Discovering the persistent deep memory in Generative Design. Duets

Topic: Architecture, Urban Design

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Abstract
The city is a collective dream performed by a growing toward an idea of future. It's made by different and unpredictable events carried out by different ideas during the time. The beauty of historical cities in their wonderful results springs out where we can appreciate the memory of multiple and different interpretations recognizing their own identities.

The challenge of my generative design approach is to store in an original software program, during the time of my life, the memory of different operative points of view for creative processes. The target is to construct something like a logical labyrinth, able to generate the complexity similar to the complexity of cities, that lived different cultural moments and different design points of view, as a taste of time.

This deep persistent memory of "how" to approach the architectural and urban evolution is the peculiarity of my generative software. I started to design it in the eighties. In this generative software nothing was erased in the last 30 years but all the different ideas coming from all the different character of each subsequent project and occasion that I lived, were recorded as transforming process, as algorithms that could be always used as a possible parallel path inside the main generative process. Each process is different and, sometimes, in contradiction one each other, but these processes, all together, reflect the idea more than one axiomatic choice.

The result of this approach is the possibility to generate complex urban environments with a history taste, following the contemporary presence of different architecture and styles but all inside a well-identified evolving *idea* of the city.

The generated cities that I am presenting in this paper interprets, as a *duet*, the character and the identity of medieval cities with a renaissance core, like Siena and Florence. My generated cities are not a representation of these cities. They are contemporary cities with the taste of lived time. For feeling in sinthony with human life.
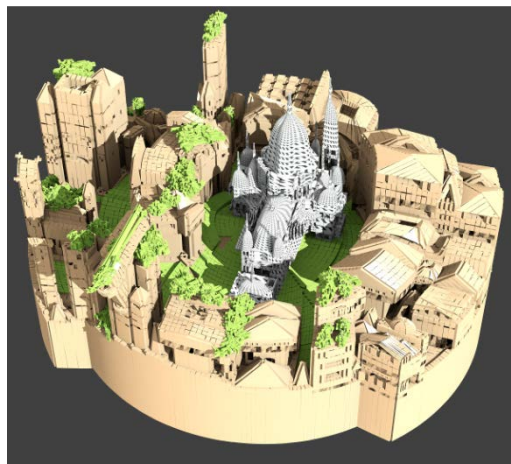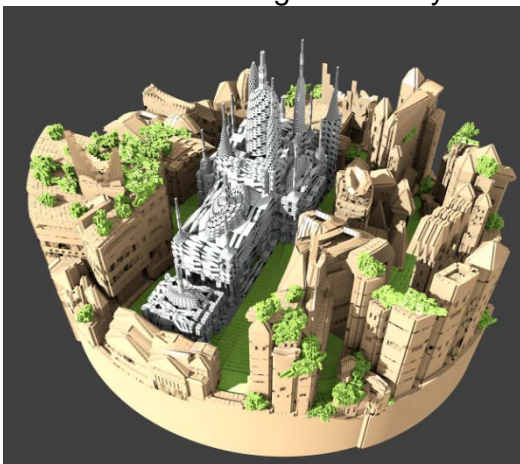
The discovering of persistent deep memory in Generative Design. Study case: Duets

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Cities and Future

The ***city is a collective dream of which we don't know the end but only as it is running***. The city is a site where each one can be able to contribute with own vision, own performing acts, own projects, and with own dreams.

Each city rises by a shared idea of future and by a multiplicity of interpretations of this idea that have brought to the carrying out of every single urban event. This city-Idea transforms itself in progress by building an urban identity and uniqueness, that we can identify as a peculiar way of looking to the future. This is the reason why we cannot design a city in a glance, thinking to communicate this dynamic idea. We need to develop the city creation running different transforming processes, following multiple points of view, experiencing a wide range of possibilities in fitting the idea.

Fig. 1. Lorenzetti, the good govern

Cities evolving process

The ***interpretations***, particularly those made by the architects, perform the single architecture, sites and other city events by following the cultural moment, the new building technologies and also the fashion and style. ***These multiple acts interpret and very often strengthen the uniqueness*** of this shared idea of the city, that we can call "Ideal City".

For political and social problems there are moments of deterioration tied up to moments of loss of love for this idea, of loss of identity not only of the city but of the same shared way to look at the future. This happens because the future doesn't interest anymore, and it is however reputed too far and impossible. Then people looks only at the present and the city loses its identity together with the love of the people for the environment where they live. So we have the forgotten suburbs. or the cities in decadence, where everyone feels to stay

imprisoned and only looks for the possibility, the occasion to run away.

The only escape is when another shared idea will be born, an idea of transformation that looks to a possible future. And everyone starts again to dream, interpreting the way to increase the city beauty and acting for approaching it.

Cities and Future: Cities designing process

The city, with its complexity but, above all, with its strong identity was always the object of investigation both in the field of the representation and on that of the creativeness and design.

Shortly, fully representing the complex identity of a city is impossible if we try to do that with an extemporaneous sketch or project. The result could be only a representation of a momentary impression, of a proposal of a partial aspect that appeared able to evoke a possible increasing process of urban identity. *Designing a city needs always the time, a process able to stratify designing acts,* each of which it referred to a subjective interpretation of the city idea, to a creative freedom able to express and to consolidate a point of view inside a common sense of the ideal city.

The stratified increasing complexity and beauty of cities happened particularly in the *cities loved by people* living their architectures and urban spaces. Rome and Venice, Florence,New York, Hong Kong, Chicago, Paris, London, and small cities like Lucca and Siena are cities that strongly remain in our memory for their character and identity and, at the same time, are amazing in every possible aspect. Every road, building or point of view is able to increase the identity of the city in our memory by increasing our ability to appreciate it. This appreciation increases our desire to design something on it, following this way to look at the future, and of staying inside this beautiful dream. Nobody is able to design a new city that has these characteristics because these cities have, explicit and pregnant, *the taste of the lived time*. The trace of the life through the progressive transformations of their history.

Even with the generative design is impossible to reach this purpose. But *an advanced generative approach is able to give us a small help to manage this complexity and the multiplicity of different subjective interpretations and acts*.

