

**Celestino Soddu****Generative Design Futuring Past****Abstract:**

Generative Art is inspired to Nature. It proposes the logics proper of the natural events, from the generation to the species, from the oneness and un-repeatability of every event to the multiplicity of the variations belonging to a same species.

But there is an aspect that appears really interesting and essential. The possibility, for Generative Art, to be a tool to communicate the passage from the past to the future. The memory of the past doesn't exist if it doesn't happen, contemporarily, a logical interpretation of the same past and its re-thinking in terms of progressive structure able to be used for the construction of the future.

The "magnificent fates and progressive" (Giacomo Leopardi) of the man, in other terms the construction of our future has always been connected with the ability of the memory and, progressively, with the ability to create artificial events based on the interpretation of the memory of our past as engine to trace the future. The logical interpretation of the own references, of the artworks to which we are inspired, can be at the base of the generative structure, of the algorithms that progressively operate for producing future scenarios.

Generative Art founds on this structure of continuous progressive transformation.

Generative Design was born as "Art" to design a progressive path of transformation from the initial idea to the final result. Then all inside a creative run. But also as "Art" to activate this progressive path from the past to the future.

If, as it appears clear, the design and every other creative activity of the man is a progressive run of transformation, as in nature, it cannot be born from an equilibrium but it needs an initial disequilibrium. Also the final result, as in nature, cannot be a static final result, optimized, perfect in the sense of non modifiable result because the changes would remove the aura of perfection. Also the result belongs to the progressive path: it is perfectible, is dynamically connected to the progressive path that traces the future from the past.

Generative Art opened, very expressly, this possibility: to be able to represent the progressive dynamics of the past toward the future. It can work rereading the artworks of the past by identifying the harmonic structures of them. Better it could run by logically interpreting, through peculiar creative subjectivity, the structures of harmonic transformation identifiable in these masterpieces. And transcribing them in algorithms.

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C.Soddu, *Generated Venetian Cities*, 2015

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# Generative Design Futuring Past

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## Introduction

Generative Art is inspired to Nature. It proposes the logics proper of the natural events, from the creation of unique and un-repeatable events to the multiplicity of variations belonging to the same species.

But there is an aspect that appears really interesting and essential, and I should like to enlighten it with this paper: *Generative Art can perform the passage from Past to Future*. The memory of the past time doesn't exist if a past logical interpretation doesn't happen contemporarily. We need to re-thinking it in terms of progressive structures able to be used for the construction of future.

The human "*magnificent fates and progressive*" (Giacomo Leopardi), in other terms the construction of our future has always been connected with the ability of our memory and, progressively, with the ability to create artificial events based on our interpretation of the memory of our past as engine to trace a possible future. The logical interpretation of artworks to which we are inspired, can be at the base of a generative structure, of the algorithms that progressively operate for producing future scenarios.

Generative Art is based on this structure of continuous progressive transformations.

Generative Design was born as "Art" to design a progressive path of transformation from the initial idea to multiple final results. Then all inside a creative running as "Art" to activate a progressive path toward the future.

## Generation and Genetic Evolution

Just considering this peculiar aspect of Generative Art, we must appraise that a deep difference exists among the different souls of Digital and Algorithmic Art. Particularly interesting is the difference among the Generative approach to Art and Design and other approaches founded on the Evolutionary and Genetic structures.

The creative process of Generative Art starts from an idea still not expressed in events. We can identify this "*starting idea*" as a structure in *disequilibrium*. It is an *idea of "species"* defined only focusing some characters and references, but not already focusing a form.

The result, the "Generative Artwork", is the generative engine. This is as an artificial code, that we can identify as the progressive procedure of designing for increasing complexity. We can automatically manage this progression through algorithms able to control the subsequent transformations.

Still reporting this process to Nature, the starting point of generative processes is an embryo of which we build, through algorithms, its "artificial Dna": as a set of codes able to check and perform the progressive transformations toward a growing individual.

As we identified in 1992, (Enrica Colabella and I), in our book "Environmental Design of Morphogenesis" with the sub-title "Genetic Codes of Artificial Ware", the Artificial DNA has the ability to produce a nearly endless series of events, recognizable as an identified "species", by a generative idea, through a progressive path controlled by algorithms. The possible variations, that might be produced, are performed following too the interaction with the "environment", in which this process is performed. In my projects, for instance, the extemporaneous impact with the "environment" is concretized by a set of variables that are always *naturally* different: the date and the time when the generative process starts.

