

Chapter II Transition of Concept of Life in Art and Culture from Automata to Network

1. Introduction

There are two major reasons why I will discuss the relationship between art and life science in this chapter.

First, life has always been an important theme of the arts. While the meaning of life has been one of the major issues of biology as well as of philosophy, artists have also dealt with it as their theme from different perspectives. If there occurs a change in the way we see life, it is also reflected in art (although never as a simple "mirror image").

Meanwhile, the history of life science and the history of art seem to flow toward the same direction. Before Darwinism it was believed in the Western culture that all the creatures were designed by the Creator and had remained the same since then. The hierarchy among the Creator, the human beings and animals was absolute. When we see the role that the theory of evolution played in our way of seeing the world, as well as other important theories in science did, we can say that modern science made people accept the fact that the universe is not based on such a hierarchy. This is exactly what happened in modern art. The traditional role of the artist as a sovereign creator of art has undergone a fundamental change. An artwork is no longer necessarily considered an unchanging piece completed by a genius.

Major discoveries in life science that have taken place since 1950 have changed our concept of life. Molecular biology has taught us that life is a phenomenon that can be described in terms of physics, chemistry and information science; and that human beings are made of the same material and codes as other animals. Modern biology deals with notions such as gene, emergence, self; concepts which are more related to information and process rather than material and the goal. The fact that information is the key element that supports the diversity of life and the mechanism of evolution provides a direct link between life science and the computer.

Second, the computer has also become a medium of art.

Artists can create virtual time-spaces with virtual life forms. When dealing with life, art can now deal with the life itself, not only with the ways of life. With the advent of digital technology such as computer graphics and virtual reality, what used to be represented in an abstract manner can now be visualized with convincing reality. Artists now seek for different approaches to life, with ideas drawn from biology and other fields of science. But they are also using biological concepts derived from different approaches, developing interesting ideas that will help our culture to understand life in a richer context. Life can be a metaphor of art.

In this chapter I will show, first of all, how the concept of creating life has been developed

in our history. Scientific discoveries have played an important role in establishing our knowledge which has become the basis of our way of thinking. Yet on the other hand, science cannot develop without an appropriate background in the society. It may be through such socio-cultural development that both science and art develop toward the same direction, while interacting with each other. That is the reason why certain kind of convergence occurs between these two fields of human activity.

Because of that I will also describe how the same questions regarding our life are interpreted in a different culture -- namely the Japanese -- with a different background. Even at the risk of burdening my argument with too many details, I will try to cover some points which may be hard to understand particularly from outside our culture. However, I consider such a detailed presentation essential from the point of view of my argument.

We should not be trapped in a single point of view. As the histories of science, art and technology are too often described and discussed only from occidental point of view, I hope the attention given to Japanese media art here will offer hints for further analyses on the meaning of science and technology in art.

2. Art and Change

As explained in the first chapter, art had undergone big changes both in concept and in method since the early 20th century. The artists became fascinated by machinery both in concrete and metaphorical ways, and used new media such as photography and film in their art making. In fact, techniques such as animation and film tricks made it possible to create virtual worlds within films(1). More recently, artists have gained access to electronic media. Now they also have the possibility to use computer graphics to create illusions from numbers.(2) Interactive technology and virtual reality have come within the reach of artists. These tools promise to fulfill the long term desire among artists to construct three-dimensional imaginary worlds that we can interact with.

The nature of art, its material, and its relationship to our lives have changed. This change did not occur by itself but developed along with changes in the way we see ourselves. Science has played a major role in the transition. We are witnessing not just the influence of the science on art, but the convergence of science and art especially when it comes to the notion of life.

3. Rise of Alife

3.1 Life and Media

The rise of "Artificial Life" (alife) took place at the moment when life science was no longer considered a specific area for biologists. It offers an arena to analyze and discuss the nature of life that yields to its abstraction and generalization. For artists, life has achieved a

different role as a medium of art and communication through such abstraction.

I think that Shakespeare was quite right when he wrote that we are made of the same material as dreams are made of (3). Of course Shakespeare was not talking about bits and bytes. But if the essence of life consists of information, dreams and imagination can be simulated in the same manner as the representation of the real world.

