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Untitled*

Interactive Generative Installation for Visual Composition

ABSTRACT

The generative art changed our concepts of image and art. They are so embedded in they way we can create new visual artistic expression.

This paper will present some ideas regarding generative art and introduce Untitled* , piece developed using those principles.

Index Terms: generative, visuals, interaction, and collaboration.

1 | Introduction

In generative art, the artist sets tasks to the machine, and establishes in the machine an extension of him/herself. Those extensions can be biological or psychological [1] [2]. It provides a semi-autonomous system [3] [4] where the artist can be the agent that selects or gives a program the ability to execute a selection through the rules he builds-in.

The relationship between art and science is very close. Generative art is a discipline that values and brings together art and science. From principles of biology, where we can understand evolutionary concepts and selection principles [5], and the acquisition of the external process of the human comprehension, it allows the creation of artificial replicating structures that don't belong to the human domain. Generative art is a branch of artistic practice that uses resources from biology, mathematics, physics and other scientific fields for its simulations such that are able to generate new paradigms that until then were beyond the artist's reach.

New characteristics such as learning, adaptation and mutations are typical of those systems. Normally, the most adapted ones perpetuate the skills more valuable and desired for the system in that moment. [6] [7]

The rules are the algorithms generated by the artists and the rules applied are the parameters that shape the behavior of a certain individual, population and

habitat. But like in the living beings those rules can be transgressed and the process reacts in a lot of different ways. This unpredictability, typical of complex systems [7], gives the artist the possibility of action and results that are beyond the ones he is capable of comprehending through his natural systems of perception: vision, touch, smell, etc.

Before digital media, Ben and John Whitney Laposky highlighted the capabilities of generative art. In digital media, tools like Processing [9] (Ben Fry and Casey Reas) and openFrameworks [10] (Zachary Lieberman and Theo Watson) brought closer artists and designers in developing such projects. Artists popularized this art through graphic works (Joshua Davis and Casey Reas), sculptures (Marius Watz) and interactive installations / performances (Christa Sommerer and Laurent Mignonneau [11] [12], Golan Levin and Zachary Lieberman, Karsten Schmidt). The generative processes most often are not exposed to the eye of the beholder. Often these processes are embedded in the form of interaction with the artwork. Pattie Maes, Christa Sommerer, are names of artists who explore such issues.

Thus, the processes and the relations between humans and machines become closer. The interactions become more fluid and adapted. The intelligence of some of those systems allows that each individual gets better responses to his/her/its and more evolved and optimized actions

2 | Generative Art

The generative art is an art form widely known within contemporary arts and has gained increasing presence in the art world. Featuring works in several areas, the generative art is still very poorly understood by most people, mainly because it is so comprehensive and therefore its efficacy can be very difficult for a group meeting with very narrow parameters. What is generative art? According to Philip Galanter

“Generative art refers to any art practice where the artist uses a system, such as a set of natural language rules, a computer program, a machine, or other procedural invention, which is set into motion with some degree of autonomy contributing to or resulting in a completed work of art.” [13] This definition of Galanter was very important for generative art and is the most accepted and current. Which characteristics are different from a generative art work from any other computer program? Galanter argued that the difference is in the artist’s decision to cede part of its control over the piece to an external system. That is why these projects will seek its roots in the work of conceptual art. The artist transfers the function of the construction of the object and decides to give instructions. Just like in the early days of conceptual art, where artists like Yoko Ono and Robert Barry defined letters with instructions as their artistic works.