All happens in different ways, by using genetic algorithms or evolutionary algorithms. The starting point is not an idea but a series of finished events, that operate like "parents" in the creation of "children", and so on. There is not a progressive increase of complexity but the starting points and the ending points are events with *comparable* complexity. In other terms a generative structure of increasing complexity doesn't exist inside the genetic path; but the possibility to identify the best solution in a set of parallel alternatives exists.

The existence of a "*simulated time of growth*" appears as the difference among these two approaches. My opinion is that the "simulated time" could produce complex results; in absence of this "time", we could only generate stochastic results. The generative approach proposes the use of the creative time following what happens in all the design activities: today I am interested in one possibility, tomorrow I can change idea and I am fascinated by another aspect. At the end the design result answers to manifold different requests, sometime in opposition. And the complexity was born.

The main aims of the generative approach are the progression and the multiplicity. The aim of genetic approach is the optimization toward perfection. Completely different also if both are useful. If we apply these different approaches to re-thinking the past for shaping the future, with Generative approach we can trace progressive and increasing complexity possibilities; with Evolutionary approach we can define an optimized possibility by managing the already done.

The first uses poetic logics, the second uses analytical logics

## **Equilibrium and disequilibrium**

As every other creative activity, design is a progressive run of transformations. it cannot born from an equilibrium but it needs an initial disequilibrium.

My opinion is that the results too cannot be static results, optimized, perfect in the sense of un-modifiable, because possible changes might remove the aura of perfection. Also the result belongs to the progressive path: it is perfectible, dynamically connected to a progression toward future.

In Generative Design the result is never univocal. It is manifold as the variations are manifold in the fugues of Bach. Variations doesn't deny the possibility to perform events extremely harmonic and dynamically perfect. In Generative Design nothing is "statically perfect", optimized; but every event is unique and un-repeatable, belonging to a species in which all the individuals represent together an "idea". They have in common characters and identity of a well identified and recognizable "species".

No individual is perfect. But every individual, in their uniqueness, following their progressive disequilibrium, gives an essential contribution to the "*dynamic perfection*" of the species. We can identify the species perfection with an idea of progressive transformation from past to future.

If perfection means that the project cannot be modifiable, it will not be able to gain the increasing complexity of our time, stopping its time toward future. In practice it might not allow the designer to go ahead. As final results, the generations of a series of variations open toward future, build results through the multiplicity of possible facets of a same design vision. These will give an essential contribution to the next generation of variations, that are progressive creative reality, as in Nature.

### **Beauty and Harmony in *futuring past***

Very expressly, Generative Art opens the possibility to represent the progressive dynamics of past-future. It can work re-reading the past artworks by identifying their harmonic structures. Better it could run by logically interpreting, *through a peculiar creative subjectivity*, the structures of harmonic transformations identifiable in the past masterpieces, by transcribing them in algorithms.

It is not a novelty. This act has always been effected by artists of all times. This ability of Art gave an essential contribution to communicate the progressive evolving from past in future. What could appear as static perfection of a masterpiece will be transformed in progressive harmony. Only quoting some of these "*futuring past*" actions, Picasso has done it, following Velasquez or Francis Bacon with Van Gogh. This is the main condition for tracing the innovation for the future.

My main aim was always to give my possible contribution inside this way of working. I pursued it starting from my first generative work, the "artificial DNA" of Italian medieval cities in 1987. I constructed a generative code by interpreting Giotto and Simone Martini paintings.

I followed always this approach until my last generative work: "*Futuring Canaletto*", made by interpreting Canaletto for generating possible Venetian cities, that, in the appreciation of this marvellous city, try to break every residual concept of stillness. Venice as a city, that is not (statically) perfect but it is always able to fascinate us in multiple and parallel visions of its dynamic harmony. We cannot only relate this strong fascinating identity to peculiar repeated forms, colours or presence of particular events. This identity works through the multiple possible interpretations by progressive logics.

In my generative experiments on the past artworks identities, a constant has always been the consideration of their "*patina of time*", more than their formal characters. This aspect concerns what appears "transformed by time" more than what appears "perfect", as just finished. I must admit that this approach to the masterpieces of Art, Architecture and Cities could be considered as a "very" Italian approach. Piranesi, in his engravings on the Roman ruins, identified and interpreted this "time patina" in exemplary way.