A more recent topic in biology and medicine has drawn the wide attention of people, including philosophers and artists: the research on the manner in which a living organism distinguishes itself from others. Immunity is based on such a recognition of the "self". When a recognition mechanism malfunctions, the body starts attacking itself. On the other hand an originally alien life form, such as mitochondria, resides in of our cells without being excluded. Questions, such as how a microscopic organism defines itself making distinction between the self and others, or what is the nature of "self" at the level of organisms without any sort of consciousness, bring about the more general question on our body and mind. "Self", a traditional theme of art and literature, now confronts a new paradigm.

Research on complexity has been attracting wide attention recently. The concept is likely to become the key issue on many fields. Our culture has been influenced greatly by biological concepts and facts such as evolution, gene, DNA, ecology, immunity (or the identification of self). Art is not an exception. But the influence does not necessarily have to go to one direction only.

It is needless to elaborate here on the role of Charles Darwin and his theory of evolution. They are too well known. Scientists who have worked in the field of life science have had great influence on our culture. The points of view they have developed through their research often go beyond the confines of traditional scientific disciplines, raising issues with more general relevance. Researchers such as Jacques Monod, Francois Jacob, Richard Dawkins, Stephen Jay Gould, and the Japanese Takeshi Yoro are among them. What is the case of artists working with concepts in/from life science? How do such concepts influence their works, and what do they bring to art and culture? Do their works go beyond the realm of art to influence science?

3.2 The Objective View of Life

How can the events in space and time which take place within the spatial boundary of a living organism be accounted for by physics and chemistry?... The obvious inability of present-day physics and chemistry to account for such events is no reason at all for doubting that they can be accounted for by those sciences.

(E. Schrodinger) (4)

The argument that life can be accounted for by objective and logical events held by Schrodinger and Nils Bohr led to molecular biology and biophysics. In one sense, the argument led to the concept of life as information inspired by the discovery of the double helix by Watson and Crick. In another, by statistically evaluating energy, which can be measured, it was possible to describe comprehensively the life phenomena from the micro to the macro scale. Statistical

evaluation means that the temporal development of life phenomena is not determined at any instant. It signifies the complexity of the process.

Schrodinger is not the first who has tried to account for life events using the principles of physics. The first physicist who reduced all facets of life into physical elements to explain the universe was Aristotle. The representative thought in Greek explains that objects live with the existence of an anima(5), but will die once it is lost. Aristotle could not conceive that all organisms uniformly possess anima so that he noted that the amount of anima present in an organism depends on the type of organism and the state of the organism(6); a view that the stages of life can be determined by the amount of anima. As he found the problem in the binary stance on the existence/absence of life, he tried to solve the problem by introducing the concept of the degree of life.

On the other hand, the ancient Chinese had separated the soul which governs the intellect and reasoning and the soul which causes animal-like behaviour in life. The idea that there exists some middle ground if the balance or timing between the two collapses also belonged to the Chinese way of thinking. In "Peony Lantern", the classic Chinese ghost story, the dead (or can one call them the dead?) in this state cause problems. Even after the soul of the mind leaves the body, the soul of the body lingers in the flesh, purely bodily functions occur without reasoning or common sense. This describes as two different souls governing, the different functions now ascribed to different parts of the brain. It is a practical interpretation which corresponds to situations where the human consciousness is lost but the body continues to "live".

The background of such an idea goes back far in time to the elements we find in Asian culture. The same elements have brought forth different ways of thinking in terms of such concepts as self, originality, life and death, the status of human beings in our religion, etc. In general, vagueness of boundary is the underlying feature in the Asian view of life compared to that in the western world(7). I will come back to the issue in Chapter IV.

Generally speaking, it may seem trivial to determine whether an object is a living creature or not. If it is so, it should be possible to answer to the following questions. What is the essence of the Greek "anima" which divides an organism from an inanimate object? What do we have as proof that some object is living, or not living?

According to modern biology there are no clear definitions of life. Each of those conditions which 'gives life' to an organism either also applies to lifeless objects, or does not apply to all living organisms. This only allows us a definition with a list of conditions that is not necessarily fulfilled completely.

Here lies one of the reasons why Artificial Life would exist: if there are existing organisms which do not fulfill ALL of the conditions for life, there is room for artificial systems, which fulfill equal numbers of conditions to be thought of as a form of life. This allows a vast possibility for an artistic approach to life. Another reason is that unlike other fields in science such as mathematics, physics and chemistry, the traditional biology only deals with historic development which traces the paths life forms have taken on earth. It is a research area which discards entire worlds of possibilities (if there were not an ice age, if dinosaurs were not extinct, etc.) and bases itself on those possibilities which brought the world to the state in which it is now.