In fact the term generative art is a definition that can not be only related to technique. It takes more than the form and rules to “build” the art object: it is the decisions of the artist on the results generated by the algorithm developed. One of the difficulties involved in this issue is the fact that it is a technique that can be used by designers, artists, architects, scientists, etc., and so their limits are tortuous. This variety of possibilities turns out to feed much questioning of some spectators. The idea of the possibility of uniting such diverse work in one branch, lead Galanter to also realize that: “what generative artists have in common is how they make their work, but not why they make their work or even why they choose to use generative systems in their art practice”. [14]

These types of work had great importance for the current definition of the role of creator / artist. While developing the code that generates the construction of the work, their role is no longer direct and turns out to be quite distanced from the final work. As these systems gain their own life, the artist ends up losing the total control over the subject, contrary to what was happening, for example, in more traditional forms of painting or in any other more traditional artistic technique. They produce, moreover, the small contours and surprisingly unpredictable results giving a special glow to the final object. The possibilities beyond human perception plus a few random acts are some of the reasons why these kind of pieces expand (rather than reduce) the role of the artist. He gives life to something that has a relative autonomy, which allows the construction of an object within the parameters set. Despite the artist’s distance from the work, he is it the one that defines which images are to be presented to viewers. His distant perspective, almost like a god over his world, allows you to see it and understand it, allowing the selection for its best

results. Despite the author’s role to delegate tasks to the “machine”, it ceases to have the leading role for the end result. In the case of digital arts such software becomes a kind of performative extension of the artist [15].

Another issue that causes some controversy over the generative art is the interest declared by some artists to do work where the only concern is the aesthetic issue. The beauty in contemporary art was eventually perceived as a empty resource and devalued. The generative art found in the roots of pop art together with electronic music the possibility to create objects where the primary purpose is aesthetic factor by itself. Generative art looks for natural forms and harmonies - where there is a return to nature. Already Galanter said, “the universe itself is a generative system.” [16] The risk of these types of pieces is falling into the “Art of screen savers.”

Each generative work piece is unique for each performance. Artists like John Cage always incorporate such features in their work, allowing a state of constant remaking / rethinking of the work. Despite the work being executed for a thousand times, it always takes the form of something new. Everything depends on the purpose of the artist.

3 | State of the Art

The generative art as could be observed, is therefore a very broad field of art. Its main feature is using mechanisms external to the artist to achieve partly autonomous tasks following a set of rules defined by the author. Such concepts are not new. We can see the use of generative processes already for a few decades. Some works, despite being about 40 years already have a result very close to what is created nowadays on generative digital art. The contributions of major contemporary artists, Ben Laposky and John Whitney is paramount as they are considered the “fathers” of generative art for digital artists. The artist Ben Laposky (1914 - 2000), born in Cherokee, Iowa, was a mathematician and an artist and a pioneer in computer use in artwork. He was responsible for creating abstract images in the first decade of the 50’s. In his first experiments he used a device called analog oscilloscope Cathode Ray Tube (CRT). His work, called “oscillons,” were beautiful mathematical curves based on the waves used in analog computers. The analog computers were first used in the 20s and were able to perform calculations much faster in a very short time. The technique for building the code was a continuous variation of current allowing calculations in “real time” (unlike the technique used today by digital computers that makes use of finite signals). In the 40 analog computers began to be replaced by digital because digital computers were much more affordable. The images produced

were photographed, resulting in an interesting work both for aesthetic reasons as for technical. It became an icon for those who appreciate the generative art because images get organic, elegant and yet simple. Another very important example is the American animator John Whitney. He and his brother James started in the 40s to study moving images, and that was the theme that he worked with throughout his life. He managed to combine success in commercial work with more experimental work. One of the best-known works was the result of the introduction to the film "Vertigo" by Alfred Hitchcock.

In the 60s he formed a company, which specialized in making computer animations made for commercial facilities, an innovative type with an analog computer. In 1966 he began working on digital computers in residence at IBM that lasted three years. It was during his entire career as constant innovator that led to increasing levels of complexity and to achieving what he called "harmonic progression."

Both of artists were extremely important for the development of generative processes, as was the potential they could detect and use in their projects that charmed digital artists. The way we studied the movement and behavior of the particles was also essential in the study of visual processes generated through generative systems. References are important mainly for artists who seek proceeding harmonics based particles.

