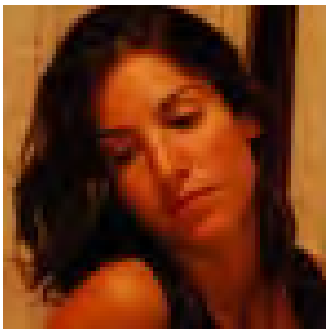
Silvia Titotto

Full Paper & Installation: **Floating Transgenesis**



Topic: Architecture

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Abstract:
The paper presents the possibilities of creating transgenic species of artificial life that take shape inspired by a particular structure while up kinetically mimic others, allowing perception of the passages in time and throbbing, in structural terms, the relationship between the worlds exterior and interior of each one, and sharpening issues concerning the relationships between visual details of structures of the human body and nature.

This polidimensional aesthetic experimentation arises from a desire to build mutations in an installation artwork that has branched form in its initial configuration but it is constantly altered according to the following types of interactions: passersby, sound and climatic environment.

It is meant to work on transformations in space over time, while it is structurally concatenated by principles of growth, branching data for patterns present in the natural world outside (trees, corals, cracks, lightning, algae and metal formations inside gems) and the inner world (neurons, bronchi, alveoli, blood capilarese ramifications and denaturing protein).

What at first seems to be fragile and delicate rhythms of a mock up ends up driving force able to transform and recycle configuration initially found by the eyes of the visitor. A structure in a subtle ballet that unfolds in joyous elegance according to each new interaction.

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Keywords:
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Floating Transgenesis

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Introduction

My ongoing doctorate researches technological innovation on branching structures and how their growth patterns are somewhat related to fractal geometry. Mathematical algorithms seem to be limited to reproduce biological complexity, given by very broad needs the beings seek to meet, but mineral structures that have nothing to do with life also present quite similar branching patterns to those resulted from bio cell morphogenesis. Can one mix growth patterns from different structure origins in order to create artificial new life?

This essay presents some preliminary discussions about the possibilities of creating transgenic species of artificial life that take shape inspired by a particular structure while up kinetically mimic others, allowing perception of the passages in time and throbbing, in structural terms, the relationship between the worlds exterior and interior of each one, and sharpening issues concerning the relationships between visual details of structures of the human body and nature.

Case overview

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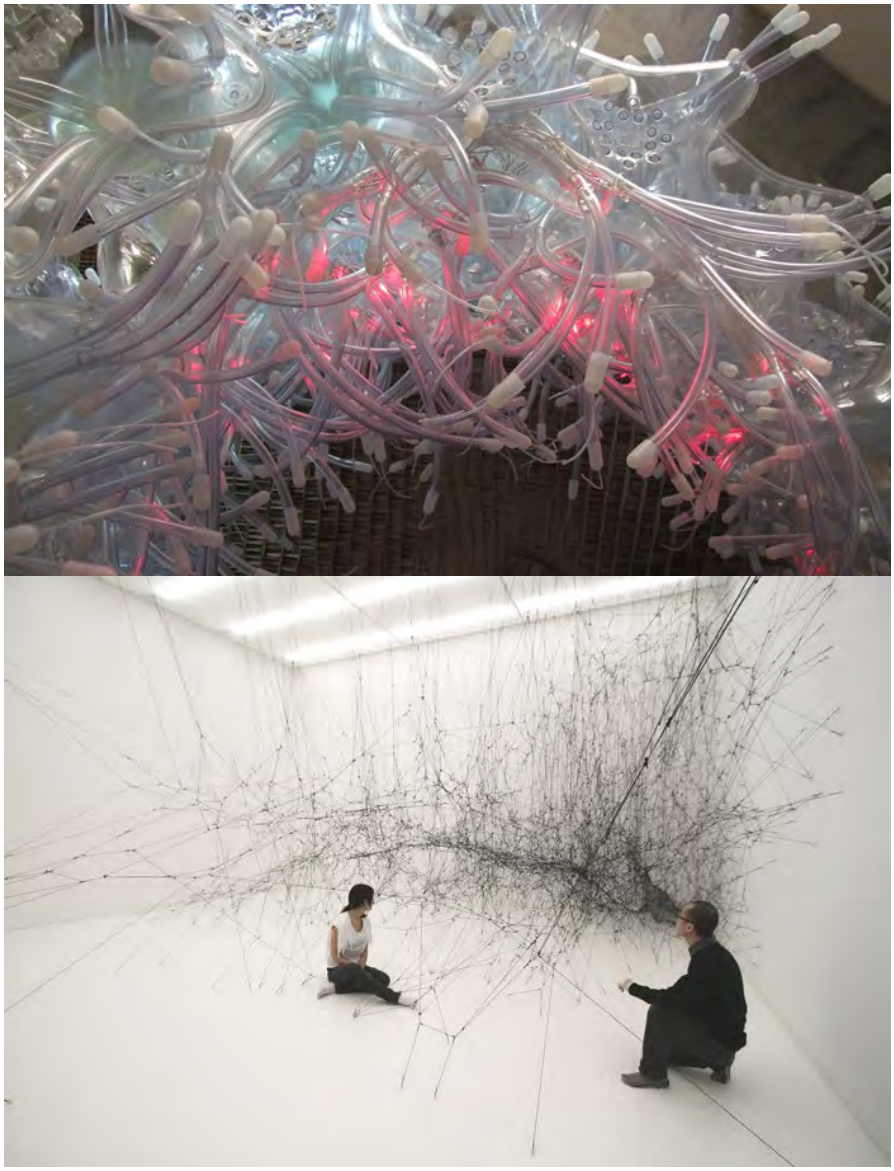
Brief State-of-the-Art