Is it, then, asking too much to bring into existence a meta-biological world which envelops as a local version, biology as framed within earth? As Euclidian geometry within non-Euclidian geometry, Newton's Mechanics within the theory of relativity, Artificial Life within Life . Such an argument is not at all out of place. The subject of Artificial Life is the "Life as it could be" as Chris Langton proclaimed at the very First Artificial Life Symposium in Santa Fe (1987).

3.3 Creating a Virtual Life

Within the computer itself, there are no mechanisms to discriminate between reality and imagination. If a logically correct, yet unrealistic world is created (as examples, an imaginary number is assigned to a parameter as opposed to a real number in the equations which simulate reality, or the equations themselves are transformed), it becomes the tangent between simulation and imagination. As the programming of a realistic 3D space simulation as computer graphics is not very different from that of an imaginary space, such alterations which convert reality into non-reality are instantaneously possible with relatively simple changes in algorithms or parameters.

The French zoologist and artist Louis Bec has simulated an ecosystem of "theoretically possible" creatures. (See Chapter I, 5.3.) His imaginary creatures are designed using a model that fulfills the necessary requirements to survive in the given environment, and are rendered using computer graphics. The colorful creatures swim in a virtual sea making beautiful movements which are correct in terms of fluid dynamics. Changes of parameters produce a variety of species which are different in shapes or patterns yet structurally similar, as in the case of real creatures. Louis Bec realized his experiment not only for aesthetic purposes but with the aim of constructing "a more general zoological system which fills in the holes left by evolution" (8). The number of conditions of life rendered in his imaginary ecosystem is yet partial - mainly those that deal with the form and the motion which is the result of the form. However powerful they have become compared to those that existed ten years ago, computers we have at hand are still far from good enough to deal with life or an ecosystem in a comprehensive manner.

That is one reason why an artist working with the concept of life would focus on only one aspect of life instead of trying to handle several of them. Yet it is also true that an artwork is usually more convincing when it contains a clear idea rather than splitting itself into different factors. Actually, visual reality is one of those factors. Realizing a visually realistic image and behaviour of life is by itself a great task in computer graphics if one thinks of the elements required for achieving such a task: form, color, texture (which gives a great deal of load to a computer), realistic motion or deformation which should be based on the structure of the body and follow the dynamics, to name just a few.

3.4 Reality: Outlook or Algorithm

One popular misunderstanding about what might be called alife art lies here. Sometimes viewers complain about the visual reality of the creatures in alife artworks, comparing it to the one they see on the wide screen of a Hollywood film. While the most important element of the computer generated animals or monsters in films is their visually convincing realism, the essence of dealing with life and bringing up a new point of view toward life in an artwork does not lie in the visual reality. In art the concept of life does not even have to take a life-like form. Life can be a more abstract entity. This is a point that art and alife share.

The way a biologist focuses on simulating life is also different from the approach of an artist. A simulation that a biologist realizes does not need to be visually realistic. The essence of a simulation lies in its algorithm, in the way it represents the reality. In other words, the result of a simulation does not necessarily have a realistic outlook, but the procedure should be logically correct. It is somewhat similar to the difference between genotype and phenotype. Rendering can give a different outlook to a model.

The "Polyworld" research project which was carried out by Larry Yaeger, based on the concept by Alan Kay, is an example of a case in which the visual representation of "life" - each of over three hundred creatures was represented by a simple polygon - was of secondary importance. The main focus of this ambitious research project was to simulate an algorithmically realistic autonomous ecosystem. But the behaviour and the entire movement of the polygon-based creatures was interesting, like a choreographed dance of snowflakes.

In fact, as is often mentioned, the nature has its beauty. A successful simulation that conveys the way the nature crafts life could lead into an esthetically interesting result. Apart from dealing with life, fractal geometry and its application in visualizing natural phenomena is a well known case(9). On the other hand, rather than arbitrarily modeled or rendered shapes, or life-like looking objects which are modeled through mimicking and patch-working the outlook of existing creatures, forms and movements created upon the analysis of laws of nature will bring amazingly interesting or beautiful, convincing results for artists. Artists such as Yoichiro Kawaguchi and William Latham have proven the quality of logic within the design of forms and motion. Kawaguchi's approach had a great influence on the development of computer graphics together with the contribution of researcher/artist Alvy Ray Smith who started using particle systems in computer graphics. (See Chapter I, 5.3.) These are widely used now (Smith later co-founded the PIXAR Company). The aforementioned Mandelbrot and Voss, along with other researchers and artists, have worked in analyzing the nature's laws to bring them into art. Since then methodology in representing natural phenomena, which used to be difficult by geometric modeling and would lead to an unrealistic outcome, has switched into procedural modeling and later to more science-oriented physically-based modeling, dynamic simulation, and others. Art and science will surely meet in this field.

