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From Artificial Life to Augmented Reality: "It's not about technology, it's about what technology is about"

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INTRODUCTION

This paper examines the influence of two areas of technological research upon my art practice. For me, technologies provide inspiration in a variety of ways. It can begin with a simple instinct on first contact with a technological object, a system, or a scientific idea. Often, an extended period of play or exploration with the technology needs to take place before the artistic possibilities reveal themselves. The two main areas of technological focus in this paper are Artificial Life and Augmented Reality, with particular attention to the development of ideas and philosophical concerns underlying the art that I make. Examples of completed works and works in progress will be shown. It is my intention in doing this to examine some aspects of the artist's role in unraveling the meanings nesting within technological and scientific endeavors.

1. ARTIFICIAL LIFE

The Spell of the Mirrors...

An old Chinese legend [Peat and Briggs 1989] tells that, during the time of Huang Ti, China's mythical Yellow Emperor, mirrors were not solid glass as they are now, but were gates into the world beyond the mirror. Beings from this world and the mirror world regularly passed through the mirrors to visit and to trade. This balance was upset when the armies of the mirror world came through the mirrors and tried to invade. There ensued a long and awful war. To avoid defeat, the Yellow Emperor cast a powerful magic spell on the mirrors. The mirrors were sealed shut and the mirror folk were forced to endlessly copy our appearance and actions. Since then, we have come to mistakenly believe that the specular world is a mere reflection of our own. However, it is said that the spell, although powerful, is only temporary and will gradually wear off. We will look in the mirror one day and notice that our reflection is somehow different. Maybe the movements will differ slightly from our own, or our skin will seem a very subtly different shade. Before long, the way between our world and the world beyond the mirror will once again be open, and our illusion of symmetry will be shattered. Glancing away from the mirror, we may fail to notice that our image continues to gaze at us.

In 1902, Charles Horton Cooley [Cooley 1902] suggested that much of our sense of self comes from our perception of others' perceptions of us. All the information about ourselves from our physical and social environment is somehow built up into a composite looking-glass image that we recognize as our self. We also make some kind of internal models of other people and situations to help determine the most appropriate of several available courses of action in a given situation. Constant comparisons are being made between the world as we really experience it, and our internal representations of the world (and our self). Viewed from this perspective, we have already been in a state of daily interaction with virtual worlds and with virtual characters since long before "virtuality" ever became associated with computers. The computer provided us with a new kind of mirror through which we could examine our selves and our world. As it becomes more sophisticated, the computer increasingly provides another world that we can adjust and remodel to suit our personality, a mixture of reflection and expression of self. The computer is slowly becoming a social artifact. It is inevitable that such an artifact, given the ability to modify and adapt itself, will eventually do more than simply reflect its user. Computer languages allow expressions to respond to their environment and even create new expressions effectively becoming a new form of life.

Artificial Life

Much of my precomputer artwork attempted to create some feeling of vital presence, the sense that one is in the presence of a living thing. I wanted to make artifacts that felt in some way alive for the observer. I was also influenced by John Cage [Cage 1990] in his attempts to step back from the process of authorship and intentionality, allowing the artwork to find its own shape and identity. When I first read about artificial life, I became very excited. Here was a technology that had both semi-living qualities and the potential to evolve artistic products that were largely out of my control. I wondered what effect evolved technologies would have on the human psyche. Imagine, for example, that the supermarket shelves contain products, the workings of which are a mystery to even the engineers responsible for their "design." Will we be in any way disturbed by the fact that we are no longer masters of our technology, or will we simply consume the product without thinking about it? I felt that artists could somehow prepare society for this kind of change. Also, I believe that any art that uses, responds to, or seeks to interpret science and technology must grow from an aesthetic, based more on systems and processes than on objects and images. I think that if people learn to see such beauty in art, it may deepen their appreciation of (and respect for) nature. If a tree is only seen as a pleasant object, then the fact that it grew to a particular shape from a tiny seed, the fact that it provides a home to a community of organisms and is part of a larger community of organisms, its systemic beauty, is lost to the viewer.