The work keeps aesthetic and mechanical relationships with some work already carried out, in particular: a pair of architects Ecologic Studio (fig. 1), engineer-artist Tomas Saraceno (fig. 2) and architect Philip Beesley (fig. 3).



Motivation

I started by visualizing some Sun rays that passed a few meters below the sea: above, that glare emulating a light at the end of the tunnel of water, and below, a colorful coral formation, intriguingly branched. In that tiny reef, the corals were not alone, they were instead part of a rich ecosystem with sea anemones, jellyfishes, colorful fishes, sea urchins and sea cucumbers, among a variety of other species.

After dwelling long journeys on the subject theory, I was willing to understand through the effective work of my own hands the movement of some of these incredible beings who, carrying in their structure traces of their growth patterns, they instigate my eyes in order to understand the potential applications of those principles in a new way of designing architectural spaces, perhaps... although mainly working on a pure installation artwork experimental field.

Processes and Procedures

During a workshop ministered by Professor Anthony Viscardi the attendees were advised to make posters on selected categories as part of the methodology in order to understand biomechanics. I separated image references into three classes: the fixed branching structures, the ones prone to very limited movement, and those that can move more freely. From those classes on,as I was seeking to draw a line of reasoning about the growth patterns of structures, I ended up refining them into sub-categories: two and three-dimensional branching biological structures and architectural spaces that took advantage of the concept of fractal repetition.

Inspired by studies of marine geometry modeled hyperbolically in crochet by the biologist Margaret Wertheim and her artist twin sister Christine, I started with anemones models, in particular those species that move according to tides, in reference to the real object that guarantees most of its drive due to the movement of other fluid, salty water (movements structured by thin elastic cables passing inside the straws).

Then, corals, because I was thinking of enriching my artificial “marine environment” of the experimental installation in coexistence of the initial model with new models of other species. I made diagonal cuts and inserted other straws in these incisions. There soon became a 'forest' or a reef of corals.

Instead of a set of models in symphony, I sought to develop adaptations to the real ones, as if they were ornamental coral or architecturally bionic. I tried several notches in such settings that could allude to the Fibonacci series. But I ended up preferring my little beings free to move according to the imaginary tides and the nutrients available in the medium.

Resuming studies intuitive joints, I tested other materials like beads and perforated plastic balls of various diameters. And to structure them, strips of cedar wood, which did not fit their robustness of the proposed red corals, which seemed to dance slowly to the rhythm of the waves echoed in the marine space.

I concluded that the medical materials could serve the purpose of searching for translucency and extensive range of thicknesses. I prepared a few preliminary tests with rubber casing colorful morbid structure, but medical silicone tubes were used in plastic tubes and trachea which have partially account of my questions and the final solution to structure the spaces was found by assembling the model using transparent carbon fiber.

I exhaustively reproduced this process in all small corals, so that they could have visually resulted in toys with projections of moving shadows and under water inside a transparent acrylic box: a micro-world, submerged, reasonably free, moving at the mercy of the waves and impromptu tides simulated by me, after all, an ephemeral sound designed to paradoxically bring along the silence of the sea.