When Chris Langton first held the Artificial Life Symposium at the Santa Fe Institute of Studies in the Sciences of Complexity in 1987, those who gathered there included researchers and

artists of computer graphics who created imaginary life systems using computer graphics, or experimented with simulations of birds in flocks and fish in schools with the aim of using them in computer animation(10). Among the participants, there were also researchers in life science, including the aforementioned Richard Dawkins.

Alife is a search for Life using approaches which are not necessarily bound to reality. Here is the key to the necessity of the involvement of art in this new field of research. While Hieronymus Bosch created a 2D world in which strange creatures resided, the currently available interactive computer graphics and virtual reality allow us the possibility of being thrown into an autonomously existing ecology of his beasts. Within the computer, processes such as principles of life, physiological responses of humans, herding patterns of animals, ecology, and evolution of species expand beyond human predictions. Artists now have access to those results in real time using computers.

4. Automata

From the days of the Greek mythological figure Pygmalion, who had the gods transform into life the marble statue which he himself carved and adored, the human race has been infatuated with the creation of life. The first machinery in the form of a human being that we can see the trace of is the mechanical serving girl by Philo of Byzantium. (11). The stories of fictional or non-existing creatures, life-forms in another space/time dimension are common themes across the board in mythology, science fiction, all of literature as well as art and film.

Today, such creations of life which used to belong to fantasy has been realized in blandly unromantic forms such as genetically engineered vegetables(12). On the other hand, we see organismal behaviours in robots with artificial intelligence, or computer viruses, those things which we do not normally consider as 'living'. In fact, the definitions arising from modern biology do not automatically exclude computer viruses or robots. In other words, there will always be exceptions to the definition of an organism such that valid existing life forms are excluded or obviously artificial forms fulfill the necessary condition. We have found out that the definition of life is blurred by its nature.

E.T.A. Hoffmann's story of Coppelia reflects the increased curiosity toward mechanical dolls (automata) which were extremely popular in Europe from the mid-eighteenth to early twentieth century(13). The precision machineries of those days had enough mastery to make people believe in such storylines.

The automata developed during these years were not restricted to mechanical dolls but also included spontaneously moving devices. The mechanical dolls used combinations of gears like those used in cuckoo clocks and music boxes. Their movements were meant to be convincing facsimiles of a living human being (or monkey, bird). The duck made by the famous Jacques de Vaucanson in 1738 cleverly took advantage of the elasticity of the then new material, rubber. Its realistic simulation of the physiological workings of the bird ingesting food, digesting, and defecating was so beguiling that the bird was displayed on view for money. The most marveled process of turning the food into feces was revealed to be a trick. But this was found out more than

one hundred years later by the famous magician Jean-Eugene Robert-Houdin who happened to repair the duck. Robert-Houdin had experience of watchmaking as well as showing of automata (or apparent automata---a contrivance which appears to be an automaton though the actual mechanism was the workings of the magician). In 1845 Robert-Houdin was asked to repair one of the wings of this duck; he revealed the trick in his book which he published in 1868. Due to this scandal Vaucanson's duck was discredited and left to ruin. There only remains a drawing of its mechanical design and a photograph of the wreck. However, Robert-Houdin himself was also using similar techniques (14).

The physiological simulation configured in Vaucanson's duck was more the exception. Amongst the numerous dancing, smoking, performing automata (initially the duck was also displayed with the "flute player" and the "drum player"), there were attempts in simulating intellectual activities such as the Harpsichord player, the Writer, and the Draughtsman constructed by Pierre and Henri-Louis Jacques-Droz, father and son,. These automata had a great success when they were brought to Paris in 1775 and then to London. Gustav Vichy's writing clown (circa 1900) is a later example of an automaton simulating an intellectual activity.

