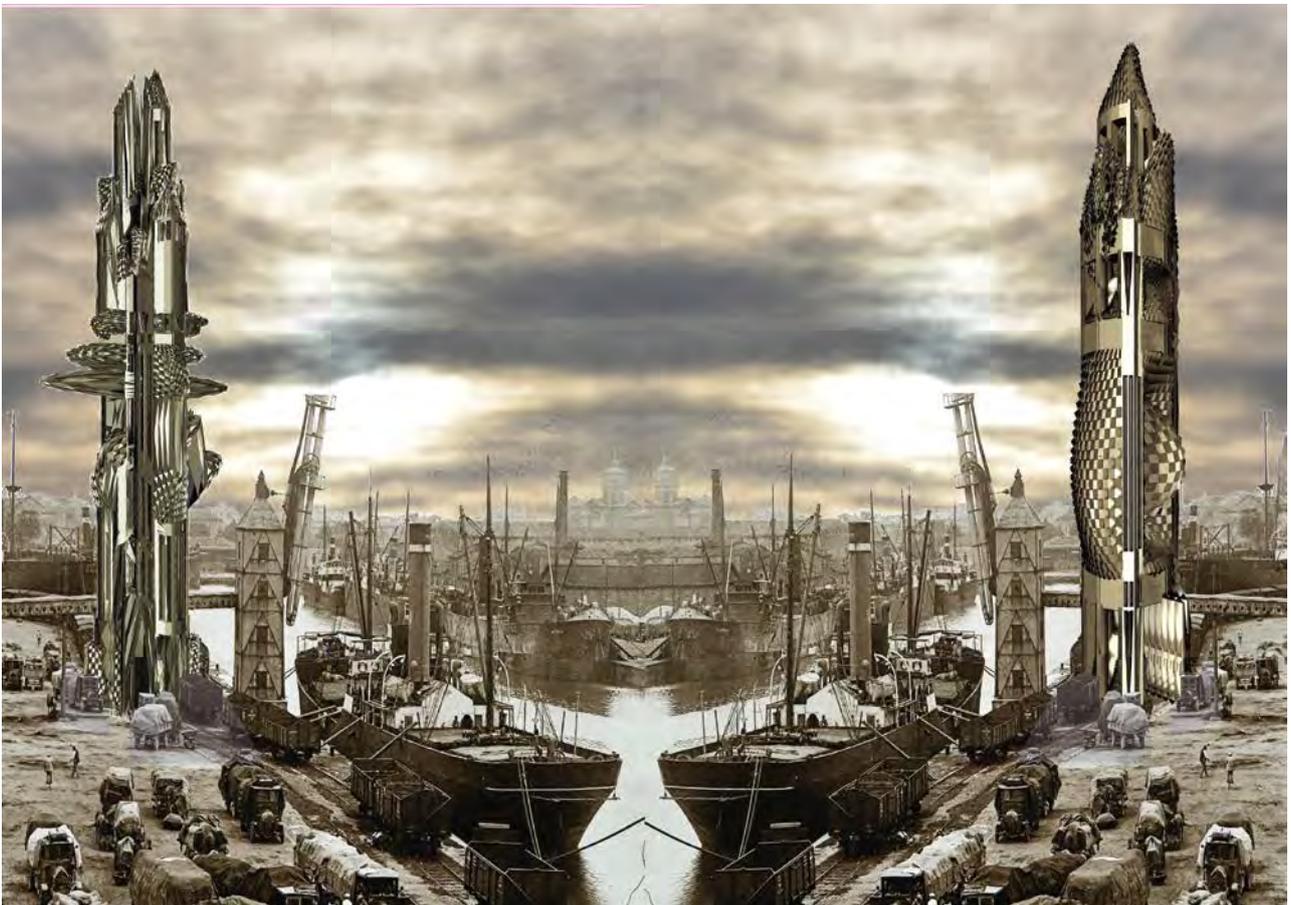
Mosaic-architecture in Piazza del Popolo, Ravenna. Variation 3. C.Soddu 2017

But this idea must exist. It cannot be derived from the tools, even by generative software created by others. It must be expressed a priori and pursued in developing the algorithms, transformation logic, topologies, and space bends that represent this idea before it becomes an achievable three-dimensional architecture.

Using advanced and sophisticated tools does not make everyone an architect, or an artist, or a musician. Instruments and technologies are not capable of turning a man without ideas into a genius. They only amplify his limits, which is explicit, above all, in the lack of character and in the impossibility of recognizing his works among others.

The recognition of an artwork is in fact directly linked to the presence of an idea. Using advanced tools, we only can easily pass from idea to its executive representation, or even to a result, in a very short time.

Mosaic-architecture in Piazza del Popolo, Ravenna. Variation 4. C.Soddu 2017

Generative Art is the art, understood as skill, to build processes capable of generating results representing the vision of an artist. The artwork is the generative process.

References

Websites:
www.generativedesign.com
www.futuringpast.com
www.generativeart.com

books:
Celestino Soddu, Citta' Aleatorie, Masson Publisher, Milan 1989.
Celestino Soddu, L'Immagine non Euclidea, Gangemi Publisher, Roma 1986.
Celestino Soddu, Enrica Colabella, "Il progetto di morfogenesi, Leonardo 1992
Celestino Soddu, Milan Visionary Variations, Gangemi Publisher, Roma 2005.

All books are for free download at www.artscience-ebookshop.com

Two mirroring generated Mosaic Architectures in the ancient harbor of Ravenna, C.Soddu 2017