Lecture: Introduction . Art + Architecture . Science

1. Introduction:
Science vs Art
Architectural Form
Sci/Art and Architecture

2. Art + Architectural form:
Oron Catts, Leonel Moura.
Types of architectural form:
Theoretical. Interactive

3. Science:
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Seminar: CA – Conway's Game of Life. Ants. My model.

1. Introduction:
Science vs Art
In the medieval times science and art carried the same meaning which was skills and logic. They were representations of the so called seven "liberal arts" which later started to be called the seven "liberal sciences" namely, grammar, rhetoric, logic, arithmetic, geometry, music and astronomy. After the 13th century and as civilization and learning developed, the words took independent meanings, where "science" meant knowledge and "art" meant application of knowledge. Thus, the science of astronomy was the basis for the art of navigation.

So what would you think art will mean in the future?

Architectural Form
Architecture has always been considered as a very important part of a bigger umbrella, art. As part of nature itself architecture is inspired by nature with ideas, shapes and forces which are represented in architectural forms that are related to human activities and the environment.

So what does form mean? What is form and how do you define it?

Form is not only a representation of the external shape or appearance of an object. Form can mean any behaviour, structural configuration, pattern of organization, or system of relations that occupy a space in time.

Sci/Art and Architecture

This is a new and fertile field that I'm introducing here and that is why there are very few references on the subject. Part of this field is concerned with bio work or what is called wet art, mainly dealing with biological materials and shapes which I'm going to talk about later. The other part which is what interests me is sci work where principles and ideas of complex systems are used and this is where the outcome which is in this case the art work might never look like the natural form which these systems and principles were derived.

2. Art + Architecture:

Oron Catts

http://www.tca.uwa.edu.au/

He is an artist and the director of SymbioticA which is a research group for artists exploring in the field of science. The group is based within the School of Anatomy and Human Biology in the University of Western Australia. The victimless leather jacket was his most recent work.

Leonel Moura

http://www.leonelmoura.com/index.html

Artist interested in robotics and bioArt painting and artificial life. Robotic action painter is his latest work where the robot can paint and determine when the painting is finished based on artificial intelligence algorithms. http://www.lxxl.pt/artsbot/index.html

Types of architectural form

Theoretical Form

The form is abstracted away from its material instantiation and encoded as a system of rules and principles working fluidly together. "form as process".

Interactive Form

Interactivity is the best way to see form as a system because of the feedback loops involved in the process of creating and sustaining these forms.

Michael Fox

Robotecture, Bubbles.

http://robotecture.com/

http://robotecture.com/bubble/

3. Science:

Complex Systems

Many artificial, natural objects and networks can be considered to be complex systems. The term complex systems refer to any system with many strongly-coupled degrees of freedom, behavioural and structural freedom.

Principles of Complex Systems

Seed: Matter and non matter/ Information

A seed/info is a starting point of any thing to happen if it is a matter or non matter.

Growth: Emergence – AL

Growth is a one of the signs for living objects and means a continuation of a process or system in progress.

Emergence

Emergence is the process of complex pattern formation from more basic constituent parts/agents or behaviour and manifests itself as an emergent property of the relationship between these elements.

AL

Artificial life is the study of life through the use of human –made analogs of living systems, evolving software that is more alive than a virus.

Behaviour: Stigmergic Behaviour.

Behaviour usually is referred to an action or reaction of an object or organism in relation to its context.

Stigmergic Behaviour

Stigmergy is a tool of communication in emergent systems where individual parts of a complex natural system communicate indirectly with each other through modifying their local environment and this is called stigmergic behaviour. The best example of stigmergic behaviour is ant behaviour. We'll talk about ants a little bit more with some interesting simulations in the seminars.

Learning: Feedback Loops

As a consequence of the interaction between those individual parts and their environment, the system starts to encode learning through feedback loops. Feedback loops can be negative or positive. Positive feedback: the more you put the more you get (makes the system grow), and negative feedback: the more you put the less you get (controls the growth of a system).

Seminars:

Talk about Conway's game of life and the ant behaviour. Introduce my genetic code model!

CA

A cellular automaton is a set of rules modelled on an infinite grid of cells, each in one of a finite number of states.

Conway's Game of Life

All the cells in Conway's game of life follow simple rules which capture coordination between the cells to form a certain pattern.

A cell can be alive or dead. A live cell is shown by putting a marker on its square. A dead cell is shown by leaving the square empty. Each cell in the grid has a neighbourhood consisting of the eight cells in every direction including diagonals.

For a space that is 'alive':
- Each cell with one or no neighbours dies, as if by loneliness.
- Each cell with four or more neighbours dies, as if by overpopulation.
- Each cell with two or three neighbours survives.

For a space that is 'empty' or 'dead'
- Each cell with three neighbours becomes alive.

http://www.math.com/students/wonders/life/life.html

The life game is an excellent example of emergent complexity.

Ants:

Ants are social insects which live in an organized colony. Colonies consist of a series of underground chambers, connected to each other and the surface of the earth by small tunnels. The colony is built and maintained by worker ants, who carry tiny bits of dirt in their jaws and deposit them near the exit of the colony, forming an anthill through a decentralized set of rules.

The ant colony behaviour is a representation of collective behaviour in complex emergent systems, which can be referred to as swarm intelligence.

Besides touching and smelling ants communicate to one another indirectly by laying down pheromones along their trails while foraging. They are attracted to the pheromone and that is why they follow each other and this is called stigmergic behaviour.

The discrepancy between the complexity of the anthill and the complexity of the individuals that construct it is, striking. Although the main drive of the inhabitants – an emergent drive rather than a designed one – is to exploit food sources through communicating with each other, but the end product is vastly more complex than just a giant

storage room for food. Each ant colony maintains a multifunctional complex system providing an environmentally controlled mass with food storages, housing, cemeteries, and even places for cultivating fungi which are fed and maintained on collected and stored food and water. Show examples of ant hills here.

http://www.forgefx.com/casestudies/prenticehall/ph/ants/ants.htm

http://zool33.uni-graz.at/schmickl/models/ants_foraging_decision.html

References:

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http://www.tca.uwa.edu.au/

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http://www.idmind.pt/en/culture/ArtsBot.php

Michael Fox
http://robotecture.com/bubble/

Interactive Architecture:
4dspace: Interactive Architecture. Architectural Design Vol 75, No 1, Jan/Feb 2005.

Physical Computing by Dan O'Sullivan
http://itp.nyu.edu/~dbo3/physical/physical.html

http://www.interactivearchitecture.org/

Conway's Game of Life
http://www.math.com/students/wonders/life/life.html

Ant simulations:
http://www.forgefx.com/casestudies/prenticehall/ph/ants/ants.htm

http://zool33.uni-graz.at/schmickl/models/ants_foraging_decision.html

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