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# Theatre of Restless Automata

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**Abstract**
*Our enthusiasm for scientific modelling techniques and fascination with natural systems has inspired us to develop computational artworks over the last six years that explore the aesthetics of emergence, computational abstractions, artificial life and belief systems. These computational works have culminated into a solo exhibition* ***Theatre of Restless Automata*** *which toured nationally during 2005-2006 and selective works have been exhibited at ACE, Los Angeles (2006), Third Iteration, Melbourne (2005), SIGGRAPH, Boston (2006) & Los Angeles (2005) and Transmediale.05, Berlin (2005).*

*Here we will discuss the three computational artworks – Biomes, RandomSeed and Ornamental Bug Garden 001 which were shown in* ***Theatre of Restless Automata*** *and other preparatory works which commenced our ongoing research into artificial-life and digital biology.*

## 1. Introduction

We are interested in building observable phenomena of intrigue and beauty, using techniques similar to those used by scientists to understand the natural world. In the ***Theatre of Restless Automata*** systems the sensation or illusion of life is our key interest rather than a desire to create life itself. Like technology, nature refuses to rest. In a fast changing world the boundaries between the mechanics of nature and technology are blurring. This is reflected in the works within ***Theatre of Restless Automata*** as they function as machines and organisms alike. We consider these works like biological timepieces built with the production values of early watchmakers whose skills were translated to the creation of automata. Here these intricacies of engineering are translated to the computer with the tiny cogs and chains replaced by computational mechanisms. Mechanisms that are open-ended, changing in a positive direction, never returning or repeating.

All the ***Theatre of Restless Automata*** works exists as objects that can either wall hang or be free-standing. The screen is visible through a square or circular lens that has a foreshortening effect, bringing the image surface level with the surrounding frame to subtlety but profoundly change the viewing experience. In this form the work is experienced intimately where only a few people can view the systems at one time. Our computational artworks have explored the sometimes uncomfortable ground between what we know to be true and what we imagine to be possible. Computer technology allows us to create compelling fictions and in our work we create fictions of nature and life. The works are always obviously unreal and do not attempt to look photorealistic but they are always live and have a quality that resonates with our understanding of life. There is a great deal of criticism in the use of special effects in films as opposed to the approach taken (when these effects were not possible) that depended on the viewers ability to imagine. It is this ability to imagine that we often adopt in the visual appearance of our computational artworks - using artificial life techniques, we aim to put forward just enough to set our imagination in motion.

## 2. Wish

An online artwork we created in 2006 entitled *Wish* (see

Figure 1) emphasises this notion of an environment that is dependant on the participant's imagination. *Wish* depicts a wishing tree inspired by the Lam Tsuen Wishing Trees in Hong Kong where visitors make a wish by writing it on some yellow paper and tying it to an orange. Then they try their luck at getting it to hang on one of the branches of the wishing tree. If your wish hangs in the tree it will come true, if not the myth claims that you have made your wish too greedy.

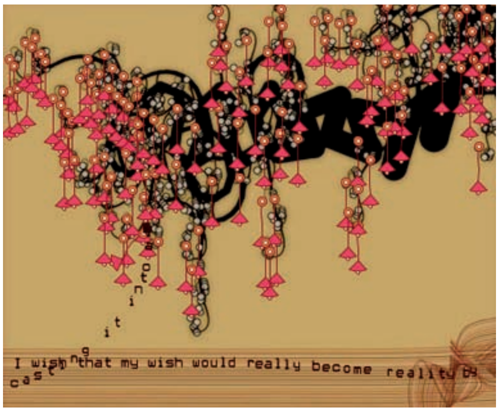


**Figure 1:** *Wish, online project 2006.*

Like the sacred Banyon trees in Hong Kong visitors can type a wish and attempt to cast it onto a branch of the online tree. We then use a simple physics simulation to add the element of chance that users of the real tree experience. Wishes missing all branches fall to the floor scattering their individual character in the dust. The database technology used allows us to store but not grant successful wishes. As one user wishfully submits to the tree 'I wish that my wish would really become reality by casting it into a computer' they note our inability to write wish granting software. In the case of the wishing tree we add weight and gravity to that which is weightless ethereal and of the mind. Unlike the real tree the weight and gravity are simulated and our belief suspended only momentarily.

## 3. Biomes

The *Biomes* are a series of six screen based computational art works produced in 2005 that use generative processes in the creation of a dynamic world. The virtual space of the world extends far beyond the bounds of the screen with an approximate circumference of a mile and is inhabited by abstract bodies inspired by creatures of the deep. Each of these bodies (we refer to as machines) uses simple rules to generate their own unique markation. Each biome is running the same software but as the machines are generative each system is evolving differently. The patterns have been slowly increasing in complexity since April 2005 when we first launched them. This visual complexity is augmented by a component of the program that acts like a virus, seeking out machines lacking complexity and forcing them to reload their pattern. Even we, the authors of the program, cannot foresee how the machines will look.

