

# gasathj #1

**Generative Art, Science and Technology *hard* Journal**

# gasathj

Generative Art, Science & Technology *hard* Journal  
[www.gasathj.com](http://www.gasathj.com)

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# Issue 1

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## A new style of life

*“But where shall wisdom be found?  
And where is the place of understanding?  
- Job;28,12*

GASATHJ is a new free journal for discussing Generative Art in the digital civilization. We will try to do our best with honesty following our many years of experience and work with the emphasis not only on digital technology, but also trying to perform an art process.

Honesty toward ourselves as artists, toward our friends, toward all people around the world, especially for young people. Our personal hope is that these intentions will not be only empty words, but very experimental proposals.

Many thanks to all friends that accepted our invitation to be members of the Editorial Board and gave their active contribution to the journal. We hope that they too will enlarge the board to people of varying backgrounds with an open approach to interdisciplinarity.

In our time of incredible transformations, we still believe that our own ability as human beings is to generate art as a new and different expression of our life time.

This is hard.... It is GASATHJ.

GASATHJ is a name hard to pronounce in all languages. This might remind us of how difficult it is to communicate an art process. Gasathj sounds the needs of a time, a generative time. But in the significance of its name there is also a common denominator: the ability to evoke in all languages the ethereal materiality, as the forms of our dreams.

Enrica Colabella  
Celestino Soddu

next

GASATHJ is the Generative Art, Science and Technology hard Journal.

As it has always been throughout the history of man, ART is focused on a interdisciplinary approach to creativity involving Science and Technology.

GENERATIVE is the focus on creative processes with a constant renewal. As in nature, the discovery and the increasing complexity process performs endless variations and not only a defined result. This concept is the main structure of Generative Art.

Hard is the character of the journal: hard work for gaining through process a good result.

It's also hard to establish a free space of discussion and exchange, a space open to different points of view and with an aim to enhance and support a real and deep investigation in Art&Science as a subjective interpretation of our world toward a common goal.

Why a Journal

The "Generative Art" community was born on 1998 with the 1st Generative Art international conference. Following the direction of these annual meetings, GASATHJ will try to develop the focus on ART as an interdisciplinary approach to creative processes and the performing of code/idea. The approach was without a pre-defined framework. The only selection was done by looking for an honest approach to investigation and the availability of each participant to open their own work to discussion, many times to hard discussions, as it has happened during the GA annual conferences.

Further to the conferences, GASATHJ opens another door, another place for improving these exchanges being:

1. a free space to communicate, explain and discuss own subjective approach to Generative Art, Science and Technology;

2. a dedicated space for having "hard" discussions among different points of view;
3. a journal with a free divulging on the Generative Art network, but not limited to;
4. a journal able to answer all academic requests, through double review of articles, ISBN number and so on, but with an open-academic approach, that is free of pre-defined limits and constraints during the review process of each subjective proposal and approach.

Welcome to GASATHJ. And welcome to its 1st issue. All the GASATHJ staff is focused on enlarging the discussion to your creative interpretation of Art-Science-Technology and the door is open to your articles. Further, the Editorial Board is open to additional members following their contribution to "hard" discussions during Generative Art conferences.

GASATHJ now and how it will be in the future.

Today, the 1st of May 2012, we are publishing in our website [www.gasathj.com](http://www.gasathj.com) the first interdisciplinary and multi-media articles. The site allows free reading of the articles and a free interchange among users. It is open to subsequent submissions of new articles that will be reviewed by the Editorial Board before their publication. The second issue of GASATHJ is planned after the summer.

The articles will also be disseminated with an e-book published by Domus Argenia Publisher. The e-book will be sent for free to each registered user of [www.gasathj.com](http://www.gasathj.com), following their request. Or it will be possible to download it from the website.

A paper-book of GASATHJ will be published on demand with a package that will include the high resolution images and movies and an original and unique artwork of one (or more) of the artists presenting their work with an article. The price will be defined by these artworks and the expenses.

This choice of unique artworks inside a publication arose from the customary format of the proceedings of the Generative Art conferences where each copy of the

proceedings was different and dedicated to each participant, with an unique and un-repeatable artwork on the cover. All interested individuals can contact GASATHJ for booking the hard copy of the Journal.

We are looking forward to your expression of interest in jointing us in this new adventure, sending us your article, and participating in our discussions.

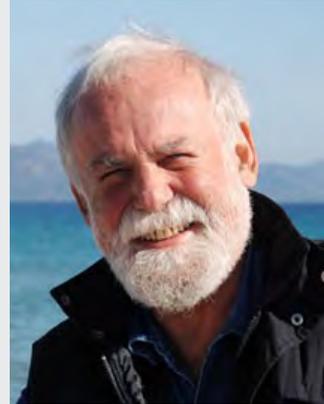
Celestino Soddu and Enrica Colabella  
The founders of GASATHJ

## Generative Design

Celestino Soddu

generative designer

[www.generativedesign.com](http://www.generativedesign.com)



*The cry of the bard in the half-light  
Is chaos bruised into form*

–Ezra Pound, *Ballad of Wine Skins*



From the movie *L.A. Identity and Morphogenetic Visionary Architecture* with Nathan Shapira, Ricardo Gomes and Celestino Soddu, 2003.

In this first part of the movie, a talk with Nathan Shapira, professor of design at UCLA, in the beach of Santa Monica

in 2003, the possibility to use generative design in intelligent production of new “natural” and un-repeatable objects was discussed. In a next issue of Gasathj, the second part of the movie, with a discussion about generative processes at Nathan Shapira office.

### **Generative Design**

*Generative Design is a morphogenetic process using algorithms structured as not-linear systems for endless unique and un-repeatable results performed by an idea-code, as in Nature. (C. Soddu 1992)*

Following this vision, each generative project is structured with a paradigm able to manage the process by controlling the topological complexity and its evolution and with a set of transforming algorithms able to manage in progress the design process of each event inside the paradigm and of the whole system. This transforming process operates increasing the complexity together with identity, feasibility and ability to answer to unpredictable subjective requests of unknown customers. Results are, obviously, a sequence of variations, all recognizable as belonging to a vision, to a identifiable idea. In other words, Generative Design operates like Nature, creating the transforming matrixes of our vision as artificial DNA for “bruising chaos into form”.

### **Generative Design, my bench-marks**

My Generative Design experimental activities start up in 1988, with the first Basilica software able to generate architectures and cities. The first project was the DNA of Italian medieval towns, able to generate an infinite series of different 3d models of Medieval Towns, all different but all belonging to a recognizable character coming from my interpretation of Giotto and Simone Martini artworks (book: C.Soddu, Citta' Aleatorie, Gangemi publisher, 1989). In 1992 I designed the first Argenia, a generative design software able to generate objects, like chairs. Each generated result was unpredictable and “new” but strongly characterized by my own design vision (book: C.Soddu, E.Colabella, Il progetto ambientale di morfogenesi. codici genetici dell'artificiale, Progetto Leonardo publisher, 1992).



In 2001 I experimented with the direct relationship between my Argenia software and industrial devices, generating in real-time STL 3D models of chairs directly produced by rapid prototyping devices.

In recent years I moved from a high-personal software to a generative software more oriented to different possible users that can directly perform their own artificial DNA. Argenia is able to generate different functional objects/architectures following subjective visions. Argenia generative software was already used for generating cars, baroque architectures, UFO, chairs, lamps, street lamps and many other different events.

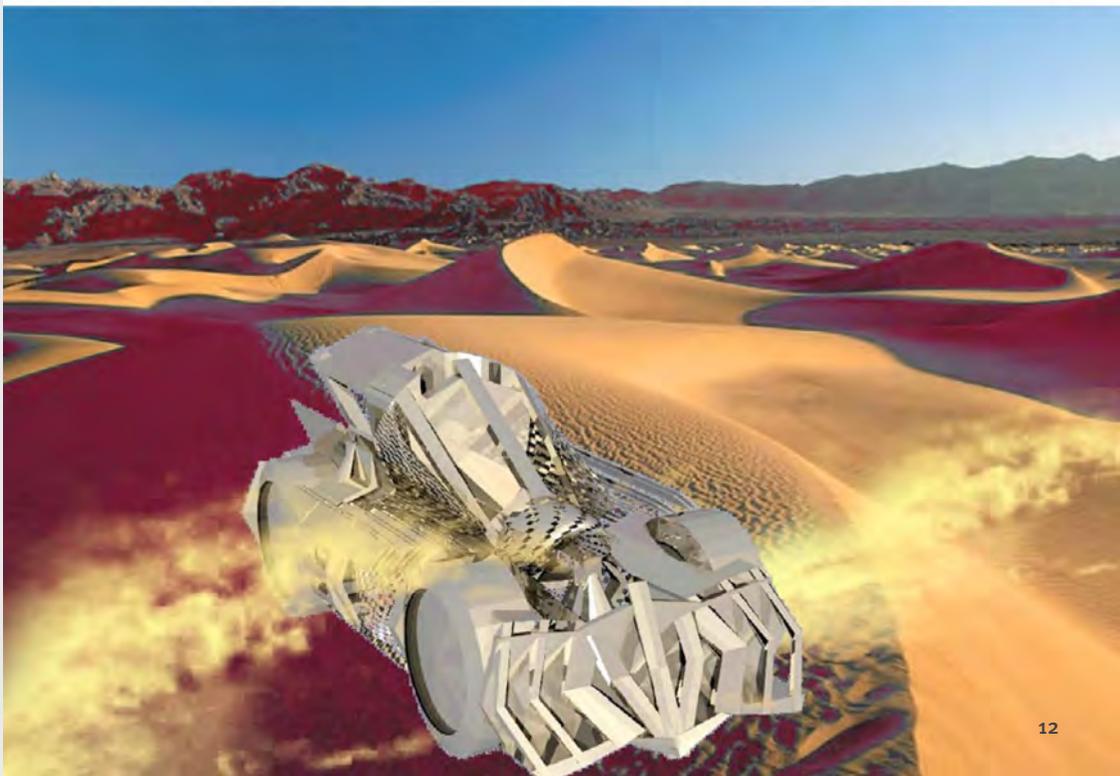
### **Generative Design today**

Finally generative design is finding its proper field in our next future. From technology to digital civilization. The revolution came from the generative approach theoretically and experimentally performed in the last 25 years. The vision of generative design as meta-project strongly linked to real-time production is today widely available because of the technology of new 3D printers that the main printer companies are launching in the market. These devices dramatically decreased their cost and are able to print objects using resistant and really fine materials. In the next months each of us will be able to purchase objects on the web, to download their “solid” files (STL files) for physically printing them in our home and directly using them in our life.

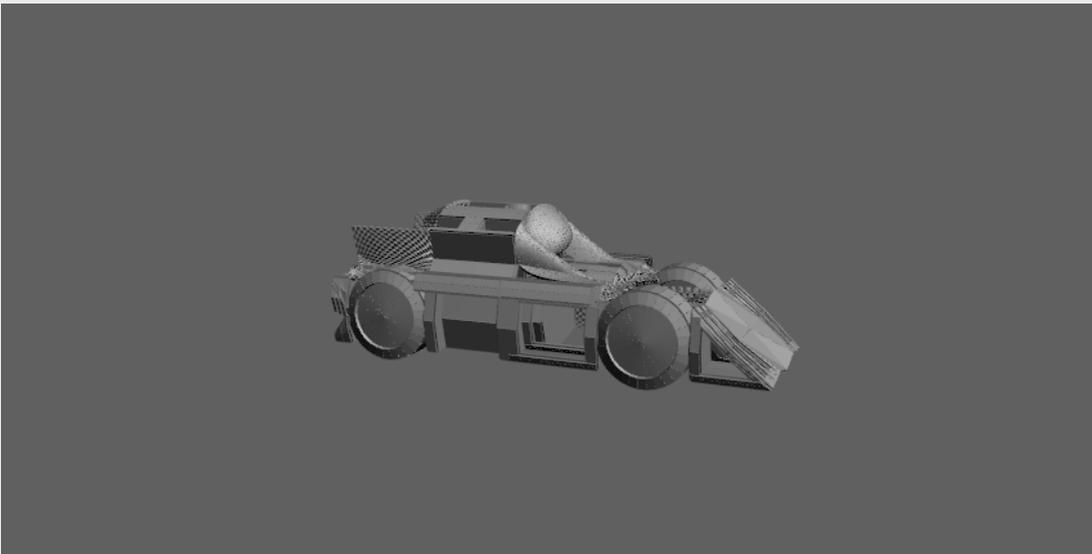
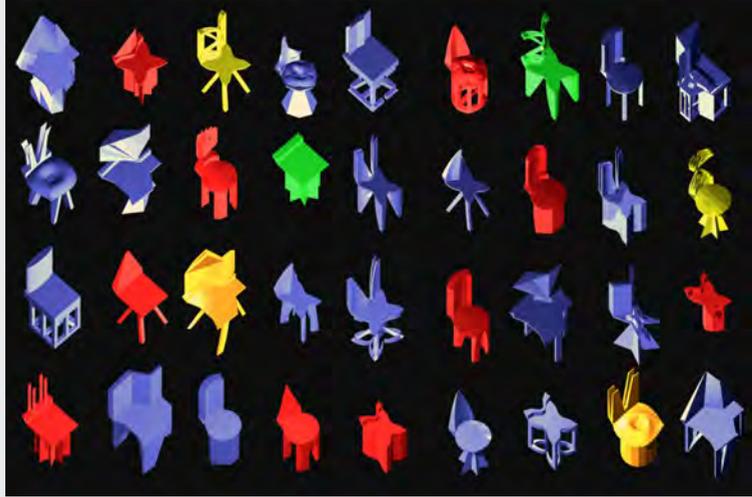


We will start downloading small objects, like lamps, shoes, cups, toys and we will be able to download spare parts for our car able to fit our own model and transform our car in an unpredictable and subjective way.

