

New naturality: a Generative Approach to Art and Design

Celestino Soddu

professor, architect, director of Generative Design Lab, Milan Polytechnic University, Italy
chairman of Generative Art International Conference, GA98, GA99, GA2000, Milan, Italy

Abstract

The Generative Art and Design represent a design concept as code. This generative code is like DNA in nature. It uses *Artificial Life* to generate a multiplicity of possible artworks, artificial events, architectures and virtual environments. In generative approach the real artwork is not only a product like images or 3D models. The generative artwork is an *Idea-Product*. This product is the Generative Project performed as genetic tool. It represents an artificial species able to generate an endless sequence of individual events, each one different, unique and unrepeatable, but each one belonging to the same identifiable design Idea. This approach, that I called *Argenia*, realizes the New Naturality of the artificial objects. The keywords of *Argenia* are: Naturality, Complexity, Identity, Recognizability, Beauty, Harmony, Artist's imprinting.

The Generative Projects: Architecture, Industrial Design and Art

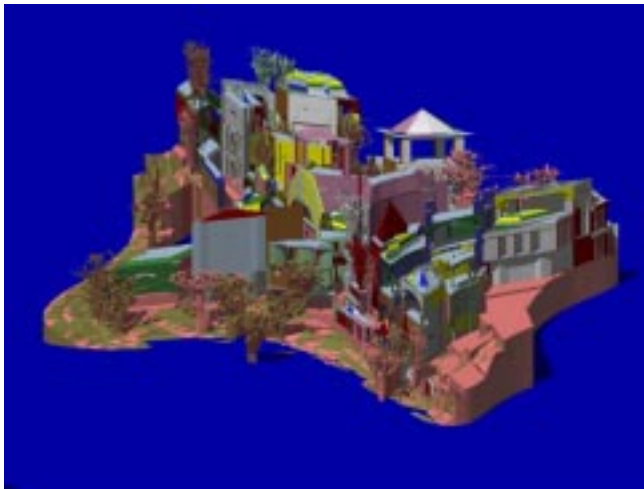


Figure 1. *Isolabella* a entirely generated isle
Basilica is the Architectural Generative tool that I have realized for my architectural design activity. It is based on my interpretation of the "DNA" of the Italian Renaissance. *Basilica* is able to generate an endless sequence of different architectural 3D models, all unpredictable, but nevertheless recognizable as part of the

same Idea, of the same architectural concept. *Basilica* represents my idea of architecture, and operates like my virtual office, It generates sequences of possible 3D architectural models in response to different design requests. I applied this generative tool in realizing environmental and architectural projects. In Fig.1 I have designed, as a natural species, the DNA of a typical Italian town environment like *Isolabella* in Maggiore lake. To obtain an acceptable complexity of the urban image I have simulated and ran the linear and not-linear dynamics of the evolution of this type of urban image.