Cities in Tuscanian environment: Siena and Florence

We are in Florence, in Tuscany, and I would like to consider the character and recognisability of these cities. I already experimented the generation of medieval cities, from my first experiments of the eighties to the generation of the medieval city surrounded by boundaries and with "green" towers as Lucca. But what now fascinates me is the character of cities like Florence and Siena. If we see the aerial images of Florence and Siena, some analogies

catch us. Analogies, besides, existing among these two cities that were always in competition among them but had in common a shared idea of a particular style of life connected to Renaissance.

Fig 2. The result of a shared idea of Ideal City: Florence and Siena are two different cities but with a common idea in the relationship of the core, made by Renaissance Duomo, and the medieval structure of the urban system that opened itself for welcoming the holy core.

The **"duet" structure** of the medieval urban system and of the Renaissance Cathedral represents, so clearly, one of the characters of these cities. These two parallel structures are strongly recognizable and each one **increases the recognisability** of the other. This is the reference field used for my last generative experimentations: I tried to generate two parallel architectural identities, that, together, identify and construct the complexity and character of their urban system basing this goal on these differences, on the track of the lived time and of the changing of styles and poetics. We can identify, in this simultaneous different events, the possibility to recognize the parallel different characters. This **"duet", renders explicit the process for gaining complexity and beauty,** as happened also in the other innumerable parallel presences of different architectural events and interpretations of a same vision of the future.

Designing the recognizable time complexity

How **can we design this urban complexity?** Is Generative Design able to support the possibility to manage cities ideas and their fascinating complex systems?

Following this challenge, I developed in the eighties my first experimentation for generating medieval cities as 3D city models: all unique and different but each one strongly characterized by the medieval idea. When I have done that, thirty years ago, the first results were interesting even if hardly usable for a real design and construction of these cities. The generated models were, above all, the identification of how the character can be developed through three-dimensional models.   **The form of each single architectural events was**

not important, but the main aspect was the generative city process, constructed following a peculiar idea in progress during a simulated time path. I considered the Generative Urban Design as a way to construct the progressive and manifold transformation toward an Ideal City.

The main aspect is ***how to start and construct this complexity***. This type of generative projects could not be performed only in a single moment but it asked for a multiple and sequential creative approach. These multiple approaches should be done by different creative subjects or, at least, by diversified interpretative moments, by ***different points of view*** that could be, sometimes, also in contradiction one each other. I know that today, I am other than yesterday: my creative actions reflect this difference. If I succeed in managing this complex progressive system I can try to manage the time progressive evolution of a city because these systems are similar. ***The memory of my different design approaches experimented in my life can be used, together and contemporary, in the generative process.***

In **my first experiments** these subsequent interpretations happened by activating multiple and parallel generative processes, above all referring to the artworks of Giotto and Simone Martini and using ***sliding among two-dimensional and three-dimensional representations*** of the same represented buildings. This was a way to produce different points of view of the same idea. Using as references the artworks and not the real cities, increased the possibility to produce parallel different interpretations usable for multiple designing acts.

After more than 30 years from these first experiments, I discovered that these effort had incredible results and a quality that surprised me: ***it was possible to recognize the differences in the subsequent approaches not only by the used forms but owing the different characters***. The reason is that I used a particular approach in designing the generative software: ***I never changed the algorithms already created with the new ones but I stratified to the existent algorithms the new ones***. In this way, I kept alive the possibility to use the previous ones, at least for generating some details. This is, in practice, an approach that performs an evident choice: ***nothing is axiomatically true or false, nothing is better than another process already used but everything is useful*** and we can develop parallel transforming paths that are similar and not equal one each other. And the difference between these possible path follows what I had in my mind as vision: the Medieval character, the Renaissance, the Baroc architectures, the Piranesi complexity, the Gaudi geometry and so on. ***Each transforming path, each algorithm is a logical interpretation of our cultural past***.

Fig. 3. Generated "Duet" city in the Tuscanian environment. It follows the possibility to recognize the Typical Tuscanian environment and the two characters, the medieval for the urban structure and the Renaissance for the core structure. C.Soddu 2016

My Generative Approach

Practically I used two rules in my approach:

1. not changing the generative software each new project but *using ever the same program list by implementing it and integrating it*. Each new algorithm is one of the possible logic interpretation of an architectural character, of an urban identity. The diversity among these algorithms inside the same finality is similar to the manifold possible interpretations of an urban character as happens with the multiple and different points of view of different people, as architects, when they work in the same city following and sharing the same "city Idea".

2. transforming the generative software, step by step*, from a linear system into a dynamic complex chaotic system*. At the end, I have realized to have built a logic labyrinth. *This labyrinth is the place of the memory of my multiple interpretations and logics*.

So, I discovered to have designed two different type of generative software. One that I can call "basic" and the second that could be identified as "advanced.

The difference between "basic" and "advanced" Generative Software is:

1. the **first** allows to **generating a sequence** of every-time different events well identified and characterized following a contingent idea.

2. the **second**, in advance, allows to **store experience of how** to generate the events and allows the possibility to use this experience following different contingent points of view in different generative projects or contemporarily in the same project. More, it's possible to increase the possibility to experiment the same transforming process for different events, with no direct relation with the previous one.

This difference is essential, also if all the generative software are similar because all work on multiple variations belonging to an Idea, for constructing a characterized "species" of events.

Fig.5.6 in the first image the generative design of cars, that I am developing now. This generative projects was born as a basic project, without using (until now) the stored deep memory of how I approached the previous projects. In the second image the contemporary city. It is an advanced generative project where it's possible to appreciate the stratification of different design experiences and identities.

For reaching this possibility I never changed the "Basilica" software written in the middle of Eighties by using my Apple II. I only moved it several times from a system to another and I **added the algorithms** that, step by step, were the representation of my architectural and urban vision in progress.

In the meantime I wrote other generative software, dedicated to peculiar occasions, also experimenting different languages. But these experimentations lived aside, with not direct contamination with the previous works. And I'm sorry for that because something was lost.