The mutable arrays of branched structures in nature and in the body, in the imagination of the visitor, slowly ceases its motion at some magical moment passing imperceptibly into the field of pictures.

After this phase, in order to achieve these poetic goals, the work started hosting an interdisciplinary technical support, for example by inserting robotic structure with empty channels whose interior contains installing electrical cables that respond to sensors, adding the dimension of a complex design.

Acknowledgments

I acknowledge Professor Anthony Viscardi for his kind support during the workskhop, besides Professors Clice Mazzilli and Carlo Ostorero who have being advising this research

across the ocean. I am also very grateful to USP Pos-Graduation Rector that made possible the exhibition of this experiment in Lucca, besides CAPES/Brazil and EMEWC/European Union for financing the author's research.

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Floating Transgenesis

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"Floating Transgenesis (FT)" is a mutant zoomorphic structure designed and prototyped by the author. The coauthor has aided in the fields of robotics programming and currently testing interactions from the input given by internet interface users in real time.

The poetic experiment exhibited in GA2012 is "transgenically" structured by the union of the branched morphological structures of one or more species with the kinetic possibilities of other biological beings that could add up broader complexity movements. In this essay some of the concepts involved in the creative process and building procedures such as their biomechanics properties, the ecologically chosen materials and the synesthetic experiences are summed up as follows:

Shape: "Artificial biomes" spatially disposed in an helicoidal configuration set
Number of elements: 8 sets of tarantulas, totalling 50 groups, 8 vertical centipedes, 3 aeroponic cultivated poppies accompanying vertically passersby and 6 denaturing protein.

- Twenty-five groups run on translucent material under impression of floating in the air. The reason for this is that the artificial "biomes" will be attached to the ceiling and the floor by steel cables thin enough to withstand its own weight and the electronics that power the robotic answers.
- There is a possibility of making a few extra anchors between the artificial "biomes", walls and stairs, because this results in thinner cables and enhance the impression of floating in the air.
- Double mirror is settled on the floor and up on the ceiling so that infinite branching images are generated virtually.

Related Elements
Poetic abstraction formed from the union of morphological elements of a species with the kinetics of another species.
*Tarantula: element represented by synthetic coral branches that emulate movements of a spider.
*Protein: geometric shape of a protein that has wobbly movements.
*Centipede: element represented by the body of a centipede and movements of their feet in wavy shapes.