The generative approach to design, with the possibility to generate endless variations, each one unique and un-repeatable, will soon be the new frontier of design and of market competition. No more “cloned” and “copied” objects but, with a generative approach, we will experiment with a new power of creativity and design.



My actual experimentation with Generative Design works generating online in real time the solid files of new, unique and unpredictable objects, downloadable by people only one time. This possibility will be a revolution in our way to buy. We will be able to fit the uniqueness of our objects with the uniqueness of our life.



**In the images, a series of cars (2011), chairs (1992-2007), rings (2001) and coffeepots (2000) generated using Argenia.**

Notes about Generative Design Philosophy and Process from my paper “Generative Design. A swimmer in a natural sea frame” presentad at GA2006, IX Generative Art International Conference, [www.generativeart.com](http://www.generativeart.com):

Generative Design is a logical synthesis of a creative process using transformation rules (algorithms). It can be realized designing a program able to simulate this process and to generate outputs as 3D models of architecture, cities, objects. As with all creative processes, it involves subjectivity in the definition of how the process runs and how the transforming rules are created and organized into a system.

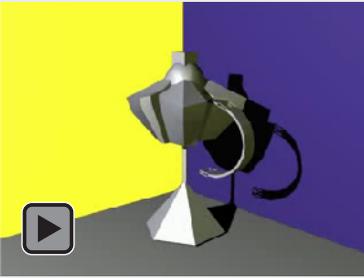
As in all creative processes two main factors are involved: the unpredictability of external factors linked to each design occasion, like the environmental context and client’s requests, and the subjectivity of designers when they interpret these external factors.

It can be realized designing a program able to simulate this process and to generate outputs as 3D models of architecture, cities, objects.

Morphogenetic Meta-Project versus Project Generative Design could be represented like a morphogenetic meta-project, an organized idea of “how to run” a design process. In the sixties, meta-projects were the structure of organization of incoming projects. They were constructed with the aim of identifying the best structure to answer to “objective” functional needs. It was not possible to fully develop this kind of approach because functional needs, extended to practice functions but also to symbolic and aesthetical functions, are strongly related to the subjectivity of customers and to the subjectivity of designers.

Generative Design is a meta-project with two fundamental extension:

1. it involves subjectivities going more in depth into the complexity of (architectural, town environment, industrial



objects...) designed artificial systems.

2. it can run the design process a lot of times, being sensible to little variations of inputs (similar to the different feel of the designer in different moments) and it can generate a sequence of endless results, all different but all related to the designer's idea.

#### Process versus Output

Generative Design, as a subjective operative meta-project, can be used to design a kind of artificial object, an artificial DNA of a species of objects because it is oriented to set up a process and not only to reach one result. Moreover, it defines and renders explicit all the steps of a "normal" design process, from the first sketch to the final executive project. And, in this way, it's a wonderful support for teaching (architectural and industrial) design.

You can find the full paper at:

[http://www.soddu.it/papers/soddu\\_GA2006.htm](http://www.soddu.it/papers/soddu_GA2006.htm)



**Generated "battle" rings (C.Soddu 2001). These rings were generated in wax using rapid prototyping devices and constructed in gold using the lost-wax casting. Each ring is unique.**





## The first decade of Computer Graphics

### 1. Interview with Herbert W. Franke

Yoshiyuki Abe & Akemi Ishijima

artist, Tokyo, Japan / composer, London, UK

In 1955, when Herbert W. Franke connected the wave signals generated by an analogue computer to an oscilloscope, the history of computer graphics began. The first series of computer graphics work *Oszillogramme* was published the next year. In 1960, Kurd Alsleben produced math based images through an analogue computer and a plotter. After such activities with analogue computer systems, the computing environment changed and digital computer has become the main platform. Frieder Nake, Georg Nees and Hiroshi Kawano were the primary players of digital computer imaging who had aesthetics in mind in the early 1960s.

Computer graphics has a duality in its purpose. One is the industry oriented imaging, for which numerous innovative devices made debuts and it has still been producing rich fruit in manufacturing and entertainment industries today. The other is art oriented image production, which unfortunately seems to have got lost itself in a labyrinth of aesthetics and technology. The border of these properties is ambiguous like the quantum-mechanical property which is regardable as both a wave and a particle. One of the unfortunate side effects of the duality was the prevailing fallacy that a photo-realistic image and a verification of a scientific research can be called work of art, and it has weakened the artistic motive for computer graphics for a long time.

Looking back on the past, we can see that the computer graphics started with a real-time interactive system of analogue computer, but the production scheme changed when the digital system became available for artists. Programming, or algorithmic design became the primary creative process, and the digital pioneers opened a new horizon utilizing Max Bense's informational aesthetics

and/or Claude Shannon's communication theory. In the meantime, the output device was a challenging issue for the artists in the very early stage.

Various ways to fix images of computer graphics reflected the situation of artists. Photographing or filming of the dancing image on the CRT screen, drawing with a plotter, and gouache onto the line printer paper were the typical methods. Later, the advancement of technology such as full color frame buffer and interactive access method brought on the paradoxical stagnation in the art, since the innovative motivations of the artists of the earlier period had been lost, and the motivation for computer graphics started to resemble that of the other existing visual media such as film or photography.

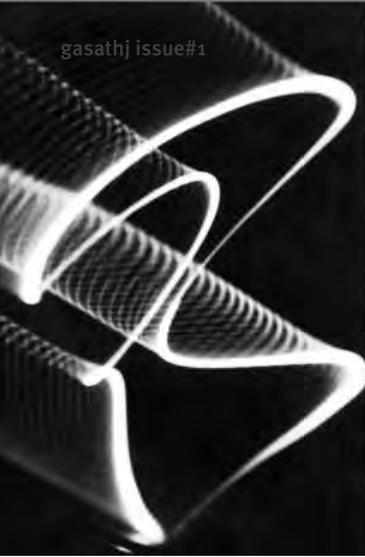
Computer graphics has distinctive imaging properties, and most of them were explored by the pioneers in the first decade. They developed their activities further, and each had moved on to a new field by the end of the next decade. The prominence of the pioneers featured in this serial is that they practiced the creative activities entirely separate from the industry. The fact that the pioneers' works of computer graphics were not recognized properly by the people of the art world then, only gives a proof that they were ignorant and incompetent in dealing with the new emerging art.

This note will describe the very first stage of the computer graphics with video clips and images of pioneers in Germany and Japan.

### 1. Herbert W. Franke (b.1927)

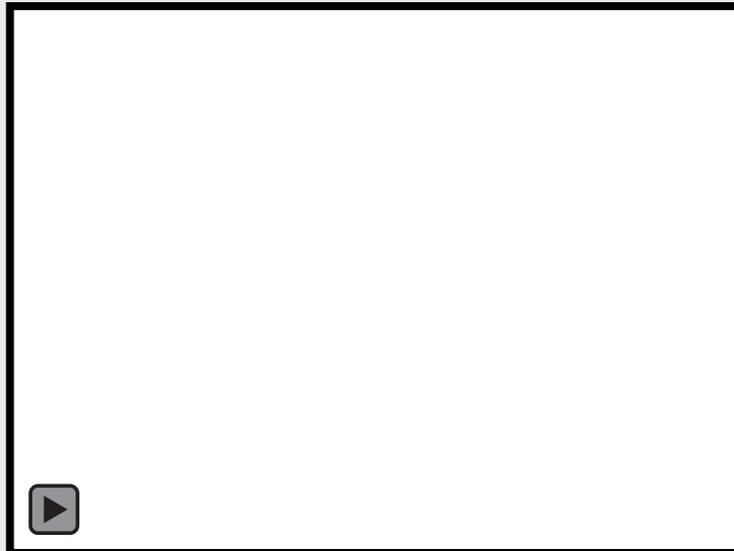
Franke's creative activities are continuing to the present for more than seventy years since he took photos of the statues in the town of Vienna in his early teens. His majors in Physics, Chemistry and Mathematics at Vienna University and his great skill in electronics and photography paved the way to the pioneer of computer graphics. He had first encountered electronic imaging in a research of electron microscope, and the experience of seeing interesting disturbed grid lines by the electron beam inspired him to produce varied Lissajous figure





Oszillogramme, 1956

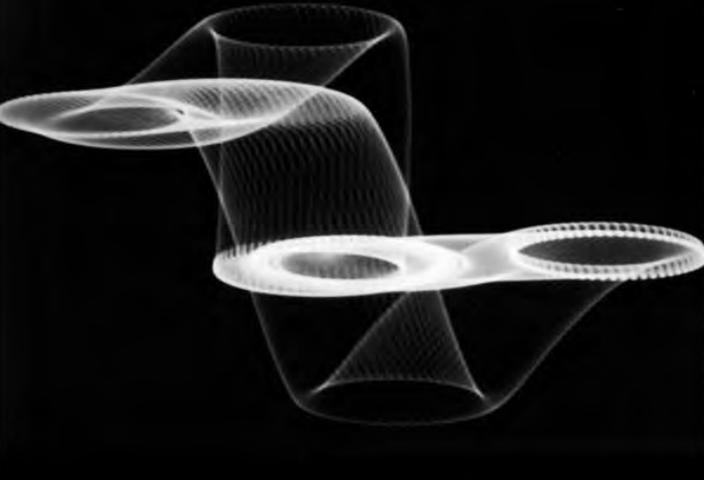
**1. Herbert W. Franke**  
**(b.1927)**  
**14.5min**



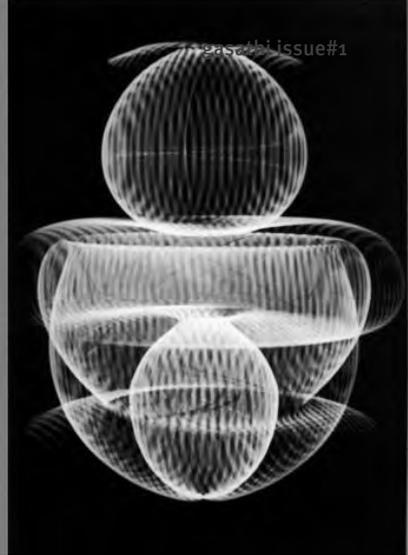
arrangements on an oscilloscope CRT. He photographed them for the series of Lichtformen in the early 1950s.

In 1956 the first series of computer graphics work Oszillogramme was produced with analogue computer and oscilloscope, and the succeeding series of Raumstudien (1957) and Elektronische Graphiken (1961) were produced in the same manner.

In 1959 he had the exhibition Experimentelle Aesthetik in the Museum of Applied Arts in Vienna. This show included



**Elektronische Graphiken, 1961/62**



**Raumstudien, 1956/57**

the photo prints of Lichtformen, computer graphics series and other electronic image works produced by x-rays. This show demonstrated his great interest in electronic visual creation and the magnificent achievement. This show traveled to London, Zurich and Munich later.(3)

With a lot of other track records such as science-fiction novels, images and animations by digital computers, sound creation, math based abstract graphics(4), writings and lectures on art and science, script writing for puppet play and so on, the long-running diversified activity of Franke has been supported by his stance on the creation that he is always looking for other possibilities and by his great curiosity about the new world. He says “I’m always interested in the innovation and changes and looking for different equipment and other possibilities. When I reach the perfect result, I’m not interested in it anymore. I do not want to stay at the same place.”

Image plates:

Herbert W. Franke, Kunst aus dem Computer - apparative und programmierte Graphik, Kuenstlerhaus, Vienna, 1975.

(c) Herbert W. Franke.

(3)<http://www.art-meets-science.info/experimentelle-aesthetik/>

(4)two images in the video interview are from Die Welt Der Mathematik by Herbert W. Franke and Horst Helbig, VDI Verlag, Dusseldorf, 1988

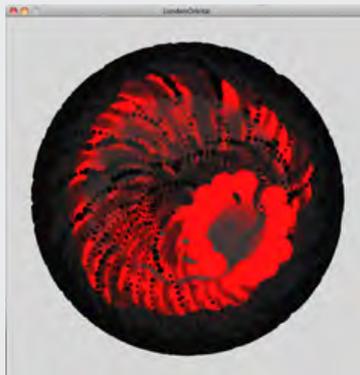
... to be continued in our next issue.



## London Orbital Peter Beyls

On a chilly winter day, on my way to Plymouth, I got stuck in London Gatwick as the runway at Plymouth Airport was frozen preventing any plane to take off. As an alternative, a bus took me across the Southern part of the UK. The perception was one of characteristic scenery merging seamlessly with unanticipated detail. It sparked the idea of perpetual excursion; I imagined a procedure that would suggest a given visual identity yet, it would equally have the capacity to renew itself in unpredictable ways. In other words, the challenge was to develop a dynamic system that would offer continuous change while guaranteeing overall structural integrity. The idea was formalised as a recursive algorithm, it represents an abstract circular visual world in perpetual transformation. The final result is a form of algorithmic (silent) cinema, a procedural movie which complexity reflects the parametric space implied in a recursive generative procedure.