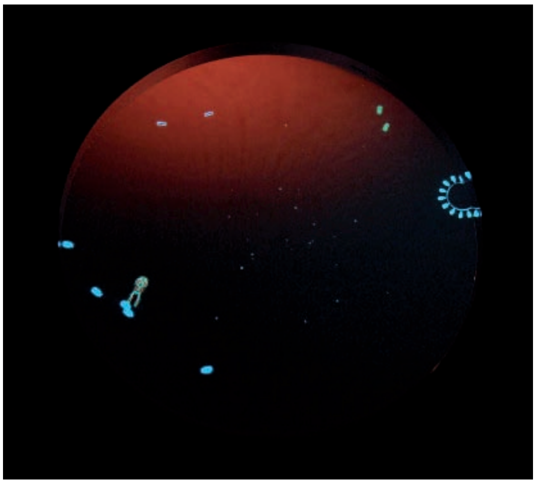

**Figure 2:** *A Biome, computational system 2005.*

The unique appearance of each machine contributes to the overall diversity of the *Biomes*. Like those who view the work we have our own favourites, likes and dislikes. As the space beyond the screen is so vast, when a machine we like disappears from view, it may never be seen again.

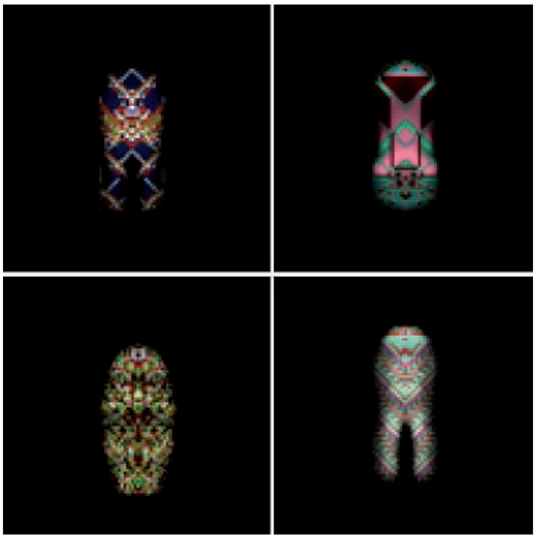

**Figure 3:** *Four different machines from a Biome, 2005.*

The *Biomes* continue our exploration into creating software driven environments that change in a positive direction over time. We first explored this concept in our computational work *System 1.6* which was produced during a thematic residency on *Time* at the Banff Centre of Arts, Alberta Canada in 2001. *System 1.6* uses artificial life algorithms to construct a live sound composition.

It is a tank that contains thirteen digital species that interact with each other in a brightly coloured electronic world. We designed a plethora of electronic species before deciding upon the thirteen used within *System 1.6*. Like balancing the ecology of an aquarium, it was important to find the right combination of hunters and prey to ensure that the audio composition would shift between moments of franticness and tranquillity. When the digital species interact, they spark off an explosion of sound.

We was keen to have an audio component within the *Biomes* so we provided each machine with a library of vocal calls that accompany certain behaviours or interactions with other machines. These are only heard when the machine is near the viewable area. Sometimes faint calls can be heard as a machine passes close by the window without making an appearance. One machine in particular sometimes makes a dramatic appearance flashing a bright light on a protrusion similar to that of a lantern fish. The flashes are accompanied by the sound of an explosive electrical discharge and many other machines react defensively, turning out their light and sneaking away or aggressively shooting sparks at the offending machine.

## 4. RandomSeed

In 2002 we was awarded a year Navvygate New media residency at Artsway, UK entitled *Hello world*. Within this residency we deconstructed computer programs to produce computational paper based artworks. Artists, students and curators with no programming experience took part in our workshops to produce flocking, movement and growth algorithms executed with paper and pen.

This year residency explored computation and algorithm away from the computer in an attempt to unravel the mysteries of programming as a creative form of expression. It was during this residency that we became fascinated with computational models that predated electronic computing, in particular Cellular Automata. This drew our attention to the high level of visual complexity that can be achieve from the repeated execution of very simple rules and we developed an extensive range of Cellular Automata based rules and systems before finally arriving at the ones implemented in the *RandomSeed* systems*, 2004* (see Figure 4).

Peering into a *RandomSeed*, viewers see small black dots industriously working their way through a circle of pixels. As the dots move through their simple world their endeavours yield structures that reflect patterns in nature. At first these appear as simple pathways weaving and intertwining. As time passes these grow in their complexity allowing the viewer to witness the formation of an intricate pattern with subtle visual qualities. This visual complexity continues to grow until the image takes on a textured appearance, similar to rough stone or television noise. The exact visual properties of these line and textures are determined by simple rules brought into being when the system was first launched.