When I wrote Argenia, I moved from Basilica, my generative software dedicated only to architecture and urban environments, to a more open generative engine. My hard work was to move all the previous algorithms from Basilica to Argenia but, at the same time, I constructed a generative software able to work in a more open field, from architecture to object design, to 3D art. The Z constraint, that is proper of architecture because of its typical

construction structure, was opened to developing sequences in all the axis, not only orthogonal axis.

With this new possibilities**, I succeed in collecting the parallel experiences made with objects (chairs, lamps, portraits, jewels) into the dynamic memory of Argenia, improving its complexity and experimenting unthinkable contaminations.**

The software remained the same and now if I use the old Basilica or the new Argenia software I can have available my design experience developed in 30 years. This memory is an **operative memory**. It's not a database of shapes but a set of algorithms, mainly structured with generative geometries, that could be used for the purpose of progressive development and unpredictable contaminations.

If I print the entire program list, I have many hundreds of pages and it's difficult, also for me, to **control** the entire system. Besides all, I don't control it. I go ahead in adding new nodes and connections and I like to surprise myself with the results, every time different but, surely, in line with my vision.

With this software I tried to generate again the Medieval Italian cities and today I will show you the **last generations** of Medieval cities. More, **medieval cities with the Renaissance core** as we can find in Florence.

The structure of my software is evolved from the first experiments of 30 years ago.

The structure of Argenia is really different from the classic shape grammar, also if transforming rules are used.

For clarifying better the structure of my generative software:

1. *my generative approach doesn't use, as a starting point, some simplified shapes but the logical 3D interpretation of the existing environment topology or artworks*.

2. *my generative approach don't use specific transforming rules linked to specific shapes but the transforming rules can be applied to all the 3D forms in progress and to the whole project in progress in an open line.*

3. *the transforming rules are identified by some basic functions*, like "how to fold", "how to end", "how to make a hole", "how to divide", and so on, which use can be performed and stratified in progress, following the structure of the paradigm. *These transforming rules are able to modify all the previous existing objects and are not focused on only one event or shape*.

4. my generative approach uses what I call *paradigm*, that is a *topological structure of void events*, for applying the transforming rules to each progressive event and for reaching a result that fits the peculiar needs of each project.

Fig. 4. Other generated "Duet" city in the Tuscanian environment. The urban structure is different, the Cathedral is also different from the previous image but the possibility to recognize the double character remains and it performs the increasing identity of this urban environment.

The Paradigm as extemporary choice

The paradigm ***is an interpretation of a peculiar fascinating past***. As I teach to my students, I suggest using fascinating artworks of the past as a ***catalyst*** for constructing this paradigm. Many times I use paradigms that have, inside, ***secondary paradigms*** peculiar of architectural events, as paradigm "***27***" (made interpreting Borromini and constructed like topological Rubik's cube with labels) or "***21***" (the same in an hexagonal 3D net) able to control the correctness of architectural structure and the possibility to fit the human needs. These last paradigms are, obviously, useful for the architectures and sometimes, also for different spatial objects.

The ***paradigms are*** only ***logical interpretation of a theme***: my last work in progress about cars have a ***paradigm that is a logical connection of dynamic space points*** each one

with a peculiar character.

Each paradigm is extemporaneous and it's possible to save it as "***project of species***". The set of transforming rules is instead founded on the memory of How, the memory of the used logical paths that I can use again to develop an evolutionary process using the platforms of the paradigm. Every time that I use this software I build a paradigm in line with the "theme" of the project. And this is "normal", or rather, it reflects what an architect normally do when he starts a new project. Then, since we are not static but every time that we act, we creatively follow the feeling of the moment, I build some new processes/algorithms of transformation that reflect the extemporaneous point of view. These processes, and here it is the peculiar aspect of this approach, don't replace the processes of transformation previously written, but they go running in parallel with them managing this simultaneous work with possible contaminations and resonances.

In other terms, ***the paradigms are always new but the stored memory of How to transform in progress the project becomes larger to every new project***. Step by step it really becomes a deep memory of *how*, an operational memory of my design vision.

The algorithms - transforming rules as persistent memory

The transforming rules are not limited and pre-defined but they are in progress, following the previous design experiences stored in the generative software as algorithms of transformation. The use of these algorithms are not random but follows the searched character exploring the logical labyrinth shaped by the stratification of the already experienced design.

The searched character of a new project is made by ***controlling the possible weight of each possible transforming rule and their reciprocal contaminations***, as in the fuzzy logic. It's not an analytical approach but a discovering path, as normally art and design are. But quicker, following the needs of each subsequent project.

For example, in the generation of these "duets", cities with two recognizable characters, I used some transforming path, that I designed for round details, for opening the Medieval town system by moving and transforming the architectures, for creating a piazza-del-campo able to host the Renaissance event.

Conclusion

The results, more than thirty years from the first urban generations, seems to me fascinating because nothing has been canceled but everything is turned into a net of connected and exploring logical worlds: a deep, persistent and interactive memory of *how* I was and I am an architect.

Every time that I had a passion, as for the Roman architecture, for the Medieval towns, for Renaissance and Baroque, for masters like Gaudì, Leonardo, Piero della Francesca, Piranesi and Borromini, all of my interpretations of these architectures are been transcribed in algorithms and they remained indelible part of the **logical labyrinth of Basilica/Argenia**. And I can find again them in some generated details inside the complexity of the results.

The interesting aspect of this approach is that all details, all complex results are **recognizable** as belonging to an interpretation, to an idea, to my architectural and urban vision. More **they are recognizable as Medieval, as Renaissance, as Baroc.**

Today my software is able to generate 3D events which complexity is not possible to directly draw, as the complexity of a city with a mix of different characters, with the presence of different points of view, different but all focused on a recognizable identity.

I go ahead in using this software-memory that I never cancel but that I keep alive by implementing it with new synapses and new neurons. This allows me not to forget my past, the experiences and the emotions that I have lived in rediscovering our history with its beauty in new generative events. I have done it by interpreting the paths of *how* and the logical paths of whom has preceded us. I am experimenting them in my contemporary time.