PB, 26.12.2011



You can download the program for your OS:  
<http://www.gasathj.com/download/>

## Arlequi

### Brian Evans

Associate Professor of Art, University of Alabama  
[www.brianevans.net](http://www.brianevans.net)

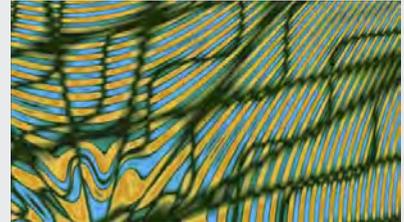


Everything reduces to data mapping and information design. The only hard question is why we do either. I never got past a fascination with numbers, a desire to write music, a desire to make pictures.

All is number in the computer. I take numeric models and see what sounds and pictures they will make. How can I map numbers to the senses—turn numbers into a tangible experience? Then I wonder how the senses map to each other. I map the maps.

Sound to image—a visualization. Image to sound—a sonification. In mapping numbers into sensory experience, aesthetic decisions are made. What palette of colors to use? What set of pitches? How long? How big? The artist chooses. In a digital world the mapping itself is a choice. Beyond arithmetic there are no rules.

I make simple rules. You have to start somewhere. One loop (now it's a narrative). Two minutes (don't blink). The sound should be seen, the image audible. Other than that, make music. It's jazz in 4D. Hear the colors, listen with your eyes.

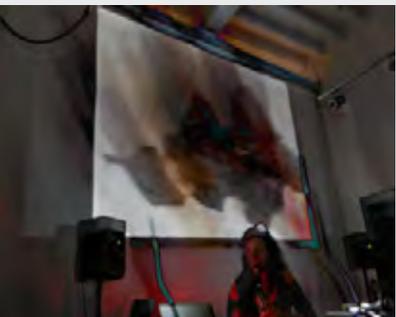
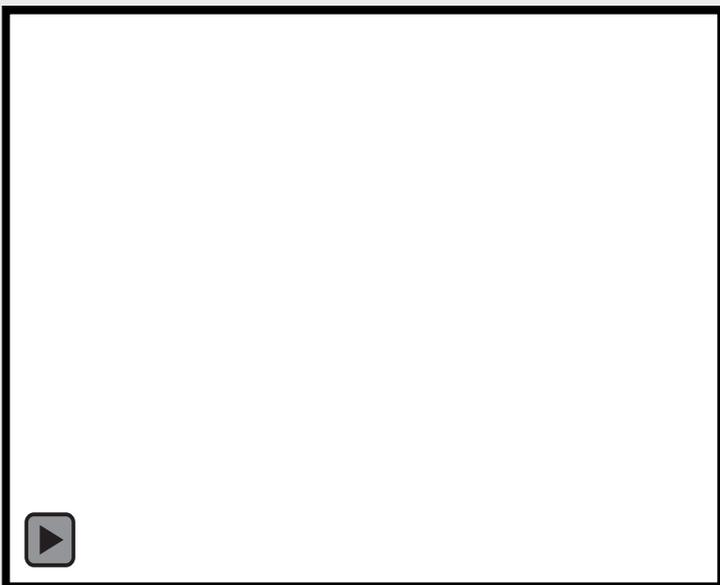




## The Process of Integrating Polymedia in Blooms and Death

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### Introduction

This paper will discuss the methods and meaning of the poly-media processes represented in Blooms and Death as a live interactive performance composition. It will define polymedia will evaluating the media that is associated with creating Blooms and Death.

Blooms and Death incorporates sounds and images based on a series of graphics created following the transformation of a freshly cut bunch of yellow roses through to their grey

death of decay. The visuals (video samples and stills) are layers of video footage displaying blowing yellow flowers, grey pencil drawings and layered scrolls of paintings incorporating the combination of computer transparencies of these images.

All the visual material has been treated extensively in various computer software packages to form this series of electronic artworks and video.

Blooms and Death explores many facets of poly-media in live performance, integrating through the audio, a response to the transformation of the dying roses employing breath sounds, and digitally processed clarinet with percussive processed piano sounds (performed by David McNicol), live processed acoustic environmental sounds, fans and the sampled video projections. The process of the disintegration of the roses and the response to this is explored through manipulation of sound and visuals to another timbral plane of textural ambience, colours and exploration in the context of poly-media. The music of Blooms and Death is scored for Bb clarinet, fan, live audio mulching (via laptop computer), multiple video projections and piano.

### **Definition of Polymedia**

One performer, composer and visual artist creating a whole identity. The composition integrates acoustic sound, live audio mulching, acousmatic sound, live video mixing and fixed video during performance.

### **How will Polymedia be integrated in the process of the composition?**

In the creation process of Blooms and Death, I the polymedia creator, make decisive day to day notes on the theme, the rose. The score and acousmatic pre-recorded audio is a combination of extended clarinet and piano techniques. Many of these extended devices on the clarinet and piano such as quarter tones, multiphonics, tri-tones, microtones, transformed clusters are reorganised and work cohesively to create sound clusters, by just changing how each of the devices are orchestrated.



Blooms and Death score incorporates graphic notations especially in the 2nd and 3rd movements, that can be either literally or intuitively interpreted according to the ambience and sound world the musician's are creating and visual setup of the space at the time of the performance. The process continues with manipulation of files into different layers and multi channels, concentrating on microtonal interaction between the samples. A similar process is applied to the visual materials including analysis of brightness, colour, contrast, duration, speed and complexity. The sound and image, influences the shape and analysis of each of the works. The imagery in Blooms and Death is a process of timing. Every image has a fade, so its all about the dissolve and the transformation in the image rather than in the fade. The layering of the transparencies with luma, chroma, speed (pulse), and cutouts dominate many of the visual samples. The aim is to make the still images move through these effects. The use of stained glass plug-in with the treated rose images is animated.

All these structures have given me freedom of process and uniquely affect the outcome of the piece. There is no correlation between the musical and video layers as the music is written at the onset and the animated video samples added afterwards, so as the creation of the musical composition has created movement in a cohesive whole.

Prelude starts the journey of Blooms and Death. It is for solo clarinet and visual shadows (video). The vivid rose is only seen in the distance as part of the many layers the movement is made up of. Movement 1 is scored for Bb clarinet, fan, multiple video projections and piano with audiovisual statements made through diffused fan and air sounds with thick clusters of sound of extreme registers and dynamics from the piano. The clarinet adds another layer of suspense with ambient long notes in low register of the clarinet that are coloured with quarter tones and tremolos. Movement 2 is scored as Movt.1 but with live audio mulching (via laptop computer). It emerges into transformed breath sounds moving into complex paths of high overtones and repeated notes as if conversing.

# Blooms and Death

Movt. 1

Brigid Burke 2011

Clarinet in B<sub>♭</sub>  
slightly amplified

Piano  
slightly amplified

FAN

airtone

ppp mf p sfz mp

Turn fan steadily over bag - do something with different sizes, depending on needs of melody but with continuous movement

ped.  $\wedge$  simile

Unpublished  
Copyright © 2011 by Brigid Burke

TURN FAN ON

©Brigid Burke

Blooms and Death1  
Score PAGE 1

Cover 1





## Original Pics Blooms and Death

Interlude brings new life to the red and blowing images in the fan of the image of red stationary rose and is fast and racy visually and audibly. Finally Movement 3 takes the vivid yellow roses, breath, acoustic clarinet and percussive piano sounds from images of slow decay but show new life in there transformation through diffused timings and multiple layers of images and sounds.

### **How will Polymedia be integrated in the process of performance?**

The polymedia performer plays Bb clarinet, controls the audio samples through the laptop and visual samples through the interactive responses on the video mixer, which is directly influenced by the sonic output of the system. The performance is the creation of polymedia counterpoints on player-defined fragments, effectively enabling the musician to perform a time-extended improvisation. The visual output is based on an abstract representation of how the music is progressing. The audio and visuals are triggered manually through the laptop and video mixer. The outcome of the performance is fluid and reactive.

Throughout Prelude there is always a glimpse of age, death and familiarity as a tangible sound through the clarinet with the rose being familiar and beautiful visually.

Musical score for page 10 of 'Blooms and Death'. The score is for B♭ Clarinet (B♭ Cl.), Piano (Pno), and Stripped Whistle (Str Wh). The B♭ Cl. part starts at 7:06 with a '5 measures of silence' followed by a melodic line. The Pno part features a series of vertical lines representing notes, with dynamics ranging from *pp* to *ppp*. The Str Wh part has a time signature of 7/8 and a tempo marking of *♩*. The score ends at 7:50.

Blooms and Death score Page 10

Pencil Drawings (1)



Pencil Drawing Image 1



Pencil Drawing Image 2



Pencil Drawing Image 3

Musical score for page 5 of 'Blooms and Death'. The score is for B♭ Clarinet (B♭ Cl.), Piano (Pno), and Stripped Whistle (Str Wh). The B♭ Cl. part starts at 2:30 with a '5 measures of silence' followed by a melodic line. The Pno part features a series of vertical lines representing notes, with dynamics ranging from *pp* to *mf*. The Str Wh part has a time signature of 2/4 and a tempo marking of *Slowly*. The score ends at 4:00. There are also pencil drawings of a flower stem and bud, and a drawing of a flower stem with a bud, similar to the ones in the previous section.

page 5 Score Blooms and Death 2



Computer Image 1



Computer Image 2



Computer Image 3



Original photograph Image 1



Original photograph Image 2



Original photograph Image 3



At the first performance of Movement 1 on 6th March 2011 a double image on the screen one with the fan switched on directly in front of the projector the other with the straight image. The result was quite astonishing and created the austere atmosphere that was envisaged. In Movement 2 there is much random computer effected samples which open up the free improvisational shaping leaving much of the decisions to the performers being intuitive with the pre-formulated material. This result means no two performances are the same. Interlude and Blooms and Death Movement 3 in performance are fixed or live audio mulching (laptop) so according to the set in the performance space which should be in the form of a movie theatre with surround sound, the out come is totally immersive with the integration of sound and visuals.

### **Conclusion**

The performance work Blooms and Death demonstrates a creation of a balance that is sensitive to environmental thought and fluidity in polymedia performance. The polymedia attributes achieve the use of acoustic sound in a sound environment at the present time that is of processed sound. The meaning of creating a polymedia work is each voice enhances the other (the music and visual). The components of a live feed of the clarinet, piano and fans with the interactive mechanisms of video and audio mulching add a component that will captivate a moment of time. By encouraging interaction with adaptive sound as from the clarinet and visually engaging footage, one can enrich the creative possibilities of polymedia processes in art, and in particular music.



## Rhythmus in folding a page

Enrica Colabella

architect, Generative Design Lab, Politecnico di Milano University, Italy

....folding a page in a rhythmic double linear action...

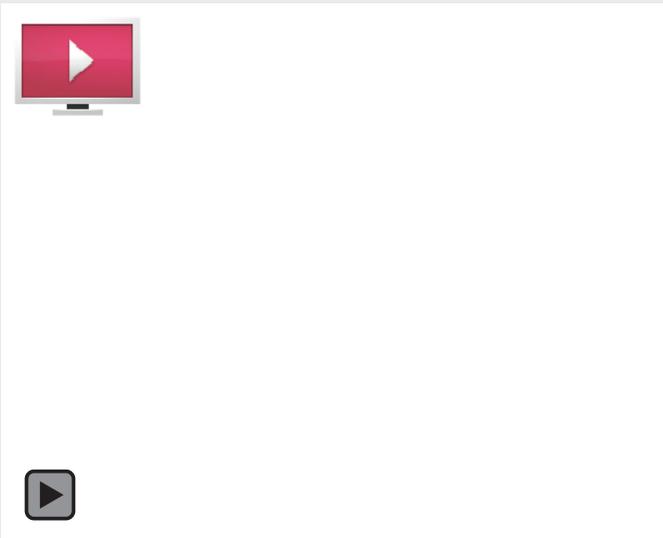
Fold the white page, writing with your blood,  
Fold, please, fold  
No, please, no tears,  
Take your blood from your heart:  
Directly from your heart. No tears.  
Fold as a breath in lighting,  
Mirrored on the smile of a child,  
In lighting, just lighted in a double folding.  
This is a new day, unrepeatable for you and me:  
It is a fold from darkness in this white instant.  
Three Angels are looking for your passage beyond the corner  
They sing a song with yellow, red and white colors.  
With flowers and always green leaves on their heads.  
But they don't open their lips singing:  
Their sound rises directly from their hearts to yours  
As in a mute space unknown for the gained enemies.  
Take care of your hearing, my darling, take care of it in your mind.  
Preserve as an art nest your ability to listen to the beauty in the sounds.  
Smiles inside your milk cup a white un visible butterfly  
That you can see when your breath folds the milk in 2 small holes,  
As a sweet rhythmic double linear action in a folding:  
Please listen to the sound of a white page of milk, folded in a small cup.

### Next

Fold your page with your breath  
Fold, without hesitations, fffold:..  
Please only with your breath..  
Take the power from your voice  
Inside your voice. Until your least bass note.  
Fold your page toward the river water under the bridge.  
Fold at the moonlight when the bees are sleeping  
You might generate a reflecting light on your page, for an instant:  
Istina, a personal truth in a double vision for an eternal fragment of time.