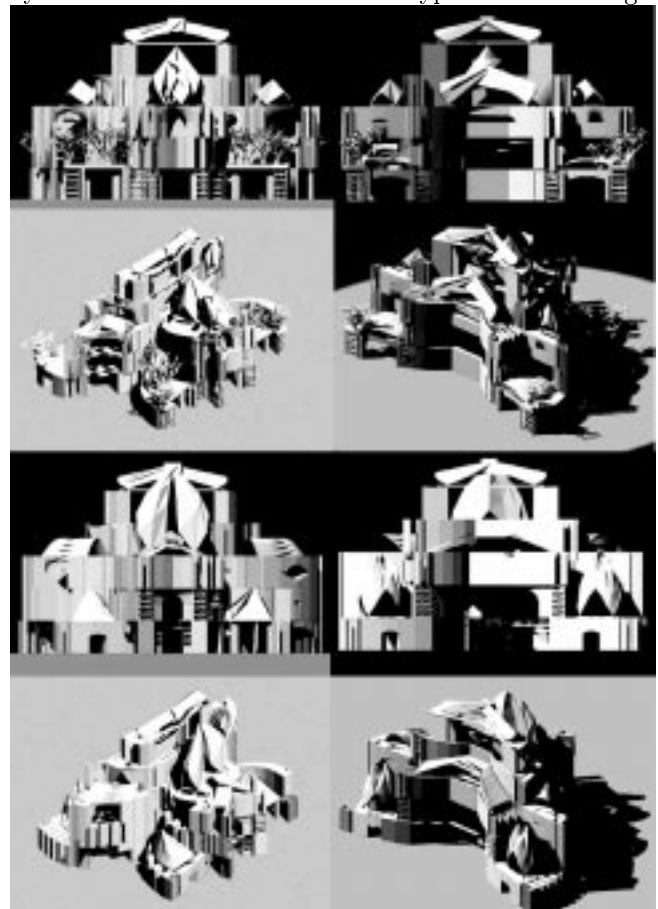


Figure 2. *Roma Barocca 1998*. Generated architectures

I have proceeded in identifying and discovering, follow-

ing my subjective interpretation as architect, the rules of the game, the modes of the transition between one order to another, the role of randomness in increasing complexity and the power of the time in shaping the environmental image.

In Fig.2 the topic is the architectural design: a project of species of Baroc Cathedrals in Rome. Every model is one of the possible parallel histories of my architectural concept. The difference between one and another virtual model is like the difference between one and another individual belonging to the same species. A difference shaped by the random components of the evolution. But every model is characterized, in front of all differences, by the morphogenetic nature that identifies this particular artificial life. I mean that every time I use this software, I run through one of the possible design histories. Each history is always different but it is also parallel to the others. Like in every fable, the structure is always the same but every time we tell it, we run one of the possible subjective paths.

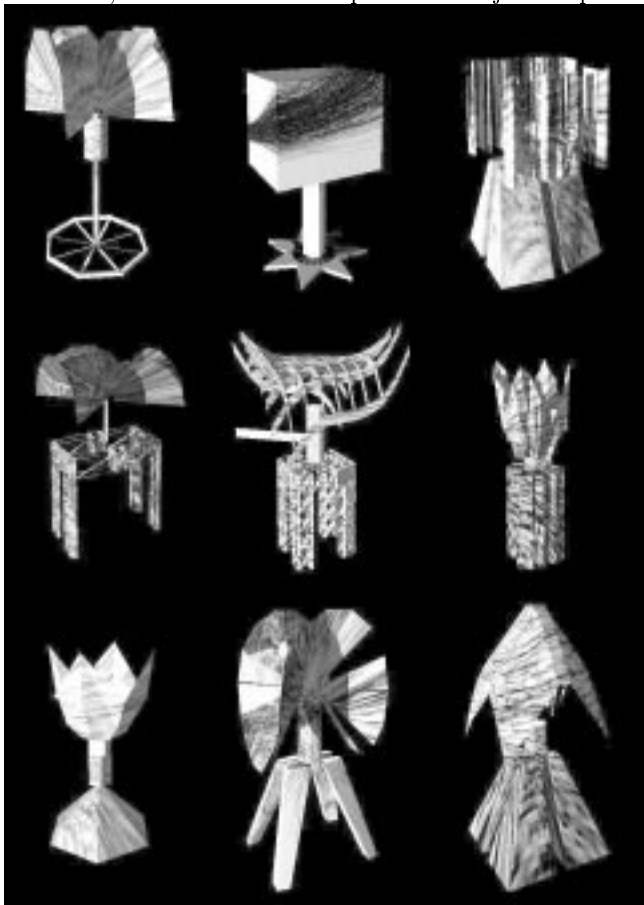


Figure 3. *Lamps*. a generated sequence of lamps 3D models are generated by C. Soddu 2D graphics texture are generated by H. Dehlinger

Argenia is the generative software I have designed to generate Industrial Object. It is a generative project able to interface with manufacturing machines to produce a series of all different and unpredictable objects.

These object are recognizable because they belong to the same design concept. In the two centuries of the Industrial Era, by now at a close, objects were produced as undistinguishable multiples. The mass-production line renders all objects equal. And this equality has been celebrated in the overstimulation of optimization processes and in the construction of an aesthetics of repetition. Now it is possible to rediscover the naturality of the artificial objects. Argenic Design might thus be seen as a conceptual and operative innovation for the realization of industrial products in the Third Millenium. These products may be unique and unrepeatable, like handmade objects have always been, but realized in factories. These objects are made to the measure of man because they are the mirror of the individual subjectivity. Furthermore, these products are good for the environment, not only because they are recyclable, but because they have a slow obsolescence.