Nowadays, artists like John Maeda, Marius Watts, Golan Levin, Zachary Lieberman, Ben Fry and Casey Reas, Joshua Davis and many more are popularizing these types of work.

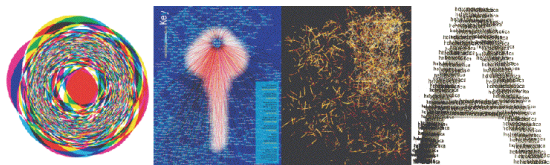


Figure 1: Maeda's projects

John Maeda and his colleagues in the Aesthetics + Computation Group (ACG) were the first to advocate the use of computers as a tool in creating objects of art and design. At that time many argued that the computer processes distort, easing through the copy-paste and other techniques, the creation process and thus generating failures caused by lack of process, intensity and rigor.

Contrary to what the analog purists defended, the work (including Paul Rand, graphic designer) that the computer has brought the arts further developed the processes of creation.

Some of the students of John Maeda are now very important. They include: Golan Levin, Jared Schiffman, Casey Reas and Ben Fry.

Marius Watz is a renowned creator of pieces in the area of generative art. He began working with software (to create visualization with code) as early as 20 years after starting the course in computer graphics. With its graphical and computational ability he began to develop projects for Raves while doing design projects.

Working in different media, Watz leaves his mark on generative art's digital features for his aesthetic choices and their presentations in large formats (such as presented in Sao Paulo at the center "Itaú Cultural on July 18, 2006). Marius is the symbol of new artists who work with the new brushes of the digital age. The line of a code gives an almost magical power to the artist that does not depend only on their drawing skills or representation. The artist embraces the unexpected and everything that can go beyond the human mind, resulting in works that are constantly changing. None of his works are presented twice. Every presentation is a new and unique experience.

In "Drawing Machines 1-12" Marius shows the flow of information in the server of the Norwegian government, distinguishing between micro and macro structures of information transfer. The result is a constantly changing construction with a visual result in 2D images. This project was developed to Odin, a public space, lasting two years.

Particularly interested in systems creation and manipulation of sound and image, Golan Levin creates performances and innovative digital systems through dialogues between man and machine. He and his staff create highly innovative and aesthetic works, which always go beyond the expected boundaries and interlinks of digital media.

A renowned artist, through the creation of many interactive and engaging works, Golan is responsible for making generative art a little more tactile and fun. With several work recognized, Levin creates projects that go beyond the aesthetic, but always take into special consideration that part of the project. With extremely complex interactive processes that are transmitted to the user in a straightforward manner, without much explanation needed.

Golan creates projects that can fulfill all the points that a project should contain. It is also known for his collaborations with famous artists such as Zachary Lieberman and Fry (among many others).

A 2003 performance, which is a collaboration of Golan Levin, Zachary Lieberman, Jaap Blonk and Joan La Barbara, uses speech, shouts and music generated by two opera singers to create interactive visualizations. With an extremely interesting result in terms of communication between performers, this system is a reference in the field of art. Inspired

by the relationship between the song lyric (from which comes the name *messa di voce* which is the name given to a singing technique where there is a gradual crescendo and decrescendo always in the same pitch) and visual creation, the performers create a variety of particles ranging in terms of size and movement, which can then be changed again according to the settings of the artist on the forms

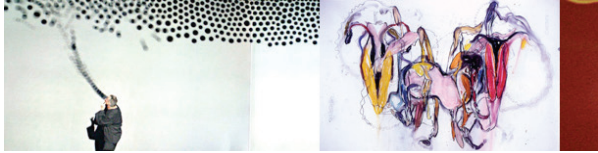


Figure 2: Golan's projects

previously created. During the performance artists were able to create different visual representations. This project resulted in an installation presented later also called "*Messa di voce*".