**homage to William S. Burroughs Cut-ups,  
d'apres Surrealist**



**homage to Rhythmus 21,  
Hans Richter, 1921**

### **Past/Next**

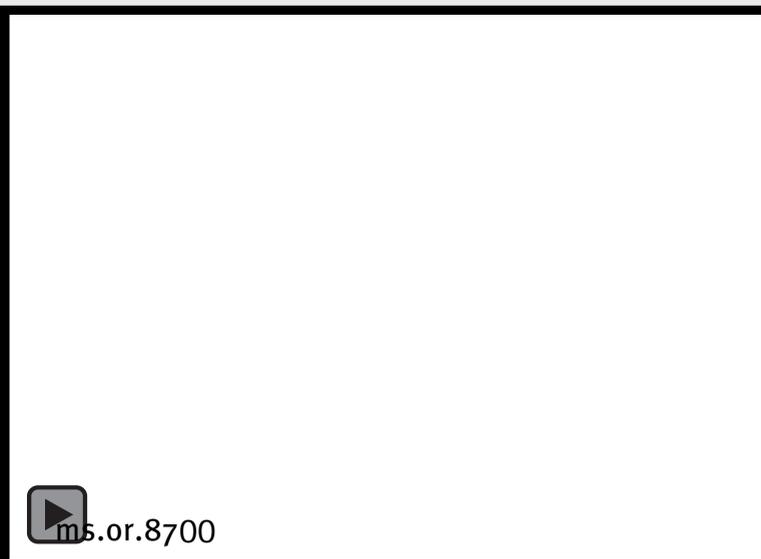
Some historical information about:  
the evolution of folding a page

by Daniela Scialanga, Biblioteca Angelica, Rome, Italy

In the first centuries of the Christian era the book changes its form: from the roll to the codex to the book, and it has sustained the same aspect until today. The actual form of the book affirms itself with the diffusion of the works of the Church Fathers in the first centuries of the Christian era. For the reason that they were impossible to contain in the rolls of parchment, that were too heavy in comparison to the slender papyrus. The whole Medieval era is crossed by the codex. But the paper is making its way from east to west to realize the perfect connection with the mobile characters of Gutenberg and the birth of the press. What the reading room of an ancient library and, particularly, the vaso vanvitelliano of the Biblioteca Angelica, offers is an imposing collection of books, handcraft manufactured, that from '400 to '800 century vary little in their technique and realization.

The large number of volumes line the imposing wooden shelves from top to bottom and are illuminated with an undulating movement of light. Great books, small books, huge books, dwarfish books. It is not a white notebook that offers itself to the writing and to the press but an original nucleus, the gathering, that multiplies itself. There is initially the mash obtained through a series of operations starting with the patient picking, selecting and maceration of the cotton rags.

*The mash entangles and interlaces its fibres together giving life to the sheet. The miracle or rather the cleverness of the typographers is the binding of all the pages that will constitute the gathering. Then the blank sheet will receive the printing and folding, which will facilitate the reading.*



ms.or.8700

**The Book of Esther**  
**17th century**

**parchment roll, wound around a wooden handle, 5200mm long**

The so-called “Roll of Esther”, a Book of the Bible used during the liturgy service and owned by Moshé, son of Yosef Del Monte (1662). Before incipit there is an illustration with the coat of arms of the owner, unfortunately bleached. The roll is accompanied by an other strip of parchment (mm 830 long) that contains the blessings to say before and after public reading aloud of the roll. In this richly decorated strip appears the name of the copyist, the father of the owner.





ms.or.87

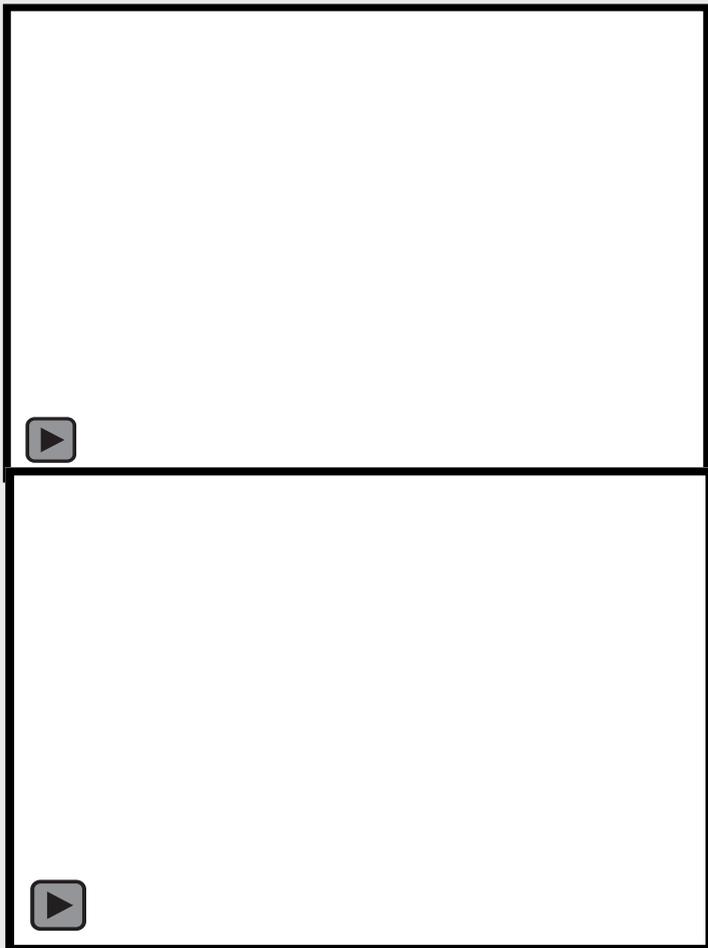
**Liber memorialis – Remiront Abbey**  
parchment, ff. 71, 300 x 240mm  
9th – 12th centuries

One of the seven medieval liturgical memorials still conserved in Europe. The Liber Memorialis was a sort of list of people to be mentioned in prayers. It contains obituaries and services for the dead. The oldest manuscript of the Angelica, from the convent of the Augustinians of L'Aquila, was already in the library at the time of the prefect Giorgi (1752 - 1797).



ms.10





Marcus Tullius CICERO, De oratore

Subiaco, Conrad Sweynheym and Arnold Pannartz, before 30 IX

1465

4°, rom.

First book printed by movable type in Italy. It was printed in Subiaco in 1465 by the german printers Sweynheym e Pannartz. The Angelica's copy is one of the seventeen in the world, including three in Italy. Three of the initials of the angelica's copy are beautifully decorated in different colours and gold leaf.

Inc. 505/3

Aurelius AUGUSTINUS (S.), De civitate Dei  
Subiaco, Conrad Sweynheym and Arnold Pannartz, 12 VI 1467  
fol., rom.

De civitate Dei is a major work of Augustinus on his religious philosophy. In this particular edition the type used is especially interesting as it consists of roman type uppercase letters and gothic lowercase letters. On the bottom of fol. 15r Augustinus is depicted sitting at the desk. On either side of the image of Augustinus there are two coats of arms belonging to the family of Fano, called Martinozzi.

This book is considered the third and final incunabulum printed in Subiaco by the German printers Sweynheym e Pannartz, but some scholars believe it was printed in Rome.

Origin: Domenico Passionei (1762).

Inc. 149

Colonna, Francesco, Hypnerotomachia Poliphili  
Venezia, Aldo Manuzio, 1499  
fol., rom.  
Inc. 590

Euripides, Tragoediae septedecim  
Venezia, Aldo Manuzio, 1503  
8°, cors.  
PP. 3. 51-52

Respublica, sive Status Regni Galliae diversorum autorum  
Leida, Elzevier, 1626  
12°  
CC. 8. 7

De Rossi, Giovanni Bernardo, Epithalamia exoticis linguis reddita  
Parma, Tipografia Regia, 1775  
fol.  
Bod. 335



Vivio, Giacomo, The true portrait of the mirabil'opera of low relief in wax stuccata  
Engraver: Ambrogio Brambilla  
Rome, 1590

Miscellany of presses, centuries XV - XVII

:C^,2.11

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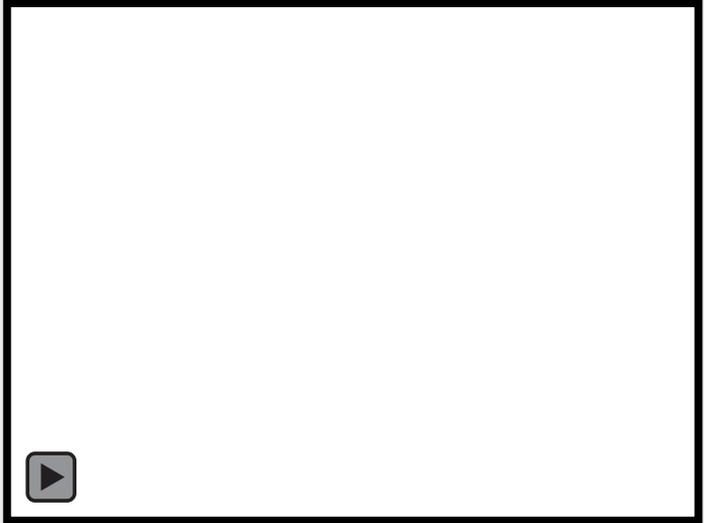
## **The unit of vision: the concept of opsieme**

**Jean Paul Courchia, MD**

Saint Joseph's Hospital, Dept. of Ophthalmology, Marseille, France

**Sarah Guigui & Benjamin Courchia**

Ben Gurion Univ. of the Negev, Medical School for Internat Health



Thanks to vision, one can discover and relate to one's surrounding world. The eye is much more than a simple photographic tool which gathers information in order to present it to the brain. Originating from the embryological neuroectoderm layer, the retina acts like a real extension of the central nervous system (1), selecting and processing information that it will later transmit to the cerebral cortex. The study of ocular movements helps us understand how the eye indeed analyzes the surrounding world. The first principle is that visual acuity is not homogeneous in the visual field.

First, the eye centers the fovea, a tiny dimple of 1.5 mm diameter in the retina, on a desired and specific target. The fovea is exclusively composed of cones, which makes it the region of the eye with maximum acuity. This way the eye achieves a fixation ; with each fixation usually lasting between 200 and 300 ms. Then the eye displaces the fovea to another target, thereby completing what is called a saccade. Vision is thus a succession of fixations and saccades, rather than a single global input. If only foveal vision can generate a sharp vision, the peri-foveal vision is indeed blurred. That is, when one reads a written page, only certain letters are simultaneously perceived acutely, while the rest of the page is blurred (2). At a normal reading pace, one perceives 3-4 letters to the left side and 7-8 letters to the right side of the eye's anchor point (3). Thus, reading consists in fixating onto micro-areas of only a few letters length in the midst of a multitude of letters. According to cognitive neuroscientist Stanislas Dehaene (4), recognizing letters and their combinations – called graphemes – and then creating an interface between what's written and what's articulated (phonological awareness) is the way to gain access to the lexicon that we use to communicate. If we indeed pay attention to the basic elements that compose the written sentence, we find letters, syllables and words. However, the smallest significant element of the sentence is probably the grapheme, since the whole understanding process derives from it. The grapheme is the written equivalent of the oral phoneme. It is comprised of the smallest group of letters making a phoneme. For example, in French, the phoneme [o] has several graphemes : o, au, and eau. Unlike a letter, a grapheme represents better the phonology of a language, or what a language sounds like. The French language counts 130 graphemes.

Does this same concept apply to a painting or an image? Just like in the reading process, the image undergoes several mutations between the retina and the sensory areas of the cerebral cortex, whereby the basic components of the image (forms, colors, orientation of the lines) are dissected first and then transmitted to the visual areas. It is only then that the image is reconstructed, and that it will be confronted against other known representations that are

stored in our memory for an identification of the present image. Dismantling, reassembly and identification are the three steps in the process of the visual representation, whether artistic or natural.

The time spent in front of a work of art is known to be very short (10-45 sec) ; in this time lapse, the spectator leaving the art piece stores in his neurons a permanent image made of sharp zones and less sharp ones. Using Matisse's *Odalisque a la culotte grise* as an example, figure 1a points to the areas of interest of the painting, and figure 1b represents the painting as seen by the fovea with a few sharp areas standing out from a fuzzy background (5). It is based on these foveal and peri-foveal elements solely that the spectator will understand the meaning of the message that the artist wants to convey, not only at a purely semantic level, but also at an esthetic and emotional level. The painter Avigdor Arikha defines this process : « Similarly to the function of grammar in a string of words, the pictorial constituents operate the picture – dot, line, form and colour in a state of tension – that underlie depiction. It is analogous to a succession of segmental phonemes that constitute a sentence» (6). Thus the reading of a sentence and the « reading » of an art piece seem to be similar processes.



We would thus like to equate visual units and graphemes. Like in reading, the basic visual element in the work of art carries an information that once integrated within the rest of the visual « sentence » will make sense. This basic element can be explicit, but still has a polysemantic potential at this stage. It must be linked to other basic elements or visual units in order for the image or the art to be understood as a whole and make « one » sense only. Can one infer that the understanding of the image is dependent upon the number of fixations? Does the number of fixations correspond to the number of fixations necessary to transition from a polysemantic vision to a homonymous vision?