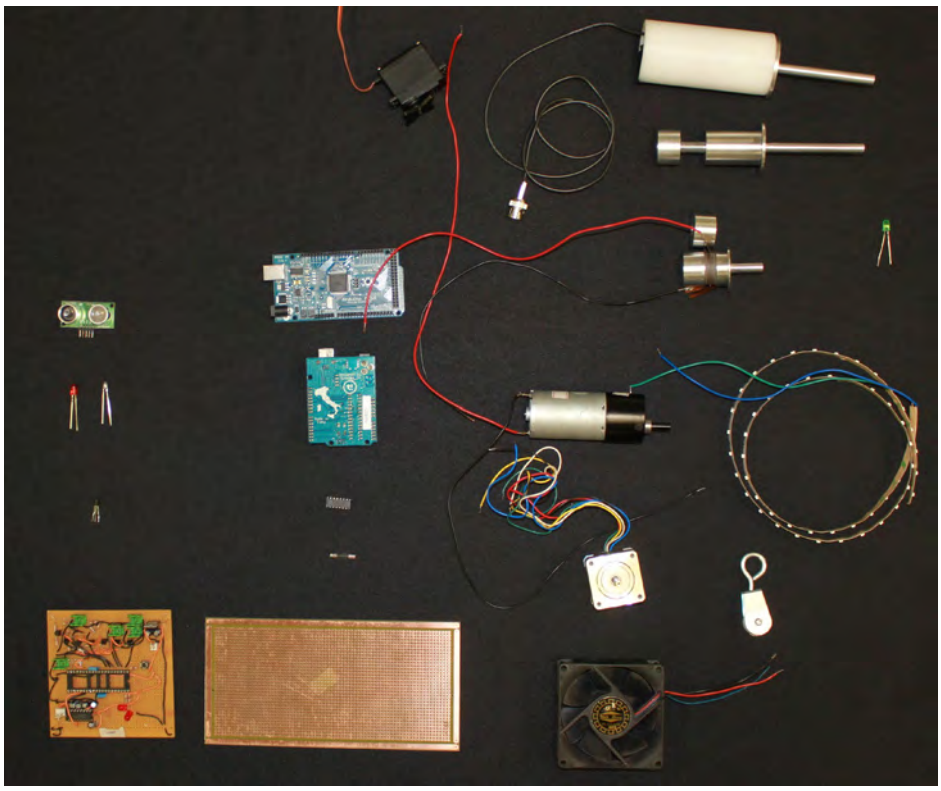
Movements and Synaesthesia

1. Use of muscle wire and memory alloy to soften and naturalize robotic movements in an intervention that aims to respond directly to the subtleties of human presence.
2. Elbow rotation of each grouping of cut pieces made of EFTE (Ethylene

tetrafluoroethylene, a fluorine based plastic) in branched structure, governed by servo motors activated by motion sensors.

3. Flexion of elbow-attached arm groups according to the intensity and speed of visitor approach.
4. LED light explosion from the inside out in a particular biome when the electrical circuit is closed by activating sensors presence when four visitors approach the biome in the same niche.

5. Activation of nature sounds in the environment through approximation of a given "device-biome" and available for re-start of another sound only after the first is finished, avoiding conflicts and sound pollution.
6. Lifting and stabilizing of vessel aeroponic poppy cultivation (absorption of water by ultrasonic spray that water roots).



Materials for construction of the main structure of objects

- ETFE and acrylic waste: to be used in prototypes and initial study of space. Characteristics of ETFE: density: 1.20. very low crystallinity, thermoplastic, clear, colourless. Remarkable properties of ETFE: resemblance to glass, highly resistant to impact, good dimensional stability, good electrical properties, good resistance to flow under load and weatherproof, flame resistant.
- PET Bottles: colourless and transparent: Use of the thread, use of the nozzle and use of the min body for structural and water reflection/refraction experiments by LED.
- Steel cable.
- Medical silicone tubes.

Synaesthesia

- Aroma: smell of forest emitted by ultrasonic spray.
- Touch: perception of materials that invite touch such as silicone, latex and ETFE.
- Color: predominantly transparent and translucent, except of course by chlorophyll green poppy and very fine silvery steel cable.
- Sound: The sound is triggered by occupancy sensors that are in the steel cable at the base of each object, thus beginning a song that recalls the context of biomes, starting another just after the end of the first.
- Movement: The movement is also done by triggering presence sensors, thereby initiating the movements of joints, turns and shakes. These reactions combined the essence of movement present in some structures found in nature result in transgenic mergers.
- Lighting: The lighting is demonstrated in every element of a particular form expressing their peculiarities.

* Tarantula: Together with their pleadings movements LEDs are driven at their ends accentuating the perception of motion.
* Protein: Driven by a vibration that causes the effect of tremor, with its lighting synchronizes the movements reflected in its structure, showing the configuration changes that occur in their primary, secondary, tertiary and quaternary developments.
* Centipede: Unlike the other elements of the proposal, its light effect is reversed and it

occurs from the inside out. It also triggered in sync with her movements and lighting refers to the rhythms of movement that can be performed by a backbone.