Obviously different approaches exist. The meticulous reconstruction of the past as perfection, as it is pursued above all in systematic way by Chinese and by some other oriental cultures, is proper of a particular concept of beauty-perfection that doesn't find comparison in the Italian approach. It would be interesting to appraise, in these cultural approaches, how Art supports the maintenance of these cultural identities in the progression from past to future.

## Identification and Construction of Generative codes.

For doing that we have to follow the subsequent steps:

1. Interpreting the past masterpieces for defining the geometrical structure and spatial relationship with the aim of performing a topology of these past events (cities, artworks, music).
2. Finding Disequilibrium. We must identify a point of view able to help us to interpret with algorithmic dynamic structures the past events, also if they seem, at the first sight, to be static.
3. Designing a not-linear structure with generative algorithms able to represent our interpretation.
4. Generating manifold variations able to represent, from different points of view, our complex vision of the past events. And verifying that their identity and our design vision remain well identifiable in their difference, also if interconnected in the generated scenarios.

### Futuring Past projects

I would like to shortly re-run some of these experiences of mine about *futuring past* working with generative algorithms.

Medieval city and castles. At the beginning of the eighties, when I was wondering how to build the first generative project able to produce 3D models of Italian medieval city, I had made a real important choice. I had available a lot of Italian medieval cities enough well preserved and with an abundant analytical and historical documentation. But I have preferred to use, as reference, the artworks of artists like Giotto and Simone Martini where they represented these cities in their paintings and frescos following their visionaries feelings. I have also had a preference for the "perspective distortions" present in these artworks. According to my logical geometrical interpretation (my book: *The image not Euclidean*, C.Soddu 1986) it didn't deal with distortions but with the creation of a disequilibrium able to transform these artworks in "a visionary dynamic visits" to these cities. These virtual tours shown the subjective interpretations of these artists by clarifying and communicating, in a logical geometrical way, the characters of their medieval towns. So, the faster and best way to approach the complexity of medieval towns was finding a possible logical interpretation of these artists and operating, on this discovery, my progressive interpretative logic. This excluded any possible simplification, always connected to analytical evaluations of the existing environment. I succeed in directly considering the complexity of the events and, specifically, their disequilibrium as powerful engine for the progression toward my future vision.

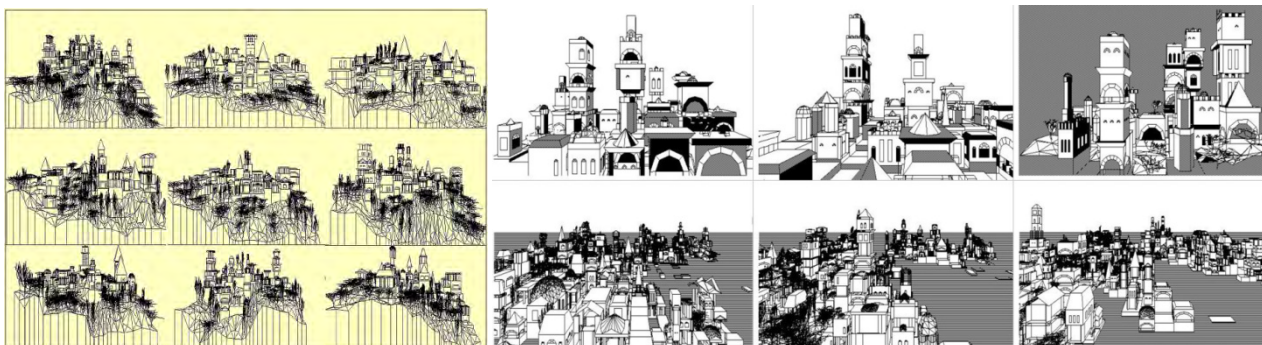
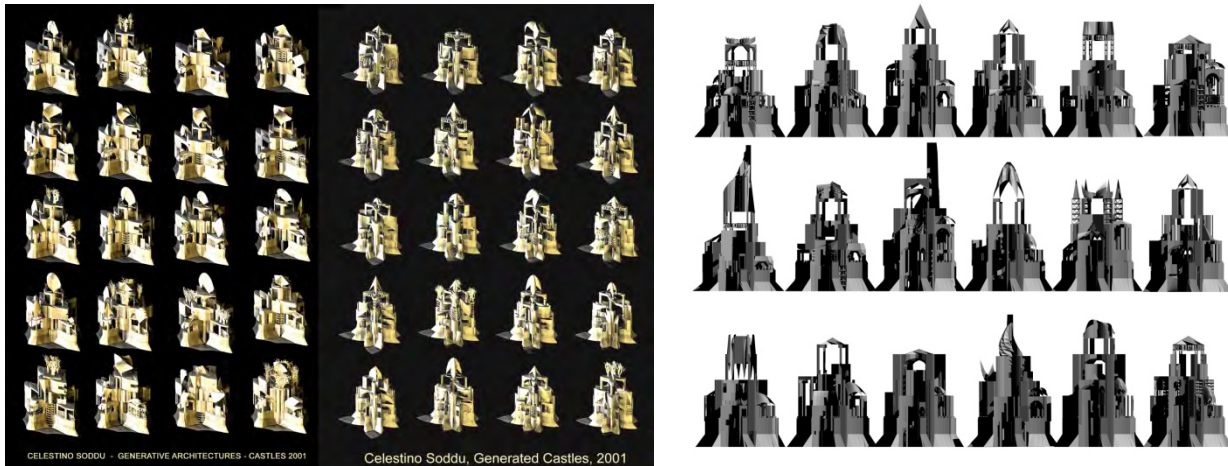