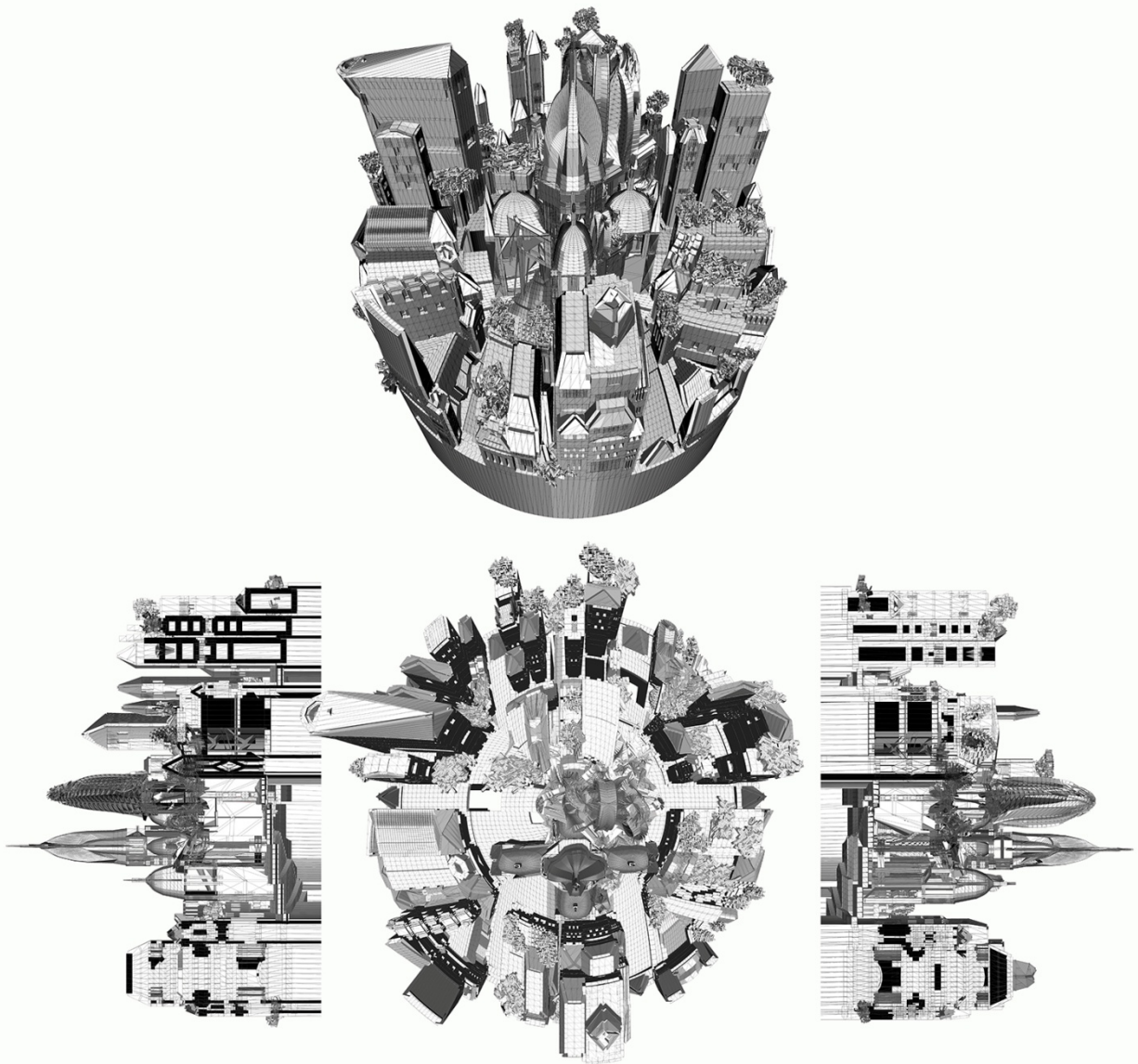Celestino Soddu, Generated Duet City, variation 005, Florence 2016
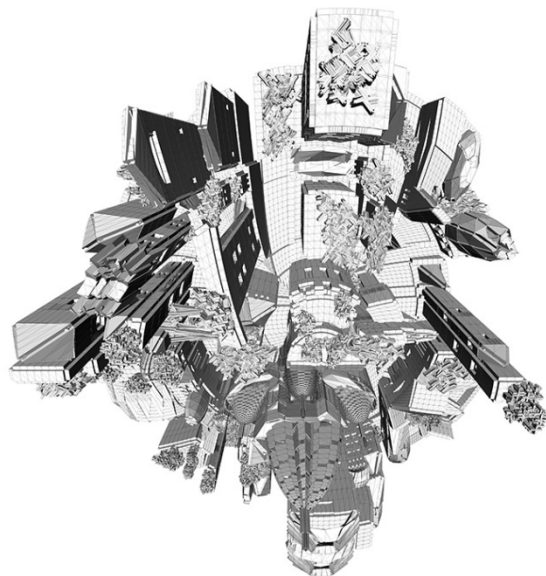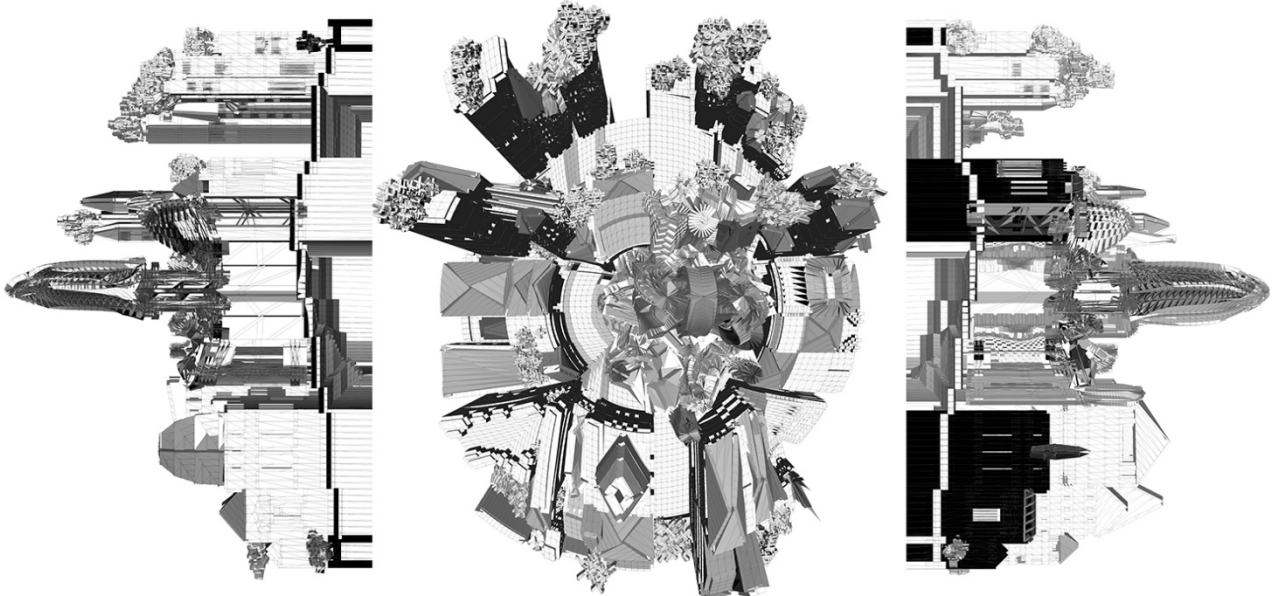