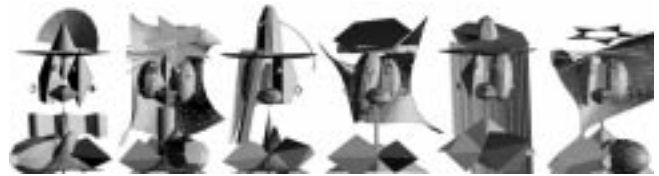


Figure 4. A generated woman portrait's species based on Picasso's code

Argenic Art. One of my last projects of generative art is the Woman Portrait Generator. WPG is able to generate an endless sequence of 3Dmodels of womans portraits. As Picasso has repainted Velasquez and has referred to the African sculptures, so I tried to repaint Picasso with a generative art project able to generate a sequence of womans portraits. Each one is different and unpredictable, but recognizable as Picasso and, in the same time, as belonging to my interpretation of these artworks.



Figure 5. Other individuals of the portrait's species based on Picasso's code interpretation

I am sure that this challenge is realisable because the identity of an artwork is a stratification (or nidification, as in fractal structures) of multiple identities, and the women of Picasso are a strong example of this evolutionary stratification. My generative project, and the generated portraits, are only a further stratification of sense as everything inside art and cultural approach must be.

The main structure of Argenia

These systems are based on two original software engines that work together.

The first tool represents a Generative Code, conceiving as a Generative DNA. This software engine is the same in all the projects and represents my architectural concept. I upgrade this code accordingly to the evolution of my Idea.

The second tool emulates the evolution of each project, using Artificial Life procedures, and manages the increasing complexity. This code is suitable to be adjusted following the needs of the design activity and the requests of each different customer.

1st. A new Concept represented as Artificial Genetic Code

The conceptual moment is the construction of a proper world of interpreted references. It is the fruit of the passage from the exegesis to the hermeneutica. This is a passage from the comprehension of our existing environment to interpretation of the same environment.

The first act of the generative design is the construction of a generative code performed as a set of different devices working together. Each device follows a subjective interpretation of the evolutionary systems that I found in my cultural references and that I value as able to increase the environment's quality. They represent the traces of subtended and evolutionary logic identified as procedure of transformation and increase of complexity of an idea.

These devices, all together, are built as a parallel system that operate transformations of each input in an output event. They define how a possible transformation, and the related increasing complexity, happens.

Obviously every possible result remembers the initial event but the process of transformation is able to characterize the final event on the base of identified objectives. These are objectives of sense, identified on the concept and abstract field using specific meta-project configurations. The storage of these matrices with algorithms is the historical memory of my generative projects.

The structure of this parallel device is defined by a primary paradigm, or better a set of superimposed and autonomous paradigms. These paradigms represent and manage the use of the procedures of transformation and their omotetic symmetry from the totality to the detail.

These procedures are the motor of each design activity. They act directly on the characters and on the recognizability of final projects.

The design concept is not a shape. It is a subjective procedure of transformation. The architect's imprinting is shaped by how these transformations happen.

2nd. Artificial Life to manage the evolution of the project

The following phase is the management of the evolution. We use a design hypothesis, an evolutionary paradigm that checks and verifies the simultaneity of the possible project evolutions.

In the professional offices this phase concerns the management of the teams project, the identification of the operational hypotheses to develop, the verification of congruity of the results to the hypothesized quality and concept.

In my Generative Projects this moment means the realization of a structure of Artificial Life able to let evolve the project, testing and increasing its complexity, and surveying the multiplicity of the possible results as endless representation of the same idea. So we can consider the double face of generative design:

1. The existence of a code, of an identifiable and designed DNA performed to represent the idea.
2. The existence of a designed artificial life, built as unpredictable environment. This artificial environment can be also sometimes hostile, however structured not to be crossed easily.

This allows to the code of the idea to germinate, to self-organizing, to grow and to increase its proper one personality really in crossing, making experiences and sometimes fighting adversities.

Artificial DNA and Artificial Life are the two systems that must be designed for activating a Generative Design. They are two separate projects, sometimes contrasted, but they represent the two faces of a same idea of project.

With a deep difference. In the first one random does not exist, in the second random is one of the factors of control and amplification of the idea. In every case random must not be used to produce random shapes but to upset the code that represents the idea. The Artificial Life stimulates the genetic code to react in a way to increase and to render explicit the identity and recognizability of the design concept. This evolutionary procedure can put up unexpressed potentiality of the idea or holes to fill.

Therefore the code will be always the same, at least in a single generation of events. The artificial life that will serve as environment to its evolution has to be always different, even if it has to be able to maintain a predefined degree of difficulty in way that the evolution of the project is completed with a sufficient degree of complexity.