The most famous of all is the chess player, or the "Iron Moslem" (because of its outlook and the mechanism) crafted by von Kempelen in 1769. It is said to have beaten Napoleon, but to have lost under a clever trick played by Catherine the Great of Russia. However, although the transmission of the precise replacement of the chess pieces was an ingeniously designed piece of machinery, the thinking part, i.e. the one that determined which move to make, was a little man hidden inside the box(15). Von Kempelen had also researched the mechanism of vocalization and designed a machine which he claimed to be able to correctly pronounce more than one hundred words. Goethe, who happened to see the vocalizing apparatus noted that it "was able to pronounced several childish words very nicely(16). Kempelen was not the only one who took on the challenge of creating a voice box. Etienne-Gaspard Robertson who is known for the Fantasmagorie also invented a speaking machine called "Phonorganon" in 1810 in the shape of a child(17).

By the end of the 19th century, these automata had largely lost their status as theatrical showpieces and display objects in wealthy homes. As a commodity, their tradition was passed down to electrically operated doll "dioramas" in department store windows, automated vending machines and simple mechanical tin toys. The "talking doll", incorporating a miniature phonograph, manufactured by Edison for a while, was a transitional device. Indeed, the French writer Villiers de l'Ile-Adam gave Edison a major role in his novel 'L'Eve Future' (1886). In this book Edison creates a perfect mechanical automaton - a woman of perfection with intelligence - out of pure friendship with a young British nobleman. In reality Edison was not only an able inventor but also a ruthless businessman, who contributed to ruining the careers of sophisticated automata makers by promoting industrial mass production and new entertainment media like cinema.



Fig.1. Vaucanson's automata (two musicians and the duck) as represented in an advertising card published in France in 1881

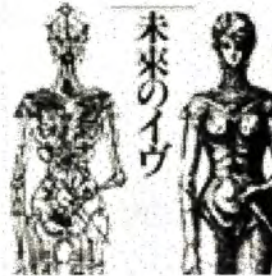


Fig.6 L'Eve Future

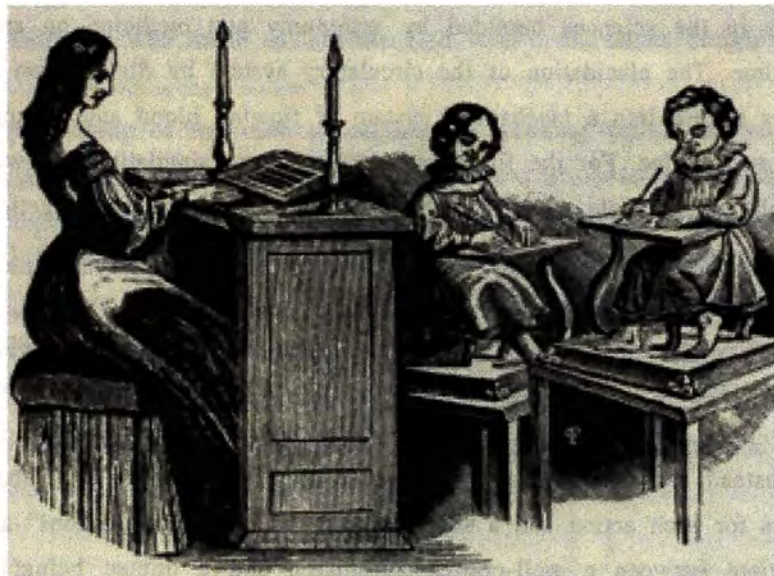


Fig. 2-3 The Writer and the Harpsichord player by Pierre and Henri-Louis Jacques-Droz (father and son)

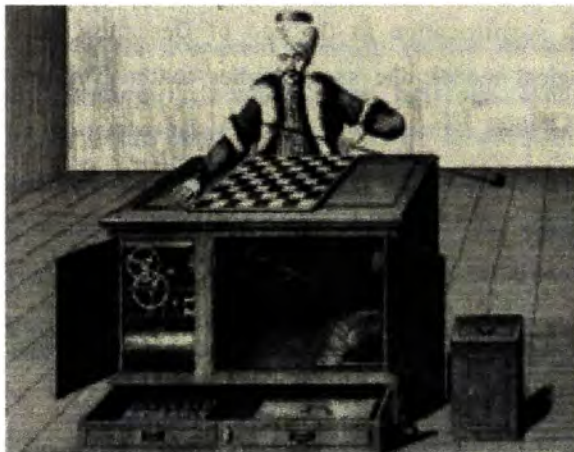


Fig.4-5 Wolfgang von Kempelen's Chess Player

The automata and machinery described above were the direct results of our desire to mimic life. Different elements of life, from a purely physiological activity such as digestion to a mental activity such as playing chess, are represented in these automata. What were the causes for such fascination with automata, that even a fake creation like von Kempelen's chess player could make people believe in its authenticity?