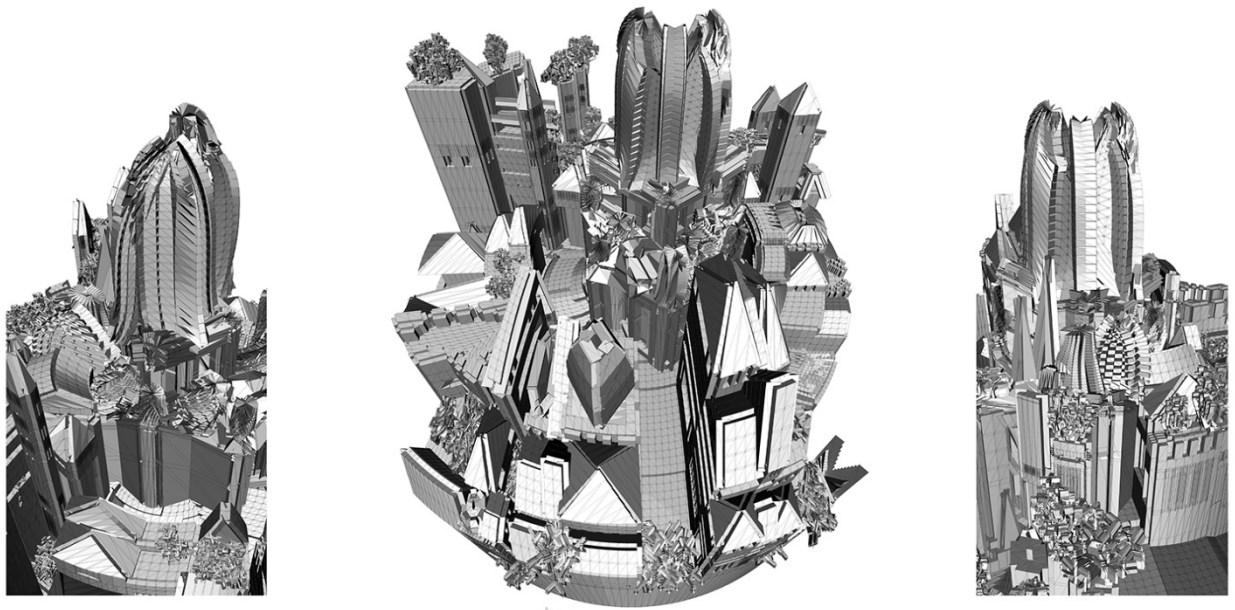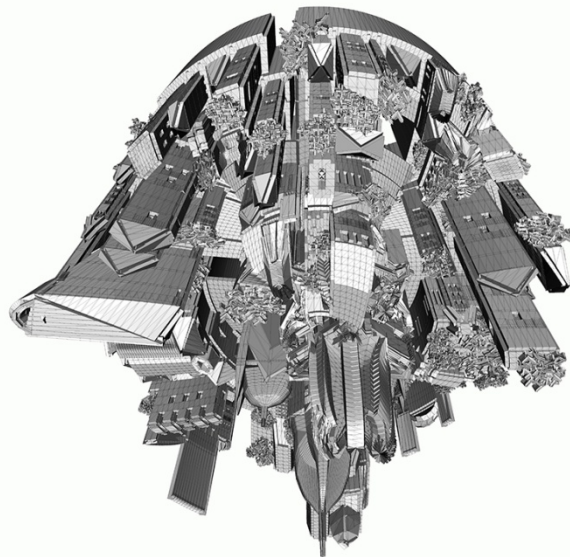
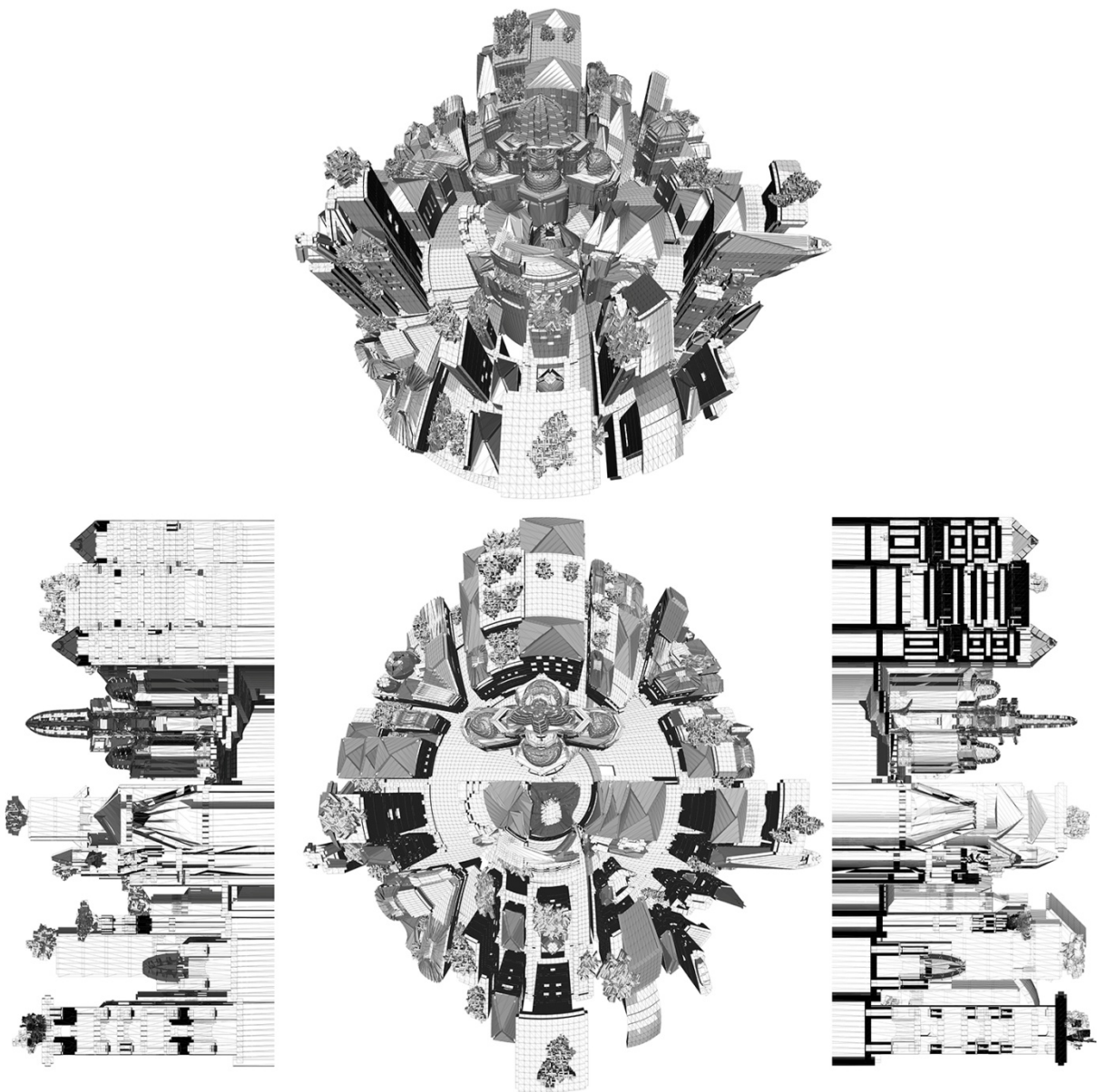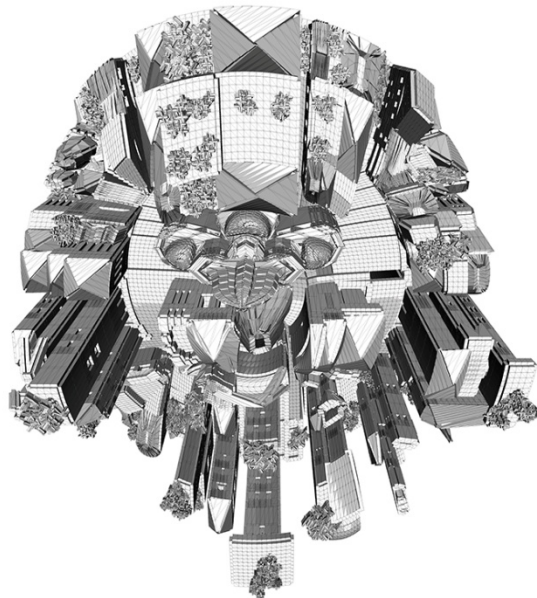Celestino Soddu, Generated