Fig. Generated Medieval cities. "C.Soddu, *Citta' Aleatorie*, Masson Pub. 1989

The first results have convinced me that medieval identity was not based on specific forms but on specific topologies, on dynamics of progression and on harmonies of relationship. The forms easily appeared interchangeable. The relationships were essential to the appreciation and to the possibility of recognizing the identity I was looking for. And I have pursued this choice in the following generative experimentations: the interchangeable structure of the forms and the pregnancy of the topology.



*Fig. Generated Medieval Castles 2001 and 2003. Forms are completely different and are changing from a generation to the subsequent, but the character and topology performs the Medieval identity.*

The main role of topology emerged also in the following experimentations on some American cities, New York City and Chicago, of which I looked for the structure of the identity through generative codes. But not only. I was discovering too the importance of their characters, able to consolidate the strong dynamic image of a city living its time and looking to the future. So I tried to identify the Identity of these city, pursuing concepts of "ideal city", that each inhabitant has of his "loved" city, as "a way to look at the future". This identity process was clear from Hong Kong to NYC, from Washington D.C. to Los Angeles. And, obviously, also when I tried to generatively approach the identity of Rome, Venice and other European cities "so loved" by their inhabitants.

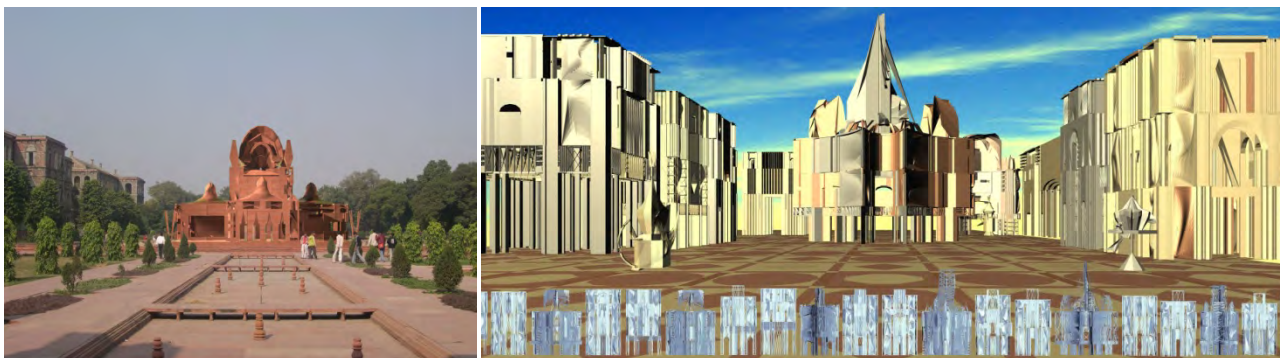


*Fig. Generated New York City, generated architecture in Chicago and Los Angeles (2002, 2003) trying to fit the Identity of these fascinating US cities.*