Casey Reas, well known designer and artist is one of the creators of Processing (programming software for artists) and one of the pupils of John Maeda. He studied design at the University of Cincinnati, which he left for MIT where he studied with Maeda and met his co-worker Ben Fry.

His work is based on the construction of art objects by algorithms, i.e. art through code. Currently his works refer to works such as Sol LeWitt, searching concepts developed by the vanguards of the 60s as minimalism and conceptualism. With work (*Software*) Structures 2004 it relates to software art and conceptual art. One question that arises is: "Is the history of conceptual art relevant to the idea of software as art?" Having built three possible structures, Reas offers new interpretations.

Ben Fry in his work reflects how much he is interested in data visualization, resulting, in general, in proposals for new forms of data presentation.

4 | Outside of the Digital Media

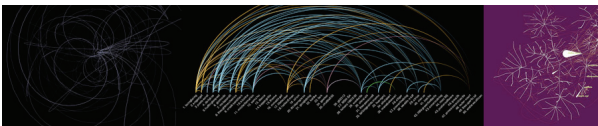


Figure 3: Visualization by Ben Fry

As we can see along this little analysis of generative art, the context in which such projects appear is extremely attached to the need to generate new ways of producing art objects. Contrary to what some may believe, the generative art is not an empty form. The process observed in the vanguard of the '60s, where artists reject everything that was perceived as traditional, is one of the main justifications of those



Figure 4: Reas's Tissue Collection

who follow this branch of the digital arts. If the digital art is itself a component that seeks new ways of presentation of artistic works, the generative art is the result of this arduous process. The result is the variation, always falling back on processes supported by digital means.

Thus, digital generative processes support many of those pieces that we know today. Even if they later gain different means, the process always involves a digital state since it is an interesting way to create semi-autonomous systems.

An interesting example is the work of Casey Reas entitled "*Tissue Collection*". In this work, Reas starts with generative algorithm (able to build various digital visual representations) from which he removes results for printing a collection of clothes. This work shows how generative art is not (nor in digital arts) a resource used exclusively in digital media. Other important artists of this area also explored the generative processes for the production of artifacts is Marius Watz. From a generative algorithm generated a set of prototypes of statues carved with Rapid Prototyping technology that resulted in the so-called Object # 1.

Contrary to what is apparent at first glance, the generative techniques in the work of digital arts are extremely remarkable, though often other finer aspects of the project disguise them.

5 | Untitled*

Developed originally at Music Technology Group (Universitat Pompeu Fabra) with the creators of *reacTable* [17] and later at CITAR (Portuguese Catholic University of Oporto) this project is an interactive installation based on a generative system. Through movement of the user's hands and of other objects visual compositions are created, which establish a very direct and intuitive relationship between the work piece and user; very typical of a tangible interface (TUI).

Each object creates shapes / particles that reflect the drawing of the object placed on the table, for

example, when the user lands one object on the table with the shape of a square the forms generated will be squares, circles when the generator is a circle, and so on.

In addition to producing the particles, the objects also modify parameters of the particles. Turning the generators around themselves alter the size of particles created; if we shake the object more or less quickly we change the speed of displacement of the particles.

Another transformation possible is related to the color of objects. Each time a new object is placed on the table, a color wheel appears around it. When the user's finger is positioned over the wheel it assigns a new color for the articles.

But not all objects create forms/particles. Some shape the surface with features such as: (1) attraction of particles for a given location (imam) and (2) expulsion preventing them from moving for a given area (barrier). With the fingers on the tabletop the user can shape the surface causing the particles to move to a given position or in a certain direction and velocity. When the particles are within a certain range of the user's finger they assume finger speed, direction and position.

This relationship established by the user with the surface and the composition is even more interesting when performed in a group with multiple users (in collaboration).