Duet City, variation 009, Florence 2016
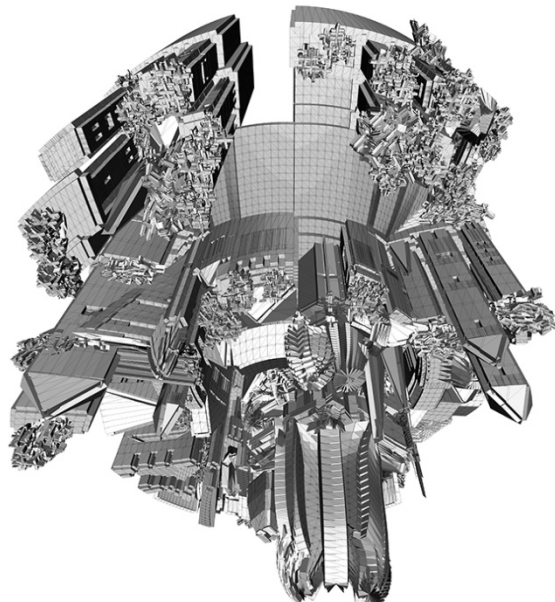
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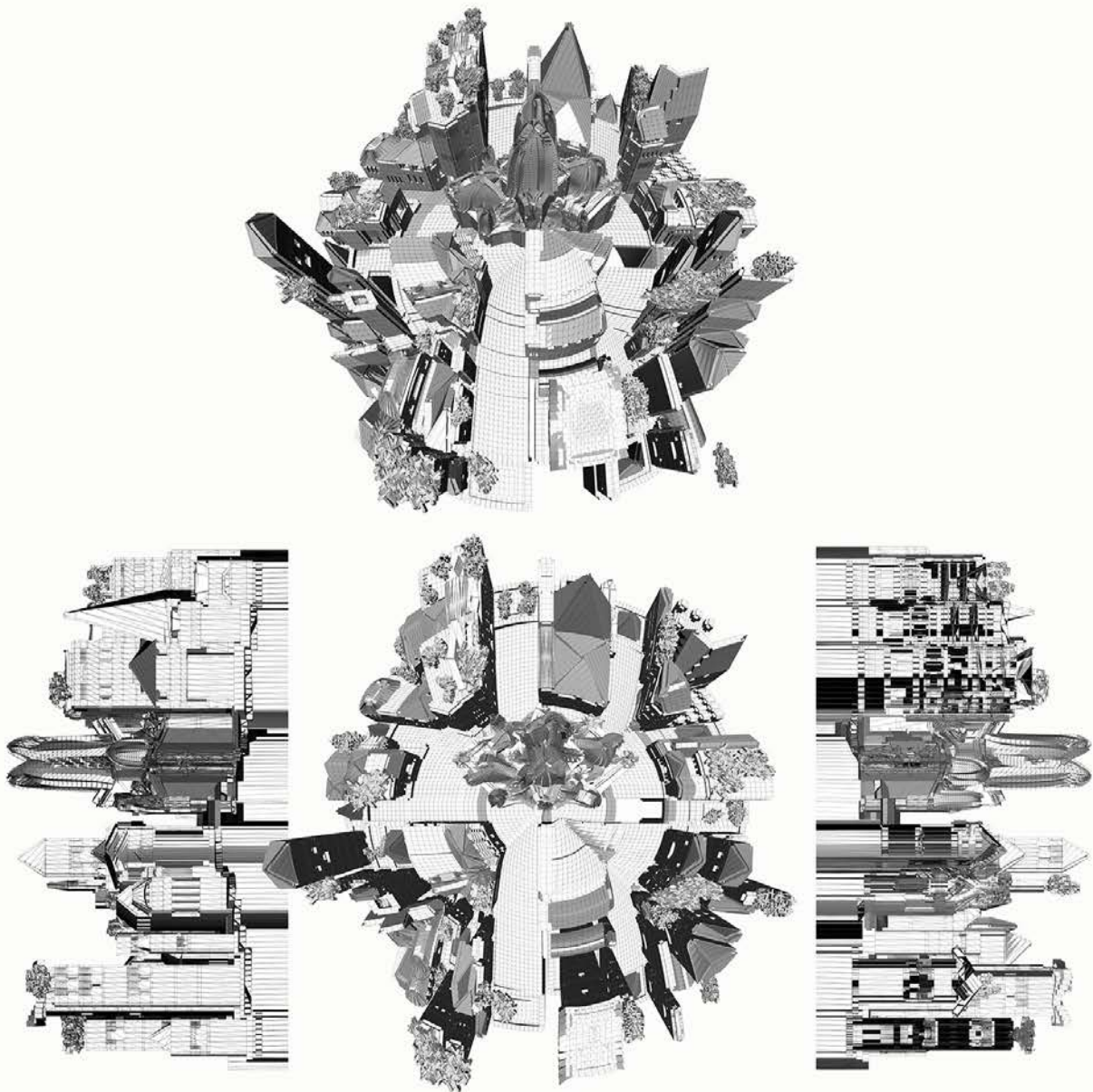