Fixation can be equated with the time necessary to identify the smallest significant visual unit in an image.

Just as a phoneme is the smallest articulated unit, and a grapheme is the smallest written unit, we suggest opsime as a designation for the smallest significant visual unit : « opsie » – from the Greek ops, opsis, which means eye, vision and « eme », suffix which signifies basic unit.



**Figure 1 : Odalisque a la culotte grise (Matisse)**

**a - the original**

**b - areas of interest**

**c - foveal and perifoveal visions**

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## Variations around the Dragon Curve

Marie-Pascale Corcuff

ENSAB, GRIEF, Rennes, France



The so-called «Dragon» curve is a well known fractal curve, also known as the «Heighway» dragon, according to one of the NASA physicists (John Heighway, Bruce Banks, and William Harter) which are said to have first investigated it. It has been described By Martin Gardner in his Scientific American column «Mathematical Games» in 1967. It appears also on the section title pages of Jurassic Park by Michael Crichton, but moreover it plays a role in the plot, as one of the protagonists, mathematician and chaos theorist Ian Malcolm, creates dragon curves in order to simulate the actions that are to take place in the park, leading to its collapse (how exactly so, don't ask me!).

I was reminded of this curve because this year (2012) is a Year of the Dragon in the 12-year cycle of the Chinese calendar. It is said to be the luckiest year in the Chinese Zodiac, so I hope it will contribute to an amelioration for a lot of people on earth that would need some...

In order to make my greeting card for this year, I combined the 2012 word with a dragon curve L-system. Instead of drawing a simple line, the R and L obtained by the rewriting system are interpreted as drawing the word 2012. As I went till the 12th step, there are 4096 «2012» in the last image. The previous step generates 2048 «2012»; too bad 2012 is not a power of 2; but remind me of doing a similar greeting card in 2048, more satisfyingly composed of 2048 «2048». I shall not be 100 years old yet, and the work is almost done, so I should be able to do it...

### The Dragon Curve as L-system

The most common way to obtain a dragon curve is to use this L-system:

$$a=90^\circ$$

axiom: L  
 $L \rightarrow L+R+$   
 $R \rightarrow L-R$

It works, but you need to introduce some multiple of a  $45^\circ$  angle at the beginning of the drawing at each step, in order to obtain curves that match each other. If not, the successive curves turn around the starting point. So I prefer to use this L-system:

$$a=45^\circ$$

axiom: L  
 $L \rightarrow -L++R-$   
 $R \rightarrow +L-R+$

You must also divide the length by  $\sqrt{2}$  at each step in order to obtain the classical process. If you don't divide the length, you obtain a growth process.



The dragon curve process is a folding process, which you can better demonstrate if you divide the length by 2 at each step, in order to maintain the whole length of the line. By the way, the dragon curve is easily done by hand by folding a long strip of paper in two, and by folding again the result (always in the same direction), and so on; and then by carefully partially unfolding this strip, all the angles having to be  $90^\circ$ .

The Dragon Curve and its variants as IFS

The dragon curve is also the attractor of this IFS:

dragon curve	scaling	rotation	translation x	translation y
w1	$1/\sqrt{2}$	$45^\circ$	0	0
w2	$1/\sqrt{2}$	$135^\circ$	1	0

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w2	$1/\sqrt{2}$	$135^\circ$	1	0

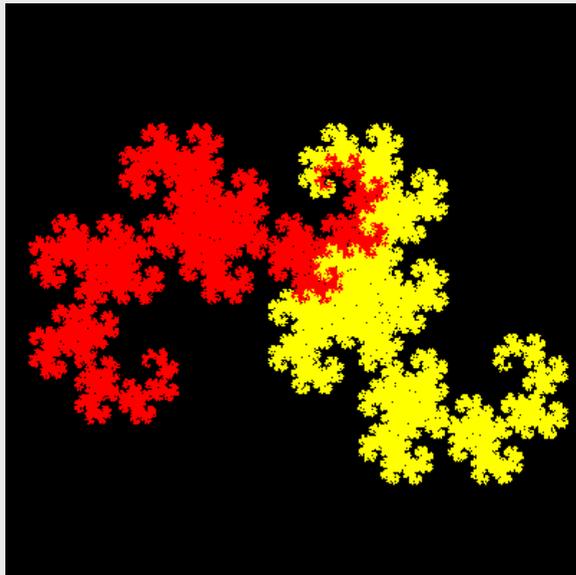
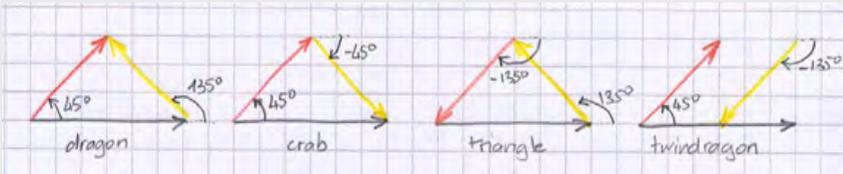


Fig. 1: the dragon as attractor of an IFS (chaotic algorithm)

The chaotic algorithm provides a thorough representation of the dragon curve, which actually covers a full portion of the plane, being of fractal dimension 2. We can also apply a deterministic algorithm to a starting set of points representing a line, which simulates the L-system. The description by the IFS leads to variants, considering that the dragon curve IFS consists of two transformations, each consisting of a scaling (ratio:  $1/\sqrt{2}$ ), composed with a rotation (angles  $45^\circ$  and  $135^\circ$  resp.) and a translation putting the two results side by side. Beyond the dragon curve itself, there are three possibilities, if we exclude those that are equivalent: the «crab» curve, the «triangle» curve, and the «twindragon» curve.

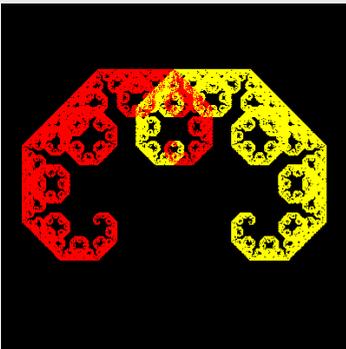
The 4 IFS may be described by the following schemes:



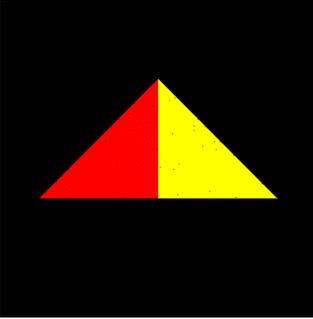
**Fig. 2:** schemes of the dragon IFS and its variants

The «crab» curve is obtained by this IFS:

crab curve	scaling	rotation	translation x	translation y
w1	$1/\sqrt{2}$	$45^\circ$	0	0
w2	$1/\sqrt{2}$	$-45^\circ$	.5	.5



**Fig. 3:** the crab as attractor of an IFS (chaotic algorithm)



**Fig. 4: the triangle as attractor of an IFS (chaotic algorithm)**

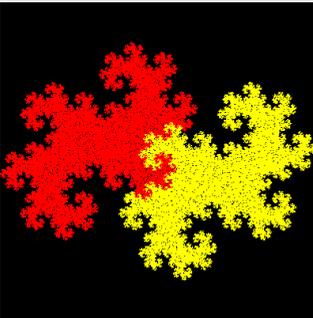
This curve is actually officially known as the Lévy C Curve, relating to French mathematician Pierre Paul Lévy. I choose to name it the crab curve here, because it looks like the eponymous zodiacal sign (also known as cancer, but it is not so joyful for obvious reasons) in western culture.

The «triangle» curve (its name is obvious) is obtained by this IFS:

triangle curve	scaling	rotation	translation x	translation y
w1	$1/\sqrt{2}$	$-135^\circ$	.5	.5
w2	$1/\sqrt{2}$	$135^\circ$	1	0

The «twindragon» curve is obtained by this IFS:

twindragon curve	scaling	rotation	translation x	translation y
w1	$1/\sqrt{2}$	$45^\circ$	0	0w2
w2	$1/\sqrt{2}$	$-135^\circ$	1	.5

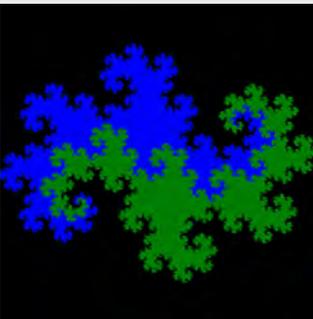


**Fig. 5: the twindragon as attractor of an IFS (chaotic algorithm)**

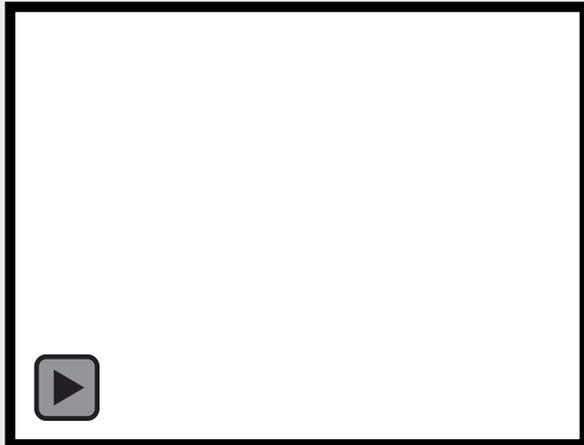
The «twindragon» curve is called this way, not because it would be a «twin» sister, a sibling, or even a «cousin» of the dragon curve, but because it is actually composed of two dragon curves, not as the red/yellow decomposition, but as this blue/green one.

### Variants in L-system

The above schemes may also be interpreted in terms of L-systems. The angle is always  $45^\circ$ , the axiom always «L». When the arrow is in the right direction, it is interpreted as «L», when it is in the wrong direction, it is interpreted as «R».



**Fig. 6: the twindragon as two dragons**





Triangle curve:

$L \rightsquigarrow -R++R-$

$R \rightsquigarrow +L--L+$



Twindragon curve:

The scheme shows a difference: the two lines are not joined... One must introduce a new letter in the system, corresponding to a jump: J.

$L \rightsquigarrow -LJ+++L--J$

$J \rightsquigarrow -J+++J-$

### Varying the dimension

The dragon curve, as well as its variants, is of fractal dimension 2. It is easy to determine: each resulting figure is composed of 2 figures  $\sqrt{2}$  smaller (and they have not got parts that are superposed, or not-contiguous, which is well shown in IFS chaotic results, where the two colours don't mix, but touch somewhere). So its fractal dimension is equal to  $(\log 2)/(\log \sqrt{2}) = 2$ .



Varying the dimension consists in varying the angle  $a$  implied in the process. It is very straightforward in the L-systems, one has only to calculate the ratio of diminution of the length ( $2 \cos a$  which, in the case of  $a=45^\circ$ , is equal to  $\sqrt{2}$ ). The respective fractal dimension of each curve is:  $(\log 2)/(\log (2 \cos a))$ , which varies from 1 (for  $a=0^\circ$ ) to 2 (for  $a=45^\circ$ ).



One notices that the triangle curve with  $a=30^\circ$  is actually the well known Koch curve, though its construction is not the classical one, which skips every other step.

**Hybridization**

Hybridization consists in mixing two (or more) processes. This can be done in many ways. Here, I hybridize the dragon with the crab by using L-systems, with 14 steps. At each step, the algorithm chooses between the dragon rule (0) and the crab rule (1). There are  $2^{14}$  (= 16384) possible results. The animation shows this transition:

```
00000000000000
10000000000000
11000000000000
...
11111111111111
01111111111111
00111111111111
...
11111111111111
```

### 3D transposition

There are many ways in which we can think of a transposition of the dragon curve and its variants in 3D. The one I chose here considers the «skipped step» version suggested above, and is obtained by this L-system («&» and «^» stand for pitching up or down):



$a=90^\circ$   
axiom= A  
 $A \rightsquigarrow -\&A^{\wedge}AA+AA+AA^{\wedge}A\&-$



I call it the 3D crab, as it looks a lot like a crab!

## Use of Art Media in Engineering and Scientific Education

Dr. Alec Groysman

ORT Braude College of Engineering, Karmiel, Israel



The aim of this work is to show how art media can help in engineering and scientific education. The philosophy of this work is establishing of interrelationships between art, science and technology in order to show the young generation of engineers, scientists and educators how learning, education and our very existence may be interesting, fascinating, creative, productive, efficient, exciting, attractive, rich, and as a result beautiful.



**Fig. 1: “The Persistence of Memory” (soft watches), by Salvador Dali, 1931.**



**Fig. 2: “The Three Sphinxes of Bikini”,  
by Salvador Dali, 1947.**

The examples of use of different arts (painting, sculpture, literature, poetry, and music) in curricula of materials science, thermodynamics, and corrosion of metals are shown. Analogies, interrelations, mutual influence, metaphors, humour, common aspects and differences between art and engineering/scientific disciplines are used in engineering and scientific education for students, young engineers and scientists, and educators.