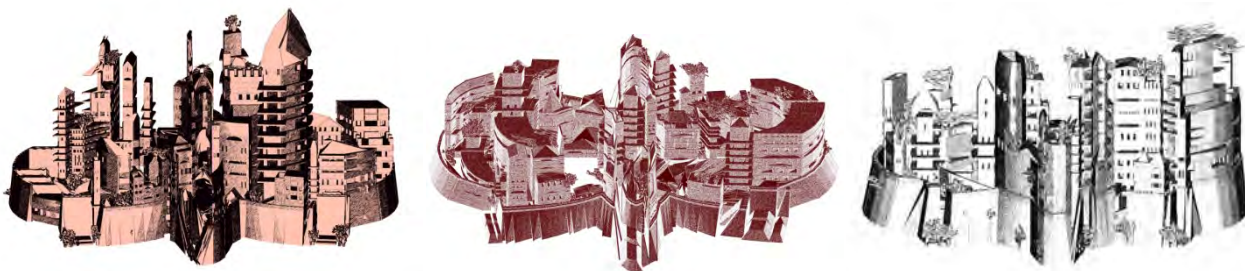
*Fig. Futuring Past with generated architectures in Hong King waterfront (2009), Brussels (2013) and Jerusalem (2011), looking for their identity codes.*

Constructing the algorithms for managing these so different city identities, I discovered the strength of the small details and of specific progressive geometries, practically of small variations in the parameters used in the generative algorithms. Small variations were able to identify some characters of specific cultural identities. For example, the attempt that I made for generating an architectural event in Delhi, done on the occasion of my visit in India. Increasing just a bit the parameter of control of the possible fractal event repetitions had brought to a meaningful increase of the "Indian" identity in my generated events.



*Fig. Futuring Past generating architecture in Delhi, 2006, and referring to the topology of the Ideal City by Piero della Francesca, 2004.*

Going ahead, I have constructed the "Dna" of the city of Lucca in the same way. I operated on the topological structure and managed, with small variations, the previous "medieval" algorithms. I have generated a series of variations of possible Lucca cities that I have used for personalizing the covers of the proceedings of GA2012.



*Fig. Futuring Past of Lucca by generating city variations, 2012.*

My experimentation of Generative Futuring of the work of Gaudi, that is one of my masters, was longer and more hard. Operational references to the catenary curve as geometry able to build the structures proper of Gaudi, appeared too much obvious and too much simplified: not able to bring to the complexity that is one of the characters of this architecture. So I have re-read some aspects of his work through progressive disequilibrium due to progressive variations of the verticality but, in the same time, by maintaining the topological structure of the connections among events. A hardly predictable generative structure was born, but full of charm. A charm that was not due to random, that I don't like in my works, but was due to the unpredictable emerging of formalized relationships among parts when these were transformed changing their progressive order. The results are recognizable architectural variations as interpretations of Gaudi, as homage to this great master. But also as pushing his works to Future