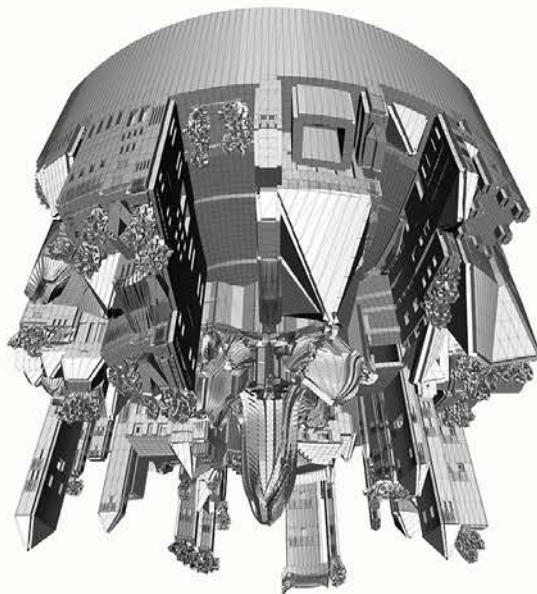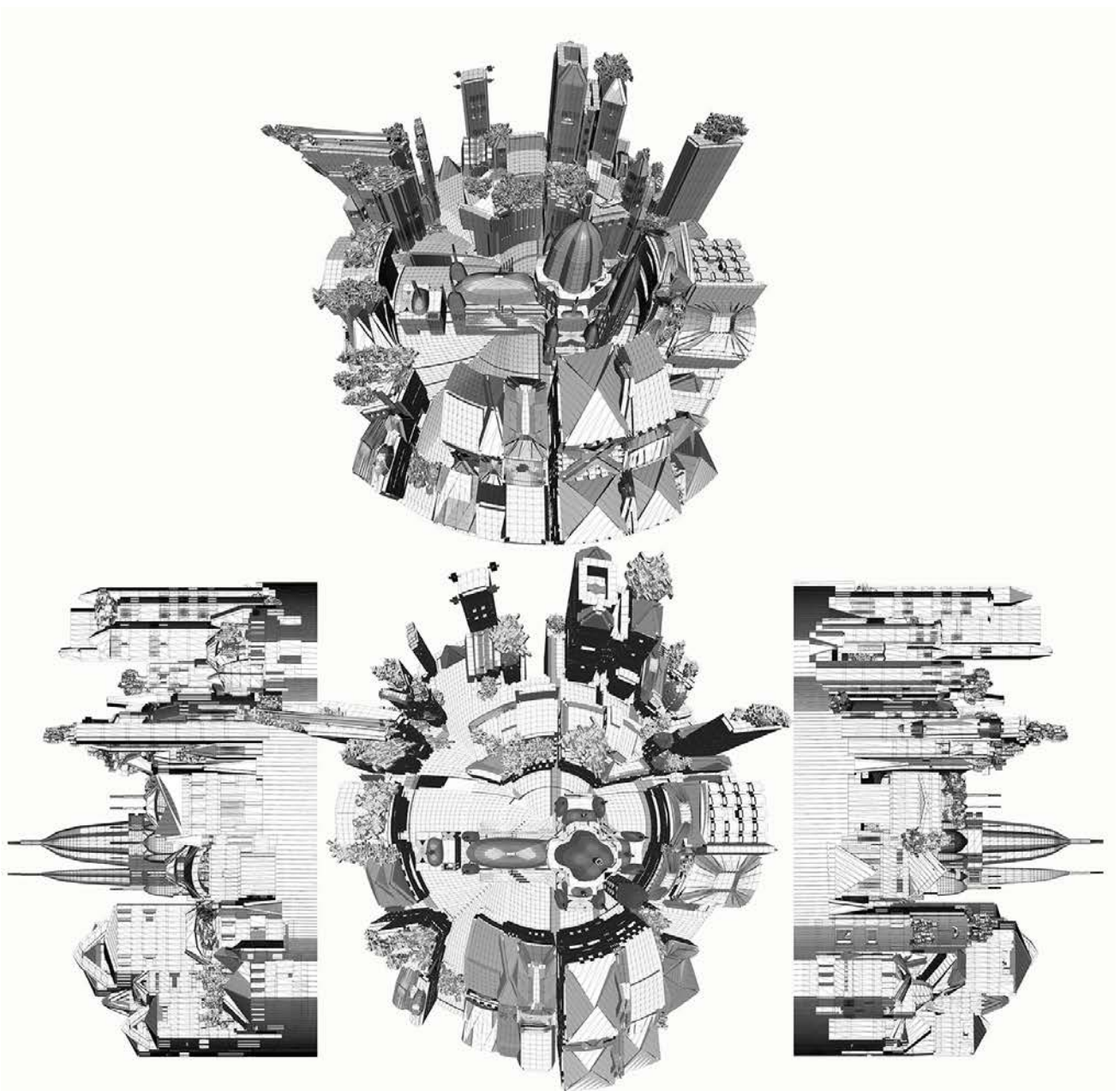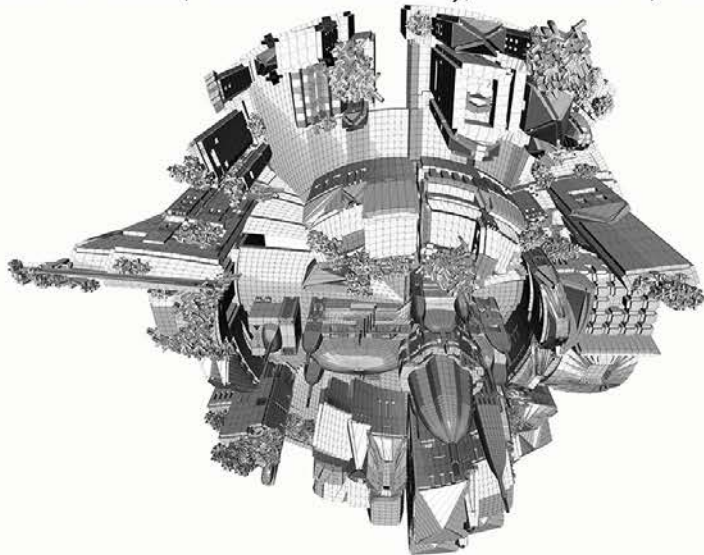Celestino Soddu, Generated Duet City, variation 013, Florence 2016