There is mutual influence of art, science, technology, and engineering. First, how inventions in science and technology influence art is exemplified by the creative work of Salvador Dalí who had special interests in materials science, nuclear physics, optics, biology, psychoanalytic theory of Sigmund Freud and new technologies. The painting “The Persistence of Memory” with soft watches can stand as an illustration of Dalí’s theory of “hardness” and “softness” (Figure 1). The invention of holography by Dennis Gabor is found in a stereoscopic painting by Dalí. Another example is the picture “The Three Sphinxes of Bikini” of Dalí which was painted after the dropping of the atomic bombs on Hiroshima and Nagasaki in 1945 (Figure 2). As a result, “nuclear” and “atomic” painting in the creative work of Dalí occupied nearly 35 years.

Another example concerns the painting “The Starry Night” by Vincent Van Gogh (Figure 3a). It was suggested that this painting which appeared to show a spiral nebula with an accompanying swirl was inspired by the sketch of the Whirlpool Galaxy M51 made by the astronomer Lord Rosse (Figure 3b). “The rayonism” (лучизм) was developed by the painter Mikhail Larionov as a reflection of the first discoveries in nuclear physics in the 1910s (Figure 4). Many works of Marcel Duchamp were inspired by non-Euclidean geometry, concept of the 4th dimensional space, X-rays (radiation) and electromagnetism. His painting “The King and Queen Surrounded by Swift Nudes” (1912) was enthused by the invisible world of electrons (Figure 5). His works bring together left-brain science and with right-brain visualizations. The French composer Maurice Ravel created “Bolero” after the visiting a metallurgical plant. When you listen to the “Bolero”, you may imagine metallurgical processes with flowing hot liquid metal, blows and strokes of metallic components, rolling-mills, etc.

Here is an opposite example: how art influences science? The Steady State model of the universe developed by the British physicists Hoyle, Bondi and Gold was stimulated by the circular plot of the film “Dead of Night”. Their Steady State model became an alternative to the Big Bang model.

We can conclude from this example that we should teach any child, young man, pupil, student, engineer, scientist, artist and educator to grasp and perceive art, as we teach reading, writing and calculating.

Art can help in understanding and remembering of different processes and phenomena studying by scientific and engineering disciplines. Corrosion phenomena are compared with pictures and statues of famous artists and sculptors. General corrosion was compared with the “Tall Figure” by Alberto Giacometti (Figure 6); pitting corrosion with the “Pit” by Philip Guston (Figure 7); three periods of car’s life (new car, beginning of corrosion, and destruction) - with the “The Garden of Earthly Delights” by Hieronymus Bosch (Figure 8); and erosion – with the “Unique Forms of Continuity in Space” by Umberto Boccioni (Figure 9).



**Fig. 3: “The Starry Night” by Vincent Van Gogh, 1889**



**Fig. 3B: The sketch of the Whirlpool Galaxy M51 by the astronomer Lord Rosse,**



**Fig. 4: “Red rayonism” by Mikhail Larionov, 1913**



**Fig. 5: “The King and Queen Surrounded by Swift Nudes” by Marcel Duchamp, 1912**



**Fig. 6: “Tall Figure”**  
by Alberto Giacometti  
(1949)  
as general corrosion.

Examples of descriptions of behavior of materials were given in literature by writers Lyman Frank Baum (“The Wonderful Wizard of Oz”), Alexander Volkov (“The Wizard of the Emerald City”), Brothers Grimm (“The frog king or Iron Henry”), and Hans Christian Andersen (“The Steadfast Tin Soldier”).

Poetry is one of the most philosophical branches of art. Let me give two examples of use of poetry in scientific and engineering education. When you teach entropy you can talk about Wystan Hugh Auden who has been admired by physical laws and wrote brilliant poem “Entropy” which is well studied by students and perceived with great pleasure. The Canadian engineer Tom Watson created luminous poem “Rust’s a Must.”

Historical aspects may be beautiful and enjoyable in learning scientific and engineering discoveries. In exact sciences there are quantitative measures of estimation of each value: mass, length, force, energy. In humanistic disciplines (history, philosophy, psychology) as well as in art there are no quantitative criteria. This is similar to question how to measure beauty, love, friendship, democracy? If there is no quantitative estimation of some category or phenomenon, any definition becomes undefined, ambiguous and abstract.

We know that in chemistry there is the function named Gibbs energy which defines the “love” between substances. Why there is no such function for estimation



**Fig. 7: “Pit”** by Philip Guston (1976). Pitting corrosion – severe local corrosion



**Fig. 8: “The Garden of Earthly Delights,” by Hieronymus Bosch (1510-1515) and three periods of car’s life: new car, beginning of corrosion, and destruction.**

of love between people? Thus people tried to estimate this and human chemistry appeared. Human chemistry is the study of bond-forming and bond-breaking reactions between people and the structures they form. Today human chemistry is similar to alchemy in the Middle Ages, it borders with art, but further investigation on the molecular level in human brains will help to discover what happens in our organisms, and intimacy will end.

Music has always been among the leading arts, and therefore has been used for different studies. Children learn the alphabet “ABC” to the tune of “Twinkle, Twinkle, Little Star”, and the states of the USA in the alphabetical order from a song “Fifty Nifty United States”; students learn some chemical reactions to the tune of “Oh, my darling Clementine”. We use mostly visual and hearing perception in education. Thus, we can connect music, word and picture or writing and use them in education. Here are some examples.

a. Thermodynamic reversible processes (a quasi-static process that happens infinitely slowly) can be associated with the eternal motion, namely, with the “Flight of the Bumblebee” by Nikolai Rimsky-Korsakov. When we are



listening to this music composition we feel that this music is eternal as well as there is no end both for it and for any thermodynamic reversible process.

b. The 2nd law of thermodynamics (the entropy of the universe tends to a maximum) is associated with the “Bolero” by Moris Ravel or “In the Hall of the Mountain King” (the suite “Peer Gynt”) by Edvard Grieg or “Polovetzskian dances” (the opera “Prince Igor”) by Alexander Borodin. The analogy is in the “expansion” of music during its development. The same occurs with the universe.

Certainly such music examples can connect beauty of scientific and engineering disciplines with the harmony – disharmony of our world, namely, better understanding and remembering of scientific and engineering disciplines. Humor is very fine and clever art in the area of human creativity. Humor occurs when the brain recognizes the pattern that surprises it (fig.9). The sense of humor is related to the ability of a person to detect a discrepancy in the world around him. Humor in education can help take away the tension, tiredness, “sleepness”, even misunderstanding, and relax. Anecdotes, jokes, jests, and quotes of famous scientists, engineers and artists may also help in understanding and accepting of the complexity and beauty of scientific and engineering disciplines. Here are several examples.



**Fig. 9: “Unique Forms of Continuity in Space” by Umberto Boccioni (1913) or “Erosion”. a, c – Erosion inside brass tube; b – The sculpture of Umberto Boccioni**

a. What is the difference between thermodynamics and stick? Stick has two ends and no one beginning. Thermodynamics has two “beginnings” (the 1st and the 2nd laws) and no one end.

b. When we use several times the name of some scientist, for example, Gibbs phase rule, Gibbs function or Gibbs energy, Gibbs-Helmholtz equation, chemical potential suggested by Gibbs, we may tell about the movie “The Angel’s Ash”. A pupil of twelve years old in small town in Ireland was asked to write a composition about Jesus. That was in 1930s.

The weather was rainy all time (Ireland’s weather!), there was no job for parents, no good flat, no enough food, and many little children died in Ireland. A little pupil of 12 wrote in the composition: “Jesus lived in the South in warm country (Israel) with much sun, there were no rains, and he had not to wear shoes. If he wanted to eat he went to fig or pomegranate trees and ate much fruit. If Jesus was born and lived in Ireland, he was ill and has died in the little age, and I had not to write this composition”. This is the place to joke that “because of Gibbs we should learn more and more thermodynamics”.

c. The British cosmologist Stephen Hawking said that we get pleasure from sex and science (and engineering), but from the latter much more time ... You may mention to your students that science and engineering are processes of continuing inventions, and we can enjoy every new acquisition in knowledge.

## Conclusion

Students, young engineers/scientists who received explanations of engineering and scientific disciplines in comparison with humanistic aspects showed more creativity and satisfaction in their job and life.

Humanistic aspects should be more and more included in engineering and scientific education, namely we can talk about “beautifying” engineering and scientific learning and education. Our experience is summarized in the book “Corrosion for Everybody” published by Springer in 2010.



## **Eternal Recurrence, Temporality & Technology: How contemporary computer art can learn from early modes of representing time**

**Laurel Johannesson, BA, BFA, MFA**  
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I am investigating the converging relationship between non-linear theories of temporality and contemporary artistic practices that use interactive, generative technology and the moving image. My enquiry focuses on the intersecting relationship between philosophy and art practices through an examination of the concept of time and temporality.

I will illustrate how philosophies of eternal recurrence relate to the origins of the moving image through early devices of repeating cycles and generative content that presented moving image or sound as a cycle, loop, or generator. I am interested in how early modes of representing time relate to cinema, and in turn how cinema has impacted the presence of the moving image in contemporary projected linear and generative narratives. At the same time, I will examine artists who make technology, the moving image, interactive, and generative content a major part of their practice.

Eternal recurrence is a concept that asserts that the universe has been recurring, and will continue to recur an infinite number of times across infinite time or space, in a self-similar form. The concept inherent in Indian philosophy was also found in ancient Egypt. The scarab (or dung beetle) was viewed as a sign of eternal renewal and the reemergence of life... a reminder of the life to come.



In a section of the Litany of Re in the tomb of Ramses III is shown some of the seventy-five nocturnal forms of the sun god, including one called 'Kheperer'. This is the dormant sun god of dawn who during the night was entirely black with a head like a scarab beetle, representative of the endless potential and inevitable spark of creation manifested in this being.



The infinitely cyclical nature of existence is also exemplified historically in the image of a dragon or snake eating its own tail.



It is a symbol that has itself been recycled by many culture but can eventually be traced back to Ancient Egypt (circa 1600 BC).



Friedrich Nietzsche resurrected the idea of eternal recurrence as a thought experiment to argue for amor fati (or the love of one's fate) and Thomas Browne in *The Garden of Cyrus* said "All thing began in order, so shall they end, and so shall they begin again." There are many more examples... however, the point is that with eternal recurrence, time is viewed as being not linear but rather cyclical.

### **Repeating Cycles / Infinite Loops / Generative Sound / Moving Images**

So it would seem that the idea of self-generative systems is not something new....they have been around for hundreds of years. Wind chimes are an example. When the wind hits the chime, it makes a new and different combination of sound each time.

By looking at the history of visual culture and media we can find many strategies and techniques relevant to new media design. To develop a new aesthetics of new media, we need to pay as much attention to cultural history as to the computer's unique new possibilities to generate, organize, manipulate, and distribute data. Artists, composers and musicians such as John Cage and Brian Eno have utilized generative art processes. They are interested in exploring the range of possibilities that could happen by chance and by accidental forces and with this in mind have created simple sets of rules to alter the original music in a random way. Generative art allows artists to define a set of rules or parameters which, once set in motion, can create works with the added impact of unpredictability and chance of the wind chime.



The launeddas is a typical Sardinian woodwind instrument, consisting of three pipes. It is polyphonic and played using circular breathing. An ancient instrument, dating back to at least the 8th century BC, Launeddas are still played during religious ceremonies and dances (su ballu). They are played using extensive variations on a few melodic phrases, and a single song can last over an hour. Circular breathing is a technique used to produce a continuous tone without interruption. This is accomplished by breathing in through the nose while simultaneously pushing air out through the mouth using air stored in the cheeks. The launeddas could be one of the first instruments to use the notion of a continuous loop.

The Phenakistoscope, the Zoetrope, the Zoopraxiscope, and the Tachyscope were all based on the same principle — placing a number of slightly different images around the perimeter of a circle.

The parallel between early cinematic and new media technology highlights an older technique useful to new media – the loop. Characteristically, many new media products, whether cultural objects (such as games) or software (various media players) use loops in their design, while treating them as temporary technological limitations. I, however, want to think about them as a source of new possibilities for new media. Nineteenth-century pro-cinematic devices, the Zoopraxiscope, the Kinetiscope, etc. were based on short loops. As cinema began to advance, the loop was downgraded to the low-art realms of instructional film, pornographic peep-show, and animated cartoon.

### **if / then**

### **repeat / while**

The loop not only gave rise to cinema but also to computer programming. Programming involves altering the linear flow of data through control structures, such as “if / then” and “repeat / while”; the loop is the most elementary of these control structures. Most computer programs are based on repetitions of a set number of steps; this repetition is controlled by the program’s main loop.



Since the 1960s artists have been gravitating towards an increased use of moving-image practices and technologically based work. I am interested in how this has impacted contemporary art practice and modes of presentation. The pervasive convergence of art and moving images has led to film and video installation becoming a dominant form of contemporary art. For example in the most recent editions of the Venice Biennale and Documenta, large-scale cinematic modes of projection have quantitatively surpassed traditional forms of expression such as painting and sculpture. From projected celluloid film, to digital video projections, to multimedia environments, film based sculptural objects, net-based and computer installations, and interactive or generative works.

The increasing acceptance of the technologically based moving image is of interest to me. For example to the astonishment of many, Bill Viola's *The Greeting*, the fifth of



the video installations *Buried Secrets* was shown in 2000 at the Art Institute of Chicago in a room surrounded by Titians and Pontormos thus challenging the paintings that had inspired the technologically based work.