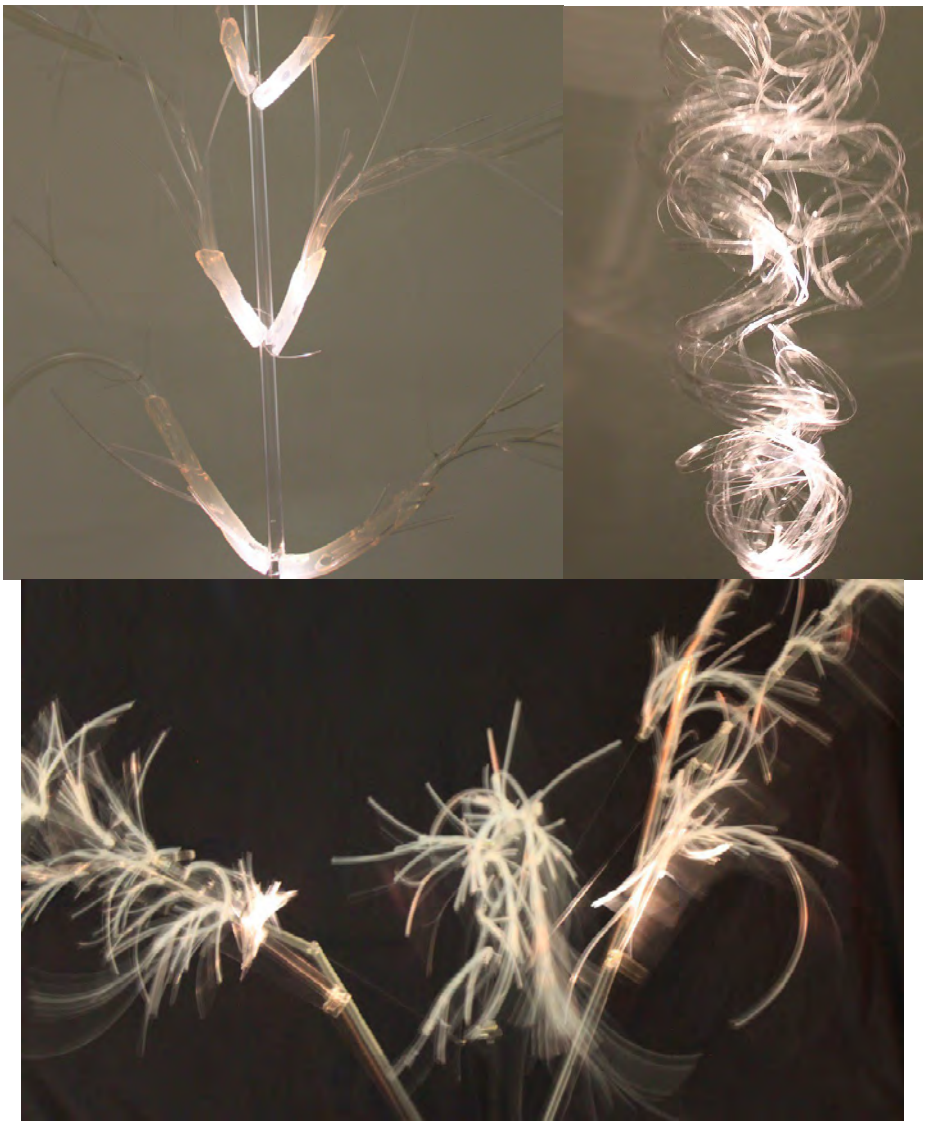
Interface between "Human - Machine - Space"
HMI interface is the communication channel between human and automated mechanical system that enables the interaction between them.
In other words, it is the part of the automated system that the person comes into physical, perceptual and conceptual contact.
The sensors are used to detect the presence of the user interface through human - machine space - and actuators are used to respond to stimuli from the sensors.
The various system sensors identify what is happening in the environment and feed this information to the microcontroller. The project elected the following sensors:

- Sonar: inspired by nature, such as bats, this system aids in navigation and detection of movements. The basic principle of operation is the emission and reception of ultrasonic (high frequency mechanical waves) which propagate into the environment. When there is a barrier, these waves are reflected and captured by the receiver. Thus it is possible to detect the presence of people in the environment and also its distance to the system, for example.
- Infrared Sensor: An invisible light to humans is emitted by a transmitter and sensor captured by another sensor, called receptor. If this beam of light is interrupted due to the presence of a person, for example, a signal is generated.
- Although infrared is invisible to humans, this is a principle used by some animals, including a rattlesnake that can see light in the infrared range and uses this ability to detect their prey.
- Temperature sensor: LM35 will be used sensors manufactured by National Semiconductor Corporation with the objective of verifying the temperature variation in the system.

From data input sensors, the microcontroller interprets the data and defines what action should be taken. The microprocessor design was chosen for the Arduin Mega 1280 due to the size of available memory, ease of handling, programming platform free and also low cost.

Finally, this information is sent to the output triggers that perform specific tasks to allow movements and system responses. Motors, servo-mechanisms, LEDs, ultrasonic actuators and coolers like those used in personal computers were elected as starters, targeting the experimental kinetic-sensory effects described earlier in this essay.

The ongoing experimental research is testing an Internet Programming Interface so that internet users are allowed to interact in real time with the installation, broadening the kinds of interaction proposed so far: climate, presence and noise. FT might need to come back to the next GA2013 for a visit in order to keeping up with news on the experiment.



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