Which is the result? Certainly the ability of the project, so trained by an hard artificial life, to answer to the requests, also unpredictable, of the consumer. A degree of complexity that can be similar to some natural objects or, I like to think, to the complexity of a historical city that owes its beauty and charm, and therefore

its ability to answer to specific needs of each man, to the lived long and difficult history, to a stratification of cultures, phases of expansion and contraction, and from the acquired (from lived artificial life) ability to grow, rather to increase, its own uniqueness and recognizability.

New artificial naturality

The generative design produces events that are unique and complex. Uniqueness and complexity are strongly related to each other. As in Nature, each event is generated through an artificial life, which, as in the natural life, produces uniqueness, identity and complexity during an identifiable time.

In the project evolution, if this evolution is performed as artificial life, the unpredictability of events increases the opportunity to explicit choices, and then to build identity and recognizability of the concept.

The gained complexity is a natural-like complexity.

Beauty and Harmony

The subjective laws concerning proportion and logic are the representation of a creative concept, performed as transformation procedures. With Generative Art we can approach, directly, the complex paradigm of proportions and logic. So we can directly design the Beauty, or better our idea of beauty, before the realization of each single possible artificial event. This is the heart of the generative approach.

Generative Art works for Beauty, in the sense of the Humanistic approach of the Renaissance, because the generative code defines how to bring together all the parts, the law of proportion, the dynamic relationship among these parts and which logic the dynamic evolution will follow. All the events that this code can generate will be, in a humanistic sense, beautiful, or, if we prefer, will belong and represent our Idea of the world. Harmony is the result of an evolutionary path, performed as Artificial Life. Man, Geometry, and Nature as references for the *harmony which is not thought as an individual caprice but as conscious reasoning*. (L.B. Alberti, *De re aedificatoria*).

Complexity

The complexity, as stratification of multiple sense, is the main channel to gain the possibility to fit the designers subjectivity with the user unpredictable request of meaning and of beauty. But this complexity is easily gained with generative design and artificial life. To manage the complexity I referred to the concept that the complexity is not generable *ex novo*, but only using a process to stratify sense into a flowing simulation of a temporal irreversible path. We can activate and control this stratification if we design a system with a self-organizing paradigm that can increase its identity and recognizability during the simulated time flowing of an artificial life.

To built this paradigm I referred to the chaotic dynamic systems that are suitable to be controlled by algorithms, even if they never produce the same event. I have used a fractal but non deterministic logical frame. In other terms, every decision cycle has inside, nested using a lot of other cycles, other decisions, and so on. The structure of these cycles is, as in fractal objects, always the same. The differences and the unpredictability born from the resonance with other cycles, from the time of activation and from always different flow of information. Each cycle represents a whole structure in simulating the decision choices. It operates the transformation of the answers into possible shapes.

Recognizability

Recognizability is the identity of possible. It is possible to draw the recognizability before the each individual artwork. It is the representation of the design concept. The Idea as generative product exists only if the Idea is recognizable through each generated events.

The artist imprinting

The artist imprinting is the answer to the users need of identity. The identity of the artist represented by the species, the generative artwork), the identity of the user explained by the choice of one of the generated artworks. The Generative Art produces events that are unique and complex.

References

- Soddu, C. 1987. *L'immagine non Euclidea, (not-euclidean image)* Gangemi Publisher, Roma.
- Soddu, C. 1989. *Citta Aleatorie, (Random Towns)*. Masson Publisher, Milano.
- Soddu, C. 1991. *Simulation tools for the dynamic evolution of town shape planning*, Oxford Polytechnic, UK.
- Soddu, C. and Colabella E. 1992. *Il progetto ambientale di morfogenesi, (Environmental Morphogenetic Design)*, Esculapio Publisher, Bologna .
- Soddu, C. and Colabella E. 1995. *Recreating the city's identity with a morphogenetic urban design*, 17th International Conference on Making Cities Livable, Freiburg-im-Breisgau, Germany.
- Soddu, C. and Colabella E. 1997. *Argenic Design*, Contextual Design / Design in Context Conference, Stockholm.
- Soddu, C. 1999. *Recognizability of the Idea: The evolution process of Argenta* AISB99 Edinburgh 1999.
- Soddu, C. 1999. *Generative Art*, Dedalo Publisher, Roma.