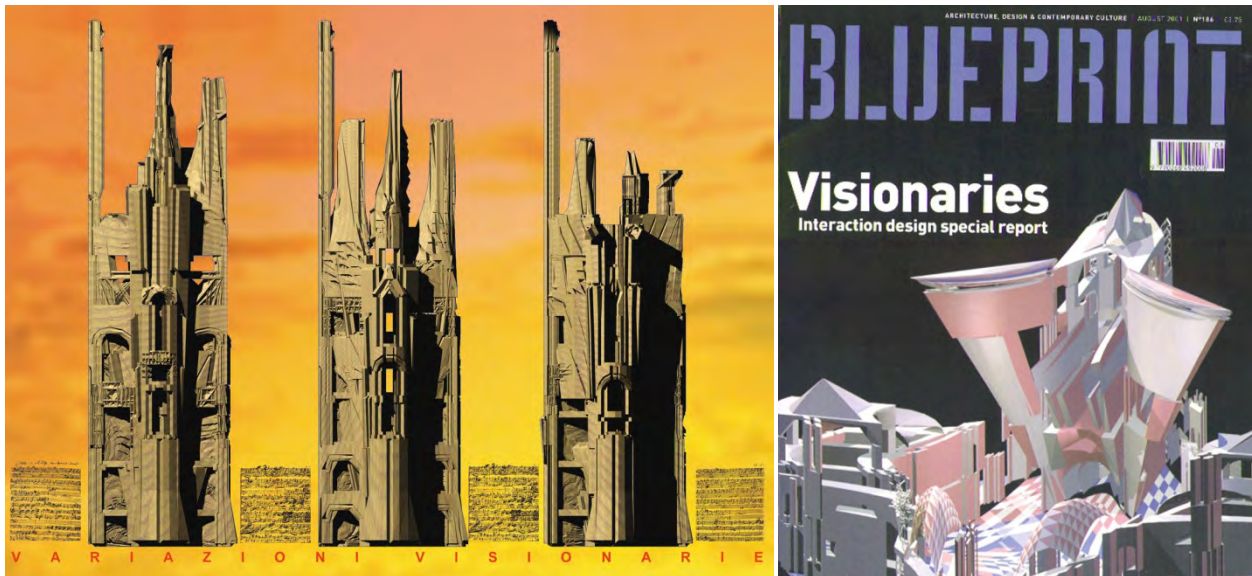


Fig. Futuring Past Gaudi (2003) and a generated architecture for a museum in Milan used for the cover of Blueprint magazine (1999)

For Milan, in 2004 when, in Hong Kong, has been asked me to prepare an exhibition on Futuring Milan, I have decided to undertake an experience that can seem different but, for many reasons, it is not different from the previous ones. I decided to give back to Milan what Milan had lost as essential component of its own identity. Milan has been the home of Futurism, but Milan has subsequently forgotten this component of its history and, today, few events remember this cultural past. I proposed this lost identity in about thirty new architectures generated for Milan; grafting on the consolidated components of Milan Identity the seeds of the Futurism. A "new DNA" of Milan was born, able to rediscover the potentialities of Futurist fever but, in the same moment, finding again, in a possible future, the progression of this lost identity. My aim was to bait a new futurist disequilibrium for the future in Milan; but it is not easy. (C.Soddu, Milan Visionary Variations. Futuristic Meta-Codes for Milan's Identity 2005)

