

A COMPUTER CONTROLLED MARIONETTE for OUT OF THE BODY THEATRE

As long ago as 30 years, graphic researchers were well on their way to moulding what we now term virtual reality (VR). At that time we saw our first head/ceiling mounted display for interactive stereoscopic wire frame viewing, and had appropriated flight simulator technologies to develop tracking devices for human motion. Twenty years ago, some of the same pioneers gave us the invaluable 'walking algorithm': a code to describe the gait of a human walk which was then transcribed into a computer graphic stick figure. We have been working ever since to *really* make it a reality.

When I began to work in interactive gestural media twelve years ago, its limitations were instantly apparent. At that time, I could use trackers to describe human motion (and much of its complexity) but I could not see and manipulate it in real-time. This real-time interaction is critical to the concept of VR. Researchers working with these limitations knew they had to achieve a sophistication of image rendering to achieve a 1:1 relationship of action-to-motion.

Poised between the technological world of development (and the sweet taste of its promises), and my need as an artist to get some art made, my work led me away from the inherent problems associated with display and real-time action-to-motion. I became engrossed in the collection of human motion data with the expectation that eventually chips would get cheap enough and processors fast enough to develop the tracked-data file structure that could be plugged into the world of virtual reality and make it truly a reality.

In the meantime, I watched the world around me and the fever that was beginning to rise in the collective temperature of my culture. Everyone had become obsessed with virtual worlds. My students had become

frantic about the possibilities of 'plugging in', 'tuning in' and 'dropping out'. An entire culture had developed, anxiously awaiting the chance to leave the reality of their own lives and go to the place where they could get away from the world called themselves. We had members of the culture lining up for temporal vacations while the VR experts were still back at the lab counting polygons.

Nevertheless popular reading material and broadcast media exploited the hype. The populace began to rely on the promises: 'The possibilities are endless!', exclaimed the technocrats. 'Unexplored creativity!', chanted the philosophers. 'I don't know what it is, but I know I want one!', chimed the people.

I must admit that this phenomenon has made me continue my work with great caution. After all, we are not vacuum cleaners, or souped-up abacuses. We are people with endless possibilities already. We *are* open systems, and machines are not. We have created these new tools (like any others we have ever made, mind you) in our own likeness – simply like us. They cannot take us anywhere we have not yet already imagined. That is the myth of virtual reality.

However, VR is part of the continuum of intellectual evolution where the value lies primarily in our ability to study our own nature. There are questions we have had to ask ourselves from the beginning of conscious time: what is reality, thinking, and perception? Can these constructs be sampled, synthesised, or even objectively perceived? Certainly each one of us is much more than the totality of our sensorial input, processing capabilities and production qualities. The questions in the abstract are interesting indeed. But this is the rub: evolving technologies are not as functional as the theory. When we become

locked into the task of development, the questions asked more often than not are: 'how do we make it happen, financially?'; 'how do we get it to work, technically?'

The gap between *virtual* and *reality* appears huge to me. On the one hand, we have the labour and genius of 'research and development', and on the other, the execution of a sophisticated application. This remains the dichotomy that reaches the very heart of the virtual reality experience.

In an attempt to side-slip uneven development of display technologies, I decided to bring my tracked data back to life through computer-aided machine applications.

Out of the Body Theatre

Historically, computer controlled human forms have been constructed for very specific applications. To date, the best funded resources have been prostheses for space travel, body replacement, and special effects within the entertainment industry. Looking at the computer controlled marionette certainly makes one think it would be well suited as a prop for another *Metropolis/RoboCop/Terminator*/put-your-favourite-sci-fi-flick-project here.

However, the marionette is a robot built in the spirit of a gestural Golem: a response to the winsomeness of human form and spirit. Her function is not to imitate human motion but, as traditional art forms do, reflect a more personal and inner self.

Furthermore, how differently might she be designed for gender? I pondered upon my collection of kitsch images of modern woman and technology. I have images of the tinkering male doctor who gently solders the shoulder of an anatomically correct blonde female (from *Galaxy Science Fiction Magazine*, September 1954), and the male scientist clad in white lab coat who enters information through a slot in the backside of a headless and hollow beauty (Rutland 1979). These are the images and the ideals which I grew up with. And now, of course, they are seen as the kitsch concoctions of a technologically uneducated era. When I thought about the 1950s, I looked around and asked myself how did I fit into the world of glittery technology and fast-paced super heroines?

Why was Wonder Woman always clad in short dresses, stockings with go-go boots, and wearing perfect hair? How could she perform her myriad duties if she had to worry about crossing her legs when she sat? What function could this sort of outfit serve? After reminiscing about the go-go boots of my own pre-teen years, I realised there really is no other reason. It is that simple: we created that female super-woman-of-the-future as the ideal of pleasure and personal servicing.