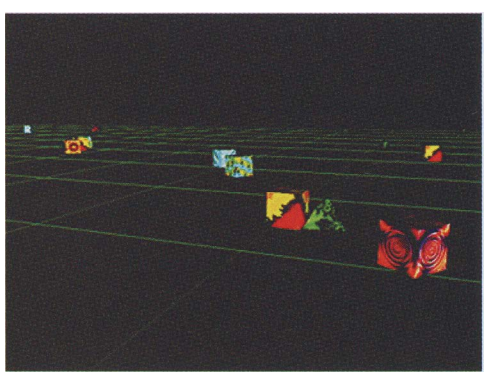

Figure 1. *Feeping Creatures,* 1997

In 1996, knowing little about computers, I was lucky to find Tom Mander, Brian Murray, and Ben Ross, programmers who helped me turn what was at first a vague idea into a finished artwork called *Feeping Creatures,* an interactive virtual environment that runs on an SGI O2 computer. The world of *Feeping Creatures* is a featureless green grid populated by colored cubes called feeps. The feeps wander around the grid looking for food in the form of green triangular pyramids referred to as trees or looking for mates. Hunger and sexual attraction are real physical forces in their world. Each feep has a sequence of musical pitches that it inherits from its parents. Half comes from its mother and half comes from its father. The trees each contain one note-duration value. When a feep eats a tree, the tree's duration value gets added to the feep's internal list of durations that makes up the rhythm with which its pitch sequence is played. Feeps mate according to the average level of musical consonance or dissonance between their respective pitch sequences. Some of them prefer a higher level of consonance, whereas others prefer more dissonance.

The piece is installed in a dark room where the video output is projected onto a screen. The visitor uses a mouse to move an imaginary camera around. The camera position serves as a virtual microphone so that nearer creatures are louder, and distant ones are not heard at all. As feeps move, their sound moves with them so the visitor can still hear creatures even when they are behind and not visible on the screen. The basic idea was to make something that would keep on changing and deliver up an endless variety of novel melodies and rhythms totally outside the control of either the audience or the artist.

In practice, however, things are not so simple. Usually the music produced is a fairly even mixture of all 12 pitches in the western chromatic scale (people have likened it to late Schoenberg). When a number of creatures with a preference for similar-sounding pitch series happen to be in the same area, they mate very quickly, as do their offspring. They very quickly become inbred and use up all the available food. Soon, the whole population of the world all end up playing the same melody. The piece might run for eight hours or more without this happening, but, once the right combination of factors happen to come together, the "hillbilly effect" can take over the whole world in just 10 minutes or less. This kind of surprise outcome is one of the things I find compelling about this kind of project. However, although I was exhilarated by the strong sense of vital presence when interacting with this work, I still felt unsatisfied with the amount of spontaneous variety created by the work. It appeared necessary to expand the model of the world to make it more complex. The result: two new artificial worlds.

Over the last two and a half years, I have worked on two other artificial life and music projects, *Gakki Monster Planet* (in collaboration with Palle Dahlstedt and Catherine Haw) and *Listening Sky* (with Alan Dorin and Wasinee Rungsarityotin). The two pieces complement each other in terms of the kinds of interaction available to the user.

Figure 2. *Gakki Monster Planet,* 2000; *Listening Sky,* 2001

Gakki Monster Planet is like a video game, complete with joystick. The visitor navigates a mountainous psychedelic landscape populated by creatures that also play music. The sound is a rhythmic, bleepy, "bio-techno" music, complete with dancing trees that make percussive sounds. The creatures are capable of a huge variety of sounds because many aspects of timbre are also part of their genetic makeup (imagine having a separate gene for each of the knobs on a large synthesizer). It is possible to grab individual creatures and drag them to where there is food or place them anywhere else in the world. It is also possible to induce two creatures to mate in order to influence what kind of sounds will be played by the offspring. Eventually, it will be possible to practice crude forms of farming by breeding selected creatures in special enclosures, or just shooting the ones we don't like.