5. Life as a Machinery

The automata may have captured the people's minds because of the arising belief that all phenomena could be analyzed by logic and therefore can be simulated by technology. The development of machinery triggered by watches and later steam engines on one hand, and the advances in the sciences heralded by astronomy and medicine on another, created such atmosphere of the time. The elucidation of the circulatory system by Sir William Harvey turned the divine mysteries of life into a mechanical system of flowing blood and became the basis of Descartes' Human as Machine. For the first time in our culture simulating life was regarded as a possible and reasonable idea. People could believe in the idea that different functions of life had already been realized in automata. As a consequence, integrating such functions to construct more sophisticated humanoids would have seemed plausible.

Descartes, who was also known for his serious interest in automata, proposes a more objective standard for the definition of life. He thought of animals as one kind of automata, however it is interesting that he chose "that they use words and are not restricted to a patterned reply, instead can communicate in response to the situation", and "that they do not need an apparatus for each action and a single device suffices for all actions" as the ways in which to differentiate between a well-crafted automaton and a human being(18).

In the mid 20th century, Alan Turing used in his 'Turing Test' the same line of reasoning as Descartes' first condition. His second condition is similar to the statement by the biologist Francois Jacob who compared engineering and bricolage to the nature of evolution. Since there were no such precise automata nor computers with such sophistication in the age of Descartes, the conditions he proposed were in fact a part of an ideological model; the same applies to the Turing Machine. I will come back to Turing's concept later in Chapter III.

6. From Engineering to Bricolage

There have been major changes in the fundamental theories of evolution and ontogeny which resulted in the decline of the traditional determinism. Instead, ideas such as chaos, complexity, and emergence have become the key issue to life science. While it is the result of recent researches, it should be considered as a part of the inevitable flow of the history of science which

can be interpreted as a series of discoveries that step by step pushed our specie and planet aside from the privileged center of the universe. Meanwhile the change did not seem to be that drastic from Asian way of thinking where the traditional philosophy had a different approach to the status of human beings in relation to the rest of the world, as mentioned earlier. Such change of our concept interestingly coincides with what has been taking place in our culture, even in the industry.

The theological statement that we must have been designed by God because it was impossible to imagine that such an exquisite mechanism could develop by itself, reflected the general feeling of the time when engineering was about to launch. The argument that William Paley made in his book "Natural Theology" (1836) was convincing enough in the epoque when sophisticated automata had been developed out of the watchmaking technology. He "proved" that human beings must be the result of a design work, saying that when we see a stone on a road we recognize that it might have been there without any specific reason, but if we see a watch instead we immediately realize that someone should have dropped it, because we know that such a sophisticated mechanism does not grow naturally without any work and a clear intention. But now we know that it was a blind watchmaker who made us, not the God with a marvelous design skill (19).

There is an increasing questioning of the faith in engineering thinking which had pushed the world forward since the industrial revolution. As represented by expert systems, the top-down paradigm of artificial intelligence has come to a roadblock. Thus the attention is focused on the bottom-up paradigm which endows the computer the flexibility to adapt to the environment. There is a demand for such 'emergent' systems in the industry such as designing highly integrated circuit, as what engineers can think of has already reached to the limit. It is a field where genetic algorithm has been applied for an extremely practical purpose. Such industry, which produces the core technology in computing, now seek for the breakthrough in emergent development, or, designing without blueprints.

French molecular biologist Francois Jacob relates the difference between the goal-oriented method of engineering and the emergent working style of bricolage to the nature's way of evolution in a speech entitled ' Le Bricolage de L'Evolution':

"On a souvent compare l'action de la selection naturelle a celle d'un ingenieur. mais la comparaison ne semble guere heureuse. D'abord parce que, contrairement a l'evolution, l'ingenieur travaille sur plan, selon un projet longuement muri. Ensuite parce que, pour fabriquer une structure nouvelle, l