Other examples of work by contemporary artists who use circular narratives in their work include Christian Marclay's epic 24 hour moving image installation, *The Clock*, in which Marclay created a montage of thousands of film and television clips with glimpses of clocks, watches, and snatches of people saying what time it is. Another work by Marclay, *Telephones*, includes hundreds of Hollywood film clips that form a repeating motif of dialing, ringing, answering, listening, speaking, hanging up.

Mat Collishaw's *Skin Flick* is based on the principle of cylinder anamorphosis. A video clip of a bullfight is used in place of a still and is presented on an LCD screen. A javelin, which appears to penetrate the screen functions as a mirrored cylinder and corrects the anamorphic distortion of the video clip. As the javelin sits at an angle, viewing of the work is not straightforward and walking around the cylinder becomes a game of seeing and not seeing, just as for the bull; taunted by a moving cape only to discover that it's target is actually elsewhere.

Mehmet Akten's *Simple Harmonic Motion* is ongoing research and a series of projects exploring the nature of complex patterns created from the interaction of



multilayered rhythms. It is a video and sound installation, developed around the concept of creating complexity from simplicity and is inspired by the works of Norman McLaren, John Cage, and Brian Eno – as well as observations from nature, physics and math. Through the use of custom software, a large number of ‘entities’ are generated, each follow an extremely simple repetitive pattern of movement and sound. On their own, each entity can be considered very monotonous, basic, mechanical, repetitive. The repetition duration, motion and sound of each entity is precisely tuned such that the collection of all entities moving together, creates a unique, evolving and complex composition – both visually and sonically.

British artist Nathaniel Mellors double-headed animatronic sculpture entitled *Hippy Dialectics (Ourhouse)* delivers a short schizophrenic dialogue that is both humorous and disturbing. The ‘Ourhouse’ in the title refers to a video work by Mellors. It’s a surrealist sitcom about an eccentric family featuring two central figures, Daddy and The Object. *Hippy Dialectics* features two versions of the ‘Daddy’ character (one blue, one yellow) connected by a ribbon of hair. Cast from the face of the film’s actor, the latex heads are brought to life by means of electronics and software. They deliver a looped pep talk, including a range of compliments (‘god, you’re looking buff. no seriously, you look great!’ and ‘cool, you are cool!’) before concluding with an absurd back and forth of “yes” and “no” between the two heads.

### **My Work**

I am an artist who is exploring the use of simple generative strategies that employ moving images and I'm interested in what sort of implications this has for my artwork. My interest is in using the moving image as a cycle, loop, or generator. How can generative strategies successfully be applied to aesthetic problems? Whether the aim is to provide a design solution or simply to explore the dynamic qualities of a given system, the process requires translating intuitive creative choices into rules and/or machine-readable code. What are the criteria for an interesting solution, what parameters and boundary conditions can be manipulated to produce satisfying results? These are some of the questions that I am interested in exploring through the process of creating my generative video installations.

My imagery concentrates around my own body integrations into naturalized settings that are depths of water along shorelines. I have recorded visual submersions of myself in distinct locations... Italy, France, Iceland, and Greece. I sought out specific locations that would reveal minimal, but absolute characteristics of the water conditions in each country. My research follows a vision whereby I utilize the waterous environs of the Adriatic, the Aegean and the Cote d'Azur as a means to camouflage the figurative self; a way of actually hiding myself in a skin that mimics the surrounding moss, sand, rock, reflections, or refracted depths.







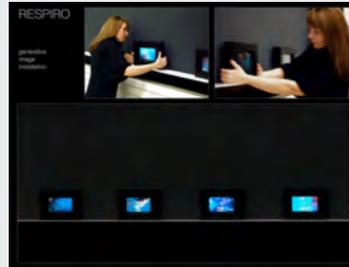
I am looking at innovative ways to input, manipulate and output self-generative visual material that still retains its' ethereal and lyrical qualities that are present in the raw photographs and video. By employing both human and technical intervention and utilizing some basic generative "rules" new image combinations are born with every permutation.

### **Acqua Vellutata Sospesa: Interactive Video Painting**

While the more primitive form of generative art easily maintains its' lyrical quality, I sometimes feel that the one fault of the technological form of generative imagery is that it can often become mechanical in appearance thus destroying any subtleties, or appearance of aesthetic emotion. I feel that the generative examples that I have mentioned are successful in overcoming this problem. So perhaps for me the real challenge in working with generative processes in my work is to combine an interest in science and technology with a commitment to the lyrical and sensual aspects of my imagery. This is a combination that would seem at odds but when delicately balanced can hopefully support one another and serve to strengthen the work.

For the Acqua Vellutata Sospesa project, I shot video of myself underwater at Santa Marinella along the coast of the Tyrrhenian Sea, sixty kilometers northwest of Rome, Italy. In antiquity, Santa Marinella was the site of Aquae Caeretanae, a Roman bathing resort. The act of swimming underwater defies the sense of equilibrium the body requires: gravity, sight, hearing... balance. I place the viewer as voyeur, inside my shifting ground that contains both figure and water as one amalgam.

The open source programming language of Processing was used to create the project. The underwater video located in the sketch's "data" directory was inserted into a chunk of simple Processing code. The code gives the command to load and play the movie in a loop and the drawing function allows the video picture to be used to paint using the mouse, track pad or other device such as the iPhone.





By manipulating the tint or transparency as well as the image, the video leaves a trail or evolutionary history in its' wake. Tint sets the value for the displayed video. The video can be made transparent by setting the alpha. For example, a tint of (255,128) will produce an image that is fifty percent transparent. For this project the fill value was set at (255,5). The image parameter specifies the image to display and the x and y parameters define the location of the image from its' upper-left corner. The image will move when the cursor is moved.



Viewers receive an i-phone shaped instruction card when entering the installation. They may choose to download the MSA remote application to their iPhone or use iPads housed in the gallery space. The viewer begins with a blank black "canvas" and then "paints" layer upon layer of video to build a fluid image.

I have created a water environment that responds to viewer controlled movements and encompasses the viewer in the environment that I put myself into in my images. I want the viewer to experience the feeling of being submerged in and enveloped by the water and to be able to "paint" with the liquid video imagery.



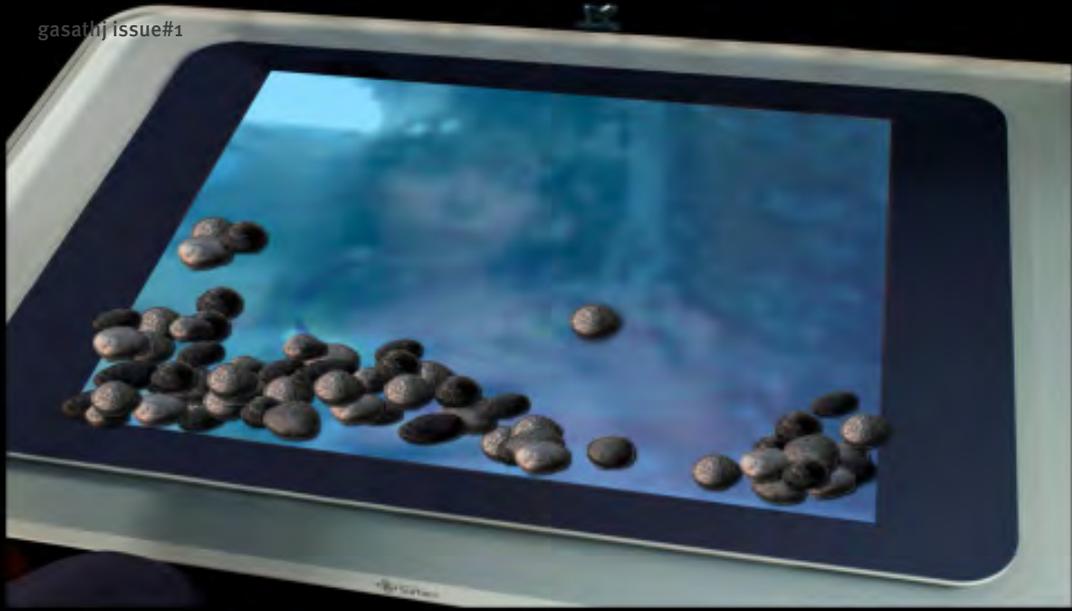
Viewers who have experienced the interactive video painting have instantly become engaged with the activity and have rapidly gained skill and ability in creating their own composition with the supplied water video. The ever-changing footage provides a sort of brush for the painter to create with. Each participating painter has come up with a unique composition with movements, gestures, and signatures specific to them.

## **The Narkissos Project**

While my previous work has related to my own body and image ... and the effect of the watery surroundings that I place myself in, The Narkissos Project casts the viewer as subject and seduces them into interacting with their own watery “reflection” through the familiar sensations of touch, vision, and sound.

Just as with my previous works, I place the viewer as voyeur and at the same time subject, inside a shifting ground that contains both figure and water as one amalgam. The point of view is from outside looking in and under, operating in a kind of *lussuria ossidionale*; as sublimations of unattainable acquisition, just out of reach by the nature of our imperfect vision into water. In The Narkissos Project the spectator’s transition into another world happens through touching their own fictitious face and moving pebbles to disturb the water’s surface both visually and aurally. Touch is the interface into the virtual world and the mediator of different languages and perceptions. To touch a water surface, to influence a mirror, to make sound when moving something are reactions which correlate with reality.

As the viewer gazes at the pool before them, an image of their face is captured. As they begin to interact with the virtual watery pool by moving pebbles around on the surface of the interactive tabletop, the sound of water is produced. The viewer can create their own soundscape by moving a single pebble to another location or by sweeping a number of pebbles across the surface. The sound created by the participant is made up of recorded samples that I collected in caves and along shorelines in Greece. Drips, drops, echos, swooshes. The more pebbles in play, the more sound combinations created. Different motions and combinations of pebbles will generate different res



The interactive water layer consists of video footage also shot in the Aegean Sea. As the participant interacts the placement of the pebbles will trigger a pooling action that will disperse the water layer in relation to the size of the pebble.

The pebbles collected along shore lines in Greece act as the tangible user interface for the sound and related visual effects. The pebbles will not have specific properties attached to each individual object but will however have general characteristics related to their size. Smaller pebbles will trigger softer and higher pitched sounds. Larger pebbles will correspond to louder and deeper tones and will disperse more water. The more pebbles in action, the more complex the sound. The sound emitted will be harmonious by default. Visual clues in the way of water dispersion created by pebble placement will relate directly to the sound. Finally, the fascination of watching one's self transform combined with tangible user interface controlled sound will entice even the novice narcissist into a brief trip into the watery abyss.



## **Conclusion**

So when I am creating my interactive or generative works I am looking to the past and the history of early modes of representing time to inform me... the philosophies of the Egyptians, the simplicity of the wind chime, the mesmerizing quality of the zoopraxiscope... all of these generative loops can inform and bring their lyrical qualities to current day technology. As the practice of computer programming illustrates, the loop and the sequential progression do not have to be considered mutually exclusive. A computer program progresses from start to finish by simply executing a series of loops.



## Mandala Cruft

### Robert Spahr

<http://www.robertspahr.com/work/mandala/>

This cruft algorithm extracts an image from the CNN home page once every eight hours. The image is then processed into a mandala, with the addition of the original source image and caption. CNN presents a constant stream of images of violence, potential terrorism, and the imminent hurricane or earthquake, as well as the daily dose of political polarization. As an artist I want to take these powerful source images and convert them into equally powerful images of peace. I hope you enjoy them, while also being reminded of the transformation from which they were created.

#### What is CRUFT?

cruft /kruhft/ [back-formation from {crufty}] 1. n. An unpleasant substance. The dust that gathers under your bed is cruft; the TMRC Dictionary correctly noted that attacking it with a broom only produces more. 2. n. The results of shoddy construction. 3. vt. [from `hand cruft`, pun on `hand craft`] To write assembler code for something normally (and better) done by a compiler (see {hand-hacking}). 4. n. Excess; superfluous junk; used esp. of redundant or superseded code. 5. [University of Wisconsin] n. Cruft is to hackers as gaggle is to geese; that is, at UW one properly says "a cruft of hackers". *The Jargon File, version 4.4.7*, <http://catb.org/jargon/html/C/cruft.html>

I am interested in how the ideas and images presented to us by the media affect our world view. As the ever present cable news cycle pushes a daily message of fear, filled with political polarization; domestic and foreign terrorism; recent kidnapped white girls; celebrity scandals; and the imminent threat of hurricane, earthquake or flood, I began to think about how these digital images and text operated, one day influencing our daily discourse, the next day vanishing without a trace. Digital leftovers reminded me of redundant computer programming.

Code that was once useful, but later forgotten and obsolete. For my current work I have borrowed the computer hacker term 'Cruft', defined as an unpleasant substance; excess; superfluous junk; and redundant or superseded computer code.