Listening Sky, on the other hand, has a more ethereal and immaterial quality to it. The visitor's viewpoint is always at a distance from the spherical world and, like *Feeping Creatures,* the visitor can only move a microphone around and listen to various groups of creatures. No direct action in the world is permitted. Like *Gakki Monster Planet,* the sound is also richly varied due to evolving sound algorithms. In *Listening Sky,* we tried to get away from the appearance of shaded polygons in favor of a more painterly approach to the rendering of the world. The sphere of the world itself is invisible, defined only by the paths of the creatures as they move around on it. The feeling is intended to be more meditative and detached.

As a pair, the two artworks are meant to give visitors a taste of being two very different kinds of god. In one, they can intervene and determine to some degree the music and events in the world. In the other, they must simply move around and enjoy the sights, sounds, and behaviors of the world. When working with programmers, I consider them to be co-authors of the artwork and not merely vehicles for the artist's grand vision. Maybe it was my early experience making music with groups that convinced me that the familiar synergy could not possibly result from any one of the separate players working alone. Programmers are often quite creative and have a strong sense of aesthetics. Through their discipline, good programmers develop a strong intuitive sense of systemic beauty that is able to adapt to an artist's perspective in a collaborative project.

Although work constraints have forced me to suspend development of these two works for the time being, I hope to eventually exhibit them together as a pair. I think that, at this point, I have run up against a major stumbling block that has hampered progress on all three of the artificial-life-based works. I am preaching an aesthetic of systems and processes, but I do not have sufficient knowledge of those systems and processes on the most fundamental level. In trying to evade intentionality, I also evaded responsibility for the code itself. The only way through this is to become a programmer myself, in order to allow the kind of tinkering and discovery that characterized and strengthened my earlier sculptural and musical works. This has forced me into a reskilling phase combined with a re-evaluation of the conceptual foundations of this work. To create a compelling aesthetic experience, the works should develop beyond their current state as a simplified reflection of existing nature. A powerful sense of vital presence will only come when we feel the eyes of our reflection gazing out at us.

2. AUGMENTED REALITY

Dad's Garage

When my father's Alzheimer's disease became severe, many relatives wanted to clean up his garage and throw out a lot of the useless junk that filled the entire space. My brother was against this. He said that every item in the garage was a part of Dad's mind, "When Dad goes into the garage, he might pick up some object at random and recall various memories and thoughts connected to that object. All these objects function as symbols and index markers for his thoughts and memories, and, in a sense, they are his thoughts and memories." It could be argued that meaning-laden objects are a part of our mind in the same sense that our tools and artifacts may form an extended body that co-evolves with the biological body. [Dawkins 1986] Objects themselves become symbols and symbols become objects. Objects may have both real and virtual aspects at any one time. In the light of this, the distinction between "real" and "virtual" gets as fuzzy as

perhaps the distinction between mind and body. It is not surprising then that we continue to externalize these boundary crossings through technology.

Augmented Reality

Augmented reality creates a gateway between the world of physical experience and the world of symbols. If virtual reality allows us to pass through the plane of the screen and immerse ourselves in the specular realm, and artificial life sows the seeds to let this other world come alive, then augmented reality provides the means for the virtual world to extend back through the mirror into our everyday world. During the course of my work at ATR Media Integration and Communications Research Laboratories in Japan, I became familiar with a technique, developed by Hirokazu Kato of Hiroshima City University [Kato and Billinghurst 1999] that allows the computer to identify and track various special markers via a camera. Because the computer can identify a marker, along with its precise position and orientation in relation to the camera, it is also possible to composite a computer-generated image into the "real" video image. This can be done with a (relatively) low-cost head-mounted display with a camera attached. When working with technology, I often equate redundancy with poetry, and this apparatus is deliciously redundant. When you wear this device, you are using a video screen strapped to your head to see (via the camera stuck on the other side), what you would be seeing anyway if you didn't have a video screen stuck to your head. Of course, the reason for this is to allow the computer to add 3D VRML objects into the scene. When you pick up a marked object, you not only see the object and its pattern but also a 3D object generated by the computer.