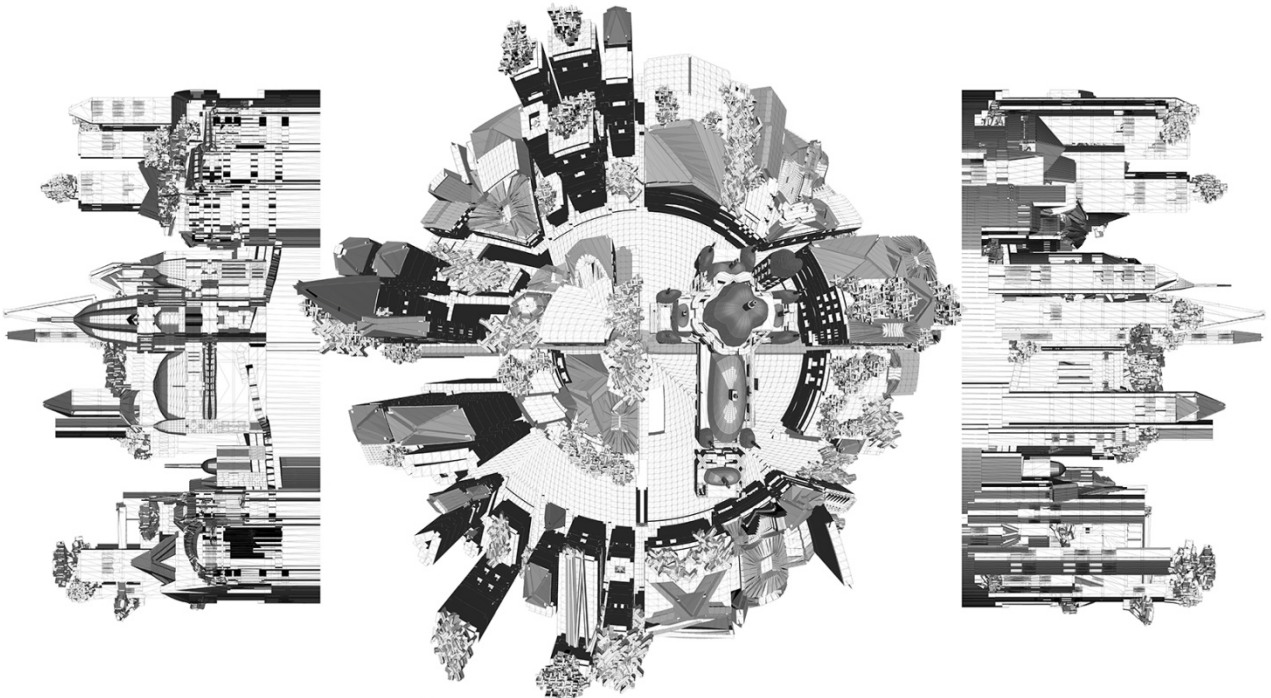Celestino Soddu, Generated Duet City, variation 014, Florence 2016

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