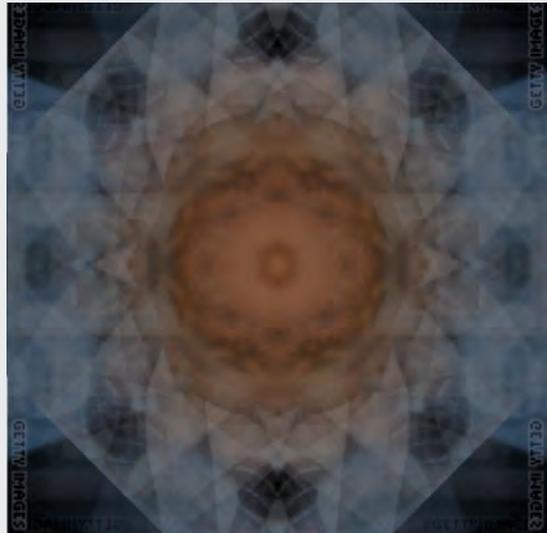
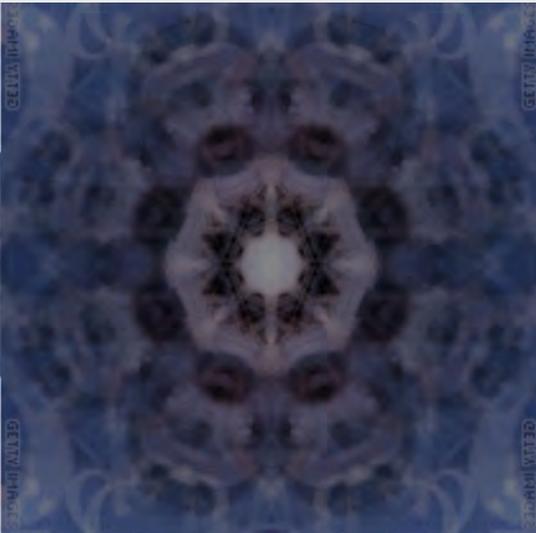


Prosecutors: Keep Sandusky indoors, away from school



Blasts hit Syrian government buildings

To create this work I call CRUFT, I write simple algorithms that an automated computer system follows. The instructions outline what websites to target, and the system then downloads selected images and text, which are then used as source material, and remixed to create new artwork on a schedule that imitates the 24 hour cable news cycle.



Romney: I was severely conservative as governor



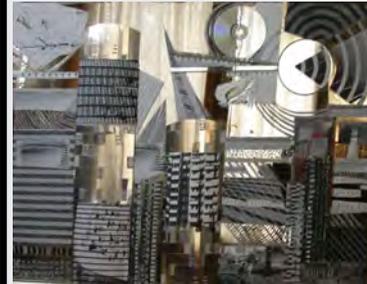
Obama budget: \$901 billion deficit in 2013

## Data Mining, Forever, Green Architecture

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### Data Mining

Humans create cities, whereas a city metaphor reflects data sets. Brief description of the storyline: What technological and human worlds have in common? Natural order guides our understanding of big data sets related to network analysis, when we employ physical analogies of the data, render the data graphically, explore them 'by eye' and interact in real time. My task is to juxtapose the regularity of nature with man's physical and intellectual constructions.

The big city, for example, combines how humans affect their environment, and how a city metaphor reflects rhythm and organization of big data sets, and makes data mining easier. Observers — whether artists or technology experts — perceive such relationships from different perspectives and different points of view.



## Forever

This work talks about the victims of the eruption of Mt. Vesuvius when an ancient Italian city of Pompeii was demolished in the 1st Century A.D. by this event. The lava covered remains. This interruption offered an insight to scientists, art historians, artists, architects archeologist, sociologists, psychologists, anthropologists, philosophers, business related professionals, and more.

Those who'd try to swim, would drown, those suffocated, would disappear from fire. Since it happened at nighttime the bodies were found mostly in sleeping positions, and the lava preserve them and their architecture, art, and artifacts in statu nascendi. The lava was used by Romans for a special long lasting type of mortar possibly used for structures such as Colloseum. Some say the wine produced at that time on the volcanic areas was recently recreated.

The city was first discovered in High Renaissance by an architect, who after seeing the frivolous scenes on the frescoes, quickly reburied his findings, in order to save it all from a likely destruction caused by people obeying current laws and moral codes. When rediscovered again, the site was preserved, categorized, labeled and organized into a database and research libraries.

Allegories of irrepressible desires, mystical scenes of funeral dances, and initiation rites survived on fragile frescoes and mosaics under the Vesuvius ash. Irrepressible desires, dances, rituals, and a mystery of life continue on the surface. The discovery of the information frozen in time and uncovered by this event started a never ending discussions, admiration, inspiration and thought provoking discourses, literary and artistic works, and forever changed our perception.



**Green Architecture** We care about knitting together dwellings with a landscape, with roofs repeating the line of the hills, and slowly learn to draw natural resources from the power of sun, wind, and water.

### **Artist Statement**

Natural order infuses several levels of both worlds: some determined by man and some determined by nature. It guides our understanding of big data sets related to network analysis, whether we employ physical analogies of the data, render the data graphically and explore them ‘by eye’ or interact in real time. Acutely aware of order, I examine what technological and human worlds have in common. Natural order, revealed randomly and regularly, infuses several levels of both worlds.

My task is to juxtapose the regularity of nature with man’s constructions, both physical and intellectual. The big city images, for example, combine how humans affect their environment, and at the same time, how a city metaphor reflects rhythm and organization of big data sets, and makes data mining easier. Observers — whether artists or technology experts — perceive such relationships from different perspectives and points of view.

I aim to develop messages using sets of images that become symbols, in a way similar to the sets of words constructing sentences. Same images gain different meaning in various contexts.

My computer graphics explorations serve as a point of departure for a series of prints or sculptures. I explore the dynamic factor of line. I transform an image of an animal into a simple image, an iconic object such as rocking horse or a symbolic picture of a bird, to present them in dynamic movement as the visible texture of the sky and the ground.

In our visual planes of multiple horizons, every time we see the familiar image on the floor of ground and the wall of sky, soft and hard inhabitants sharing lots and acres; we see them as having common goals, and joining tasks. Some of these explorations have resulted in figurative three-dimensional designs based on an image of transformed manikin that served as a point of departure for a prints and sculptures. The repetition of human figures, depersonalized for the purpose of fulfilling the goal, has been put into the ordered, endless landscape. I have unified the meaning of human and a landscape using the same approach: rigid order created with a computer.

Processes in nature and events in technology inspire my images. Such processes also support my instruction in computer art and graphics, where students learn to create artwork inspired by science and demonstrate what they understand of scientific concepts.

### **Technical Statement**

Typically, my creation process runs through several stages. First I draw abstract geometric designs for executing my computer programs. I use the computer on different levels. Some of my computer programs produce two dimensional images; others are three — depending on my composition's final dictates. Then I add photographic content using scanners and digital cameras. The programs that produce two-dimensional artwork serve as a point of departure for photolithographs and photo silkscreened prints on canvas and paper. They are included both into my two-dimensional and three-dimensional works. All of these approaches are combined for image creation with the use of painterly markings.

For three-dimensional works, computer programs make representations of masses in a vector mode that shape my wooden and mixed media sculptures. Later, the 3D wireframe designs guide construction of wooden and mixed media sculptures. I often incorporate the factor of time into the sculpture, giving the viewer the illusion of movement. I also develop time-based media.

## A Summary

Generative art results in precise images with perfect lines that follow premeditated transformations. I started working with computers by programming, with a distant dumb terminal connected to the station via modem and a phone. I waited two hours for b&w prints and three days for color slides. I remember losing generations when working with film as an analog medium.

I could include color, shade, patterns, apply clipping algorithms, rotate and paste content into other images, zoom and transform. Then, photosilkscreen and photolithograph gave me a new level of color combinations, and the messiness of paint. Movies involved the fourth dimension. Through the use of software I can recycle drawings along with generative shapes and patterns.

I transform algorithmic images into physical constructions. Free of details images became synthetic expression of the figure. I also created sculptural forms in 3-D programs and used prototyping. In order to address the factor of time and add some explanatory power and dynamic storytelling, I present images along with related movies.

We can only change the distance when we look at the two-dimensional work, yet we can walk around the sculpture and explore the interactive character of time-based art. By adding action inside the surface of the image, I hope to attain another level of possible connotations and interpretations. The next stage – combining it all together and adding painterly marking – became fully digital.

In my works, natural order infuses several levels of both worlds: some determined by man and some determined by nature. It guides our understanding of big data sets related to network analysis, whether we employ physical analogies of the data, render the data graphically, or interact in real time. Acutely aware of natural order that infuses both worlds, I examine what technological and human worlds have in common. My task is to juxtapose the regularity of nature with man's constructions, both physical and intellectual.



## **Bio-Structural Analogies: Arms, Wings And Mechanical Things**

**Prof. Anthony Viscardi**

Lehigh University



### **Analogical Design Assimilations**

One of the challenges of design instruction is to establish a fertile environment for discovery and imagination, whilst grounding design work within architectural constraints. The beginning student especially has difficulty juggling the specific programmatic requirements of a studio brief, and the openended-ness of the design process itself. To compound this dilemma, design studios often assume the lexicon of “problem-solving”; the final design is commonly referred to as a “solution” or “answer”. When the design process is goal-oriented in the early stages, the possibilities for open exploration and imagination are



curtailed. An experimental studio at Lehigh University's Department of Art and Architecture sought to remedy this dilemma.

In order to establish the studio as a setting for wonder, research, and invention, two consecutive iterations of this experimental studio emphasized the process of design inquiry. The specific programmatic requirements of the project were withheld at the beginning of the studio, and instead, the students undertook a series of intensive exercises (which were cumulative in effect) based on a series of analogical studies. Analogy was an effective device for creative invention, since parallel readings were implicit at many levels, from surface meaning to operative functioning. Analogical exploration also allowed the students to assimilate complex forms and processes from realms outside of the architectural discipline. The students were thus enabled to discover architectural form and use in a manner unencumbered by preconception and conventional program.

Using analogy in the form of design assimilation, one is positioned to rely on his or her creative ability to associate and fabricate objects that engage materials into relationships that convey parallel meanings. These constructions can, in turn, establish formal orders that become the basis for an architectural grammar of details. Their meaning is gained through their ability to conform or transform to the context in which they are placed. These construction details can also be employed as a point of departure in the development of a design process. Through an analogical study of the joints in the body, the invention of a joint detail can form the basis of an architectural vocabulary that can lead to several forms of design development.

### **Arms and Wings**

The analogue studio, therefore limited itself to the investigation of the architectural part, or detail, specifically, joints and connections. These exercises would eventually lead to specific propositions, such as, cantilevers, corbels, arches, trusses, hinges, and pivot joints.

These devices were not a priori goals, but were discovered through the form-making process itself. To begin, the students observed and compared the arm of the human body and the wing of birds, bats, or insects in terms of dynamic forces accommodated by the muscles, tendons and joints of these two body forms.

### **Mechanical Things**

The students then proceeded to develop a third collage of mechanical artifacts that had an affinity to the previous studies. Simple devices (such as lamp arms, car jacks, umbrellas, drawing instruments) were sought. As in the earlier collages, mechanical items were sampled from a combination of photographs, objects, drawings and words. The students concurrently observed the drawings of Leonardo da Vinci, in particular those that simultaneously convey the analogous workings of mechanical, anatomical and architectural devices. From these drawings the students inferred the interchangeability of parts that were human, animal and mechanical – i.e. whereby one part could be the “prosthetic” of the other.

### **SIMULATION VS. ANALOGY**

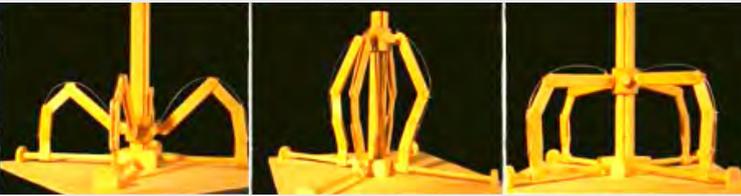
#### **mechanical simulacrum**

From the studies in Exercise Two, each student created a model, or mechanical simulacrum, that could demonstrate the dynamic actions from their wing analysis. These models were crafted from basswood using mechanical hardware for joints and built at a large scale (usually 1:1). Using the form language derived from the geometrical abstraction (the second layer in Exercise Two), these constructions translated the actions of the wing in its entirety.

Resemblance of the model to the mechanical, (or operative) appearance of the entire wing was desirable in this model. mechanical analogue

The students constructed the second model, or device, as a mechanical analogue to a specific part or detail of the wing analysis. It gained its potency from the nature and fit of its parts. This model did not attempt to resemble but to demonstrate metonymically the action of a particular condition. The parts could be separated from their context or viewed as a series of parts disconnected from the whole.

Resemblance of the model to the original was not desirable for this model. The models were meticulously crafted, whereby each and every joint and connection acquired a distinct character. The students made additional “working drawings” while constructing the models, whereby drawings and models informed each other in an interactive dialogue. Each model obtained an intrinsic value in relation to its function of movement and support and also acted as an initiator to new refinements and innovations.



### **Natural Growth as a Generative Analog**

For the second iteration of this studio, in a reversal of ordinary studio practices, the students assumed the responsibility for determining the meaning and functions of their architectural constructs. By looking at function as a response to the manufactured artifact (rather than as the initiator of its design) the students evaluated the intrinsic properties of their invented form.

Could the devices return to architectural situations that involve the action of the human arm, such as a door swing? Could their devices become roofs, walls, or both simultaneously? Could the study of natural growth patterns provide an analogous process to design development? In all things natural, growth generates form. The students were now to reconstruct a new body propagated through the multiplication of a single element of the arm or wing into an organization of parts.



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