Figure 3. Looking at patterns through HMD

The snake shown in the picture can be turned around and examined from any angle by manipulating the card with the special pattern on it. If the camera's view of the pattern is blocked, the object disappears. It is also possible to "project" video onto a virtual screen and move that screen around like any other object. When I first saw this system working, I knew that it was significant and that I wanted to use it to make an artwork of some kind. First, though, I opted for a more functional, entertainment-oriented project.

Computer scientist Ivan Poupirev and I devised a gestural controller that allowed people to mix and effect pre-composed dance music by waving a selection of old LP records around in the air. Each record controlled a different music track, and movement and rotation on the up-down, front-back, left-right axis, together with shaking the record, each had a different effect on the music. The Augmented Groove was a popular demonstration at SIGGRAPH 2000. I am now developing a related system that allows a user to compose music by arranging cards on a table. 3D graphic representations will assist them to intuitively learn about musical structure as they play with the system.

I am now working on my first augmented-reality-based artwork. The main focus of the piece is a re-telling of the legend at the beginning of this paper. Because computer vision is an important part of the technology used, I want to explore the relationship between what the computer "sees" and what the human sees, and to create tensions between their respective interpretations. The system is capable of learning to recognize any simple, iconic image. This gives a lot of scope for the creation of some kind of structural tension between the images on the actual markers and the VRML characters associated with these images. To retrieve the meaning in the work, the visitor must enter and manipulate the marker objects to find the roles and relationships between them. The visitor must look between the clues in the physical world and the virtual world to pick up the threads of a nonlinear narrative that weaves back and forth through the plane of the screen.

CONCLUSION

I hope to bring both artificial life and augmented reality together at some point in the near future. Together, they represent a massive collision of universes. They open a territory at the intersection of culture, technology, biology, the physical, the symbolic, the real, and the virtual. Perhaps the Yellow Emperor's spell is a metaphor for language itself. Long confined to description and reflection within the printed page, language now begins to reach out with newly grown eyes, ears, teeth, and claws to explore the more plastic computational space. Perhaps our mastery of technology will give way to a kind of husbandry. Perhaps we should encourage such a technology to become our friend. As an artist and as a human, my relationship to technology is one of playful partnership. I am lucky enough in my work to be in a position to influence the development of some of these technologies. The technologies, in turn, influence my ideas and my attempts to find meaning within their workings. This has led me on a journey spanning several years and thousands of kilometers, back and forth through many strange mirrors. I imagine the journey's end with myself as an old man, sitting on the floor of my own garage, wondering: "What does this technology mean?"

REFERENCES

PEAT, F. D. AND BRIGGS, J. 1989. *Turbulent Mirror, An Illustrated Guide to Chaos Theory and the Science of Wholeness*. New York: Harper & Row, Prologue p i.

COOLEY, C. H. 1902. *Human Nature and the Social Order*. New York: Scribner's, 179- 185. (Online at: wizard.ucr.edu/~bkaplan/soc/lib/coollkgl.html)

CAGE, J. 1990. *I-V John Cage*. Cambridge, Mass: Harvard University Press, 1.

DAWKINS, R. 1986. *The Blind Watchmaker.* New York: Penguin, 136.

KATO, H., AND BILLINGHURST, M. 1999. Marker Tracking and HMD Calibration for a Video-based Augmented Reality Conferencing System. *Proceedings of 2nd International Workshop on Augmented Reality*, 85-94.