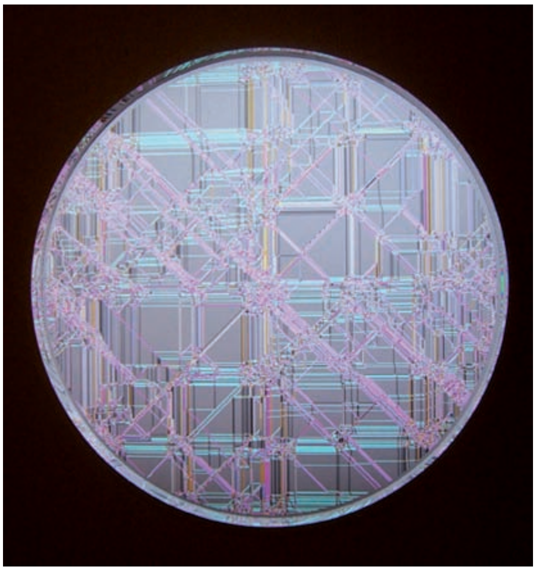

**Figure 4:** *RandomSeed, computational system 2004*

By slightly varying the machine head instructions we created a huge range of diverse images. For example, the two *RandomSeed* systems within ***Theatre of Restless Automata*** have slightly different boundaries. In one system, machine heads leaving the circle return to the opposite side; in the other system they are placed back in the centre. After running both these systems for a couple of months you can appreciate the subtle differences in how the images develop. But however many times we re-launch a system we still find ourselves surprised by the beauty and intricacy of the images.

## 5. Ornamental Bug Garden 001

One day whilst watering a house plant we found our inspirational life form for *Ornamental Bug Garden 001*. Our plant pot had an infestation of tiny bugs that ping.

Later, we learnt the name of these bugs – Springtails (Collembola) represents a versatile organism that can be found almost anywhere in the world from the Antarctica wastelands to the deserts of Australia. What we saw was not a disgusting pest requiring immediate, unremorseful, annihilation but a dynamic and engaging mechanism from which we could make a new piece of work. We first explored the movement of these organisms in a preparatory sketch entitled *Springtails* (see Figure 5).

**Figure 5:** *Springtails, computational system 2003*

Like our plant pot organism a user could prod one in this case not with a pencil but a mouse, this would trigger the bug to ping. If the bug lands on open ground then no big deal. However, on landing in a space occupied by another Springtail, the horror of this unexpected meeting upsets both parties equally, causing them both to ping. This results in two airborne Springtails with twice the possibility for a further collision. With the right population density this can cause a chain reaction transforming the system from a state of rest to one of turbulence. When so many are airborne as to leave none to land on, the system may return, sometimes reluctantly, to a state of rest. These bugs became ideal machines to populate *Ornamental Bug Garden 001* (see Figure 6), continually altering the state of the system and ensuring that a narrative unfolds over time. In *Ornamental Bug Garden 001* the Springtails attempt to space themselves evenly across the floor. Many are forced onto wires, the arrangement of which encourages their assent until they are either ejected by a falling weight or reach the top where their only option is to jump. On their decent they collide with flowers and bubbles before ending back on the floor, causing all their comrades to shuffle around and the cycle begins again.

The Individual elements of *Ornamental Bug Garden 001* have been generated algorithmically using software created by us, before being carefully composed in their final form. In building the garden we become the designers of closed ecosystems. In addition to considering the shape colour and form of the elements used within the garden we must consider their effect on the overall ecology of the system.

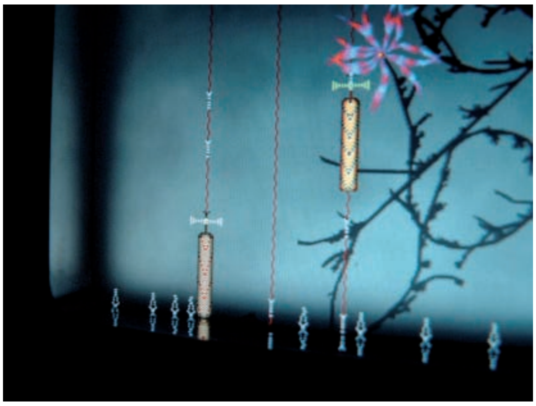

**Figure 6:** *Ornamental Bug Garden 001, 2004*

For example certain behavioural characteristics or population numbers could cause the systems to reach a state of entropic stagnation. The complexities of the overall sound composition are the result of emergence within the system. As *Ornamental Bug Garden 001* colonies of objects catapult around a garden containing bubble pumping lifts and algorithmically composed plant life. Collisions with its elements trigger sounds and compose an incidental sound piece. The pattern on the weights has been developed using a system that combines Cellular Automata rules with the principles of a two-dimensional Turing machine. The plant form uses principles similar to L-systems. In a garden, elements are composed and managed in a way that tries to be natural whilst often combining formal sculptural elements to create a place of tranquillity and relaxation. In artificial life modelling the purpose is normally to understand or predict how a natural system may behave in certain circumstances. Here we attempt to combine the two approaches by building a population of modelled life forms into a formally arranged space with a compositional and aesthetic agenda.