I think female robots got the same schtick as my childhood super heroines. When we think of a robot carrying certain attributes such as aesthetics or perhaps more delicate applications, its gender is thought of as female. A fine example is the wind-up automata dolls found during turn of the century Europe and North America. Enchanting, adorable, with the function of chasca. There is little reference to female automata today beyond these outdated models. The computer controlled marionette is my alternative to this cliché. *Out of the Body Theatre* are performances where the marionette is used to help construct a woman's journeys of identification into a sense of self which exists during dreams, epileptic seizures, madness, and places where the human psyche is not as defined as we might imagine it to be.

As an extension of my own self, the nature of the marionette is a reflection of the interlaced relationship of perceived body and psyche. In this way, we can think of all the things we make and do as human beings to be an extension of our selves. It is how we *see* ourselves that designates how we build our perceived reality of *world* around us. The function of our tools is to transmit our own nature onto our surrounding reality. It appears to me that my society is obsessed with acquiring exceptionally large areas to transmit this reality into.

For example, the worth of an individual is better when they own more things. Or the worth of a country is better when it consumes smaller countries. Or the white collar dream to control the stock market. Like the size of anything in Texas. This is my heritage. Americans are obsessed with the computer because it is able to propagate this image. The digital machine can assist in our aggressive

and territorial nature faster than any other tool we have ever made.

As an alternative, I think of the marionette simply as an extension of myself. I do not think of it as a metaphor to empower the entire world. It is a personal relationship where I naturally internalise aspects of her in the form of kinaesthetic and perceptual habits. In this sense, she not only becomes an extension of my perception, but modifies it, thus altering the basis of my effective relationship to myself, to her, and subsequently, to the world.

I believe that if anyone takes another look at the accepted ways of thinking about automata and virtual reality, they will find much more personal ways to use it. I believe my culture needs to re-engineer our collective perspective about technology to encompass the intimate and private. *Out of the Body Theatre* is such a reflection on my own private observations of perceived reality which is not concrete or irrefutable.

Computer controlled marionette technique

Out of the Body Theatre is a network of electronic devices that, through their inter-connections, service each other. A performance space is prepared with tracking devices, processors, and outputs to computer controlled lighting, projection and sound. I use the term *environmental tracking* to refer to this collection, by machine, of the physical movement of a performer. The collection is raw data read and arranged by an object-oriented computer language. It links together unlikely structures such as computers to people, people to automata, automata to video projection, and as light, back to computers.

For example, the movement of a performer across the path of a video camera would trigger the movement of the marionette by activating a pre-described motion stored in the computer. The program calls upon files stored as both words and an associated image. This is an easy way to scan and locate action files of all kinds which can be plugged into a performance. The use of a video camera and edge detection software allows the movement of the performer to be tracked. It is a simple digitiser that employs time delayed colour separations to calculate trajectory of motion.

Human motion can also be translated by optical tracking techniques and read by the marionette as a hierarchical structure made of

a torso and its limbs. For instance, the fingers are children of the hand or wrist, which is a child of the elbow, which is a child of the shoulder, which is finally attached to the chest. The data is collected by special cameras, and software which is used to coordinate the larger the aspects of the performance such as lighting, projection, and sound.

The hierarchical structure chosen for the marionette has been simplified tremendously by two different techniques. First, the upper torso of the marionette is radio-controlled. This is appropriate for the delicate gestures needed for the arms and the subtle yawl, roll and pitch rotations of the neck. Altering the wave form of the signal through a small, unobtrusive computer chip enables the small on-board motors to double their radial efficiency. This eliminates excessive gearing, and in turn, keeps the weight and visual clutter on the upper torso to a minimum. The remainder of the marionette relies on joints that limit motion through wires connected to pulleys, bailers and motors. These wires enable the marionette to achieve aerial positions that, in performance, appear to defy gravity. The wires found in traditional marionettes help to retain a more intuitive feeling of body motion. The combination of radio and wire controlled joint manipulation, helps to retain this intuitive feeling of *gesture*.

In conclusion, computer control of the marionette represents a significant breakthrough in coordination of complex movement. It allows a software sequencer to handle as many of the synchronised events as required, as well as coordination of sophisticated live work between the computers, other machines, director, and performers. It is also a simple tool that helps in the unification of a concept: everything that appears so exclusive to itself within the performance arena, is indeed, all together as one.

References

Rutland, Jonathan, 1979, *The World of Robots*, New York, Warwick Press.

Jennifer Hall has been working with interactive media since 1977, and is experienced in the traditions of sculptural installations, live theatre, and using electronic media as an artistic tool. She is the director of Do While Studio, and is a Professor of Environmental Computer Design at the Massachusetts College of Art in Boston.