GENERATORS AND PARTICLES

Generators are objects that are displaced at the



Figure 5: Untitled* at Serralves on 30th July 09

tabletop and that are able to generate particles. In general, each time a new generator is added:

- i) The color is black. Can be changed through movement of the finger used around the object. The finger movement only changes the color of the particles generated from that moment on. The color projected onto the center of color wheel represents the color that is being assigned at that time to the particles;
- ii) the size of the particles changes according to the sound analyzes (FFT) and is proportionally altered

according to the rotation of the object around itself.
 iii) the speed is associated with movement of the generator on the tabletop. In other words, when the object moves faster, the greater is the speed of particles generated;

iv) lifetime (from 0u to 100u). Represented through particle's transparency. Each unit of life added, the greater becomes the degree of transparency of that particle. When the transparency is 100 the particles dies.



Figure 6: Untitled* Objects/Generators

v) the direction is random (except when a tool or fingers modify/define a new direction).

TOOLS:

Each tool has a function. They are:

- i) the imam attracts particles to its center. They are inside the tools (maintaining age, speed, size and color) allowing an explosion of particles when the object is removed from the table;
- ii) the eraser that removes particles from the visual composition
- iii) the barrier that prevents particles from moving to certain regions of the composition.

The tool's range of action is determined by the rotation of the object into itself.

All work was carried out with free tools (open-source): Processing was used to create the graphics. TUIO [18] is the protocol and reacTIVision [19] is responsible for computer vision.

This project aims to create an interesting and graphic display that results from the interaction of multiple users. Based on the established generic forms, this is another project within the generative aspect. The use of generative algorithm is serving to define the characteristics of the particles by treating them as beings who respect some parameters such as: lifetime, direction, speed, color...

6 | Setup

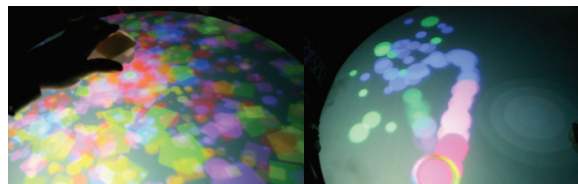


Figure 7: Image showing the tools in use

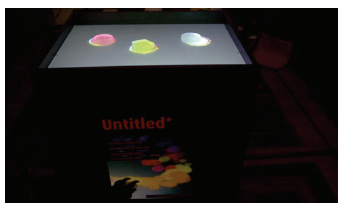


Figure 8: Untitled* overview

Untitled* is based on a tabletop system. Inside the table is a system equipped with a video projector, a webcam, four sets of infrared LEDs and a mirror (see Fig. 9).

Developed by the reactTable Team, this systems is optimized for a computer system software called reactIVision which is capable of recognize the fiducials glued on the bottom of each object. Each fiducial retrieves for the system information about the object that is on top of the table. The camera behind the tabletop is cable of seeing trough the semi-transparent surface and identifies which object is on the table, the rotation and position. The information is transmitted through the application developed in Processing that will generate the projection that is presented on the surface of the table.

7 | The Goal

The goal of Untitled* is to make a visual stimulus on the user and call the attention to a simple way to experiment with visual composing. The user interface is at the same time exploring an easy and fun way to



Figure 9: Inside the installation

experiment with this visual generative system. Due to the possibility of connecting the particles reaction with sound, this work is also oriented for live visual performance in music concerts.

8 | Experience

Over the period that this installation was presented, different reactions from different audiences were observed. When presented in Ciclo Arte e Novas Tecnologias (CANT), this work sought to draw the attention of those who are not in contact with this union of art and technology and to give them knowledge through a free and intuitive way.

Initially, this piece seems to be just a fun game with objects on a table. Gradually, however, the game starts to become an aesthetic experience. The colors, shapes, location and movement of the particles are concerns that arise. Concepts of visual composi-



Figure 10: Space

tion are being addressed in a enjoyable way. Another important aspect is that during the time when people gather around the table a sort of tie between them is created, resulting in a very interesting collaboration.

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