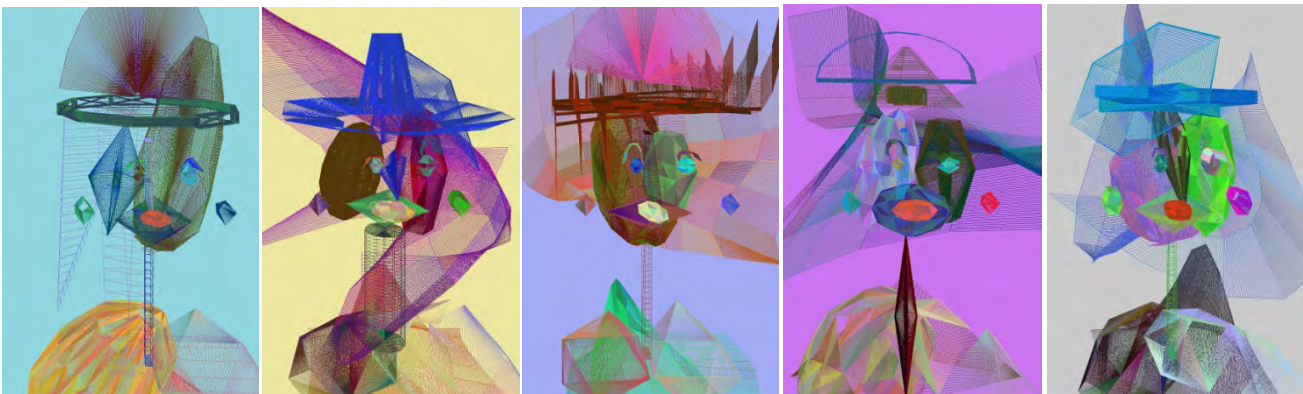




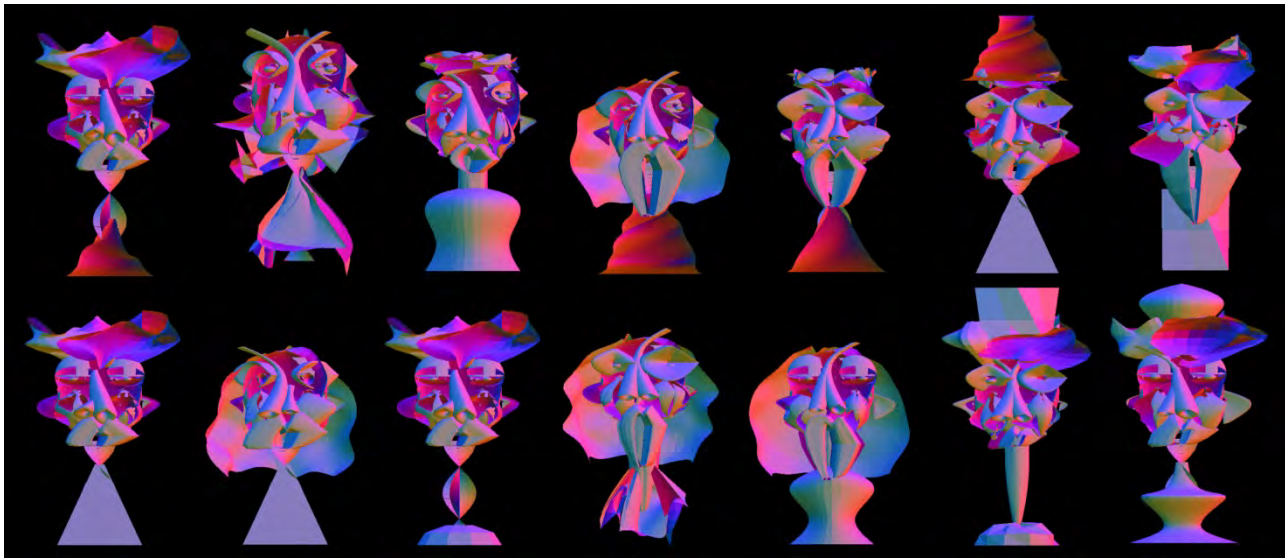
*Fig. Futuring Milan, Futurism museum variations, 2004*

Visual Artworks are certainly a field in which the ability of Generative Art to communicate the progressive passage from past to future seems to be immediate and extremely strong. I experimented that by interpreting the portraits by Picasso and Francis Bacon. These artists were experimenters of the Futuring Past too, working by interpreting Velasquez and Van Gogh.

Doing that I had a very important advantage. My main interest and acquired knowledge is the three-dimensional space. The main logical geometrical interpretation that I adopted has been the passage through different dimensions. In fact I interpreted the works of Picasso and Francis Bacon reading them as 3D models. With this approach I succeed in activating in the space some topological structures and relationships that I had identified as interesting in their bi-dimensional paintings. Moving from 2-dimensional events to those in 3D has meant to have to insert my own vision because, as it clear appears, it is not possible to increase the dimension from 2 to 3 without operating a subjective interpretation, without inserting further relationships among events and building new geometries. Therefore the results have been 3D artworks, sculptures that I directly printed with the first 3D printers.



*Fig. Futuring Picasso, Generated woman portraits, 1997.*



*Fig. Futuring Francis Bacon, 2013*

The most interesting discovery has been the practical verification that different identities don't annihilate one each other. The possibility to recognize past and future persists and it's stratified in the complexity of the results. The artworks still have two different identities: not only Picasso or Bacon but they have also assumed a clear possibility to recognize them as my artworks. The bridge between past and future has been created without copying the past but only with the increase of significance due to the interpretation. As it happens when in a strongly characterized city a new architecture is built. If the new architecture is not a copy but a subjective interpretation of the existing city made by a good architect, the identity of the city grows through this new facet of sense. This is the charm of ancient cities, but also of cities, like NYC or Hong Kong where the love to own city is strong and each possible interpretation is full of sense.

In all these works the starting point of creative acts is gathering the disequilibrium of the past. That is considering the past as alive. This is a generative approach: identifying the character of the "species" and increasing it with subsequent possible interpretations for performing further possible qualities. In fact the results are variations, nearly endless, of three-dimensional portraits. Them, in my intentions, could increase the complexity of the memory and appreciation of the works by building further disequilibrium for a "progressive memory", consolidating a bridge between past and future.

In the engravings of Piranesi, especially in those representing the ancient Rome, the progression is explicit. The progressive disequilibrium is appreciable both in the content (Rome with an explicit "time patina") than in its structure. Piranesi operated in the time with progressive incisions on the plate, one after the other. Besides, in these progressive stratifications of contents, the perspective structure was slightly varied so that the vision of the work was "dynamic", asking to the observer to virtually move himself when he considers a detail of the work. In 2008 I have tried "to continue" one of the works of Piranesi following this process of progressive stratification. I have in fact inserted in one engraving of Piranesi a series of variations of an architecture generated by me, a "Babel Tower". The result has been a series of prints that I have used as different unique covers for the proceedings of Generative Art conference of that year, dedicating every cover to one of the participants. Just this multiplicity of variations shaped a further and explicit disequilibrium dynamically connecting the past with the future.



Fig. *Futuring Piranesi: Generating Babel Towers*, 2008

Always using the engravings of Piranesi as environment for my new architectures in Rome, I have tried to find again the contemporary sense of the Baroque architecture. More specifically of the architecture of Francesco Borromini. Here the generative approach has been focused on the geometries trying to dynamically read the complex geometries of the Baroc. In other terms I have tried to read the geometries as generative geometries (V. paper GA2014). The most difficult moment has been when I needed to make dynamic the "perfection" of Sant'Ivo alla Sapienza, based on the equilateral triangles. It strongly appeared as static in its "perfection" as if it were impossible to push this geometry inside a progressive path able to produce variations. The attempt has been done by performing the possible dynamics of this geometry through an interactive transposition of the topological relationships among different geometric models. Following this approach I succeeded in finding again a lost disequilibrium in the apparent fixity of the equilateral triangle (v. my paper GA2013).

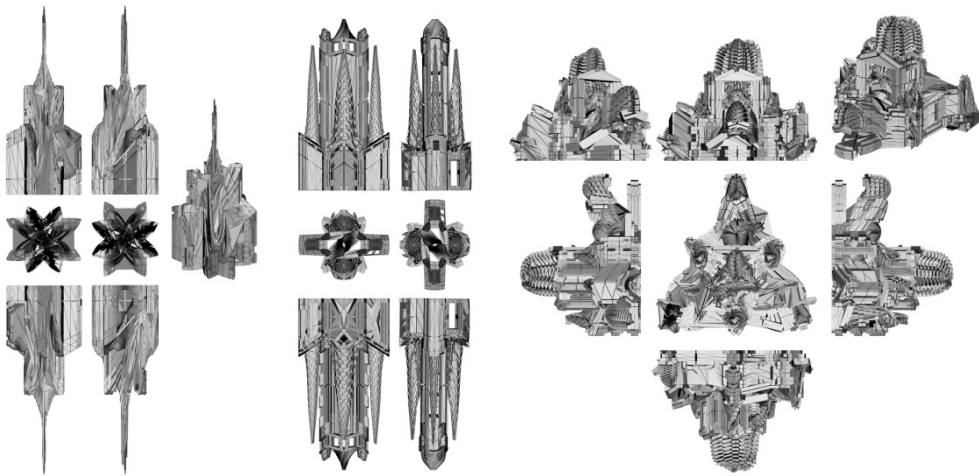


Fig. *Generated Baroque Architectures*, redefining baroque identity with generative geometric systems



*Fig. Futuring Baroc and Rome Identity. Generated baroque architectures interpreting Borromini in Piranesi engravings, 2013.*

Finally the experimentation that I have done for Venice on the occasion of this conference. I would want to call it "Futuring Canaletto" for the reason why, as I have always done when I designed virtual Dna of cities, I didn't used as reference the physical city, analyzing single parts and aspects of it, but I have "progressively" interpreted the works of an artist that represented Venice by interpreting this "Ideal City": Canaletto. I have not only abducted from Canaletto the progressive geometric structure of the architectural and urban events but I have also interpreted his so important feeling for this city, that is a way to look at the future. More, Decio Gioseffi, the great expert of geometries and art history, said me twenty-five years ago, that my artworks remember him Canaletto. I always asked myself why and, finally, I assumed that it was because of continuous progressive perspective, from the whole city to details. And I followed his indication. The architectures that I generated for these Venetian variations, as the urban orders, the bridges and so on, are not present in Venice. No copy or repetition of existing events, and not even a formal or deconstructive analysis. I also inserted, like Canaletto with daily Venetian events, a fashion generation for showing a typical contemporary event. The results would like to be, in my intentions, as expression of the identity in progress of Venice, of its recognizable Dna. Breaking, in this way, the static approach to Venice and giving back to this city a small engine to glimpse its Venetian future and the pride of a city that it is not only the static analysis of what is present, not only a museum, but a way to think progressive, a way to think generative.



*Fig. Futuring Canaletto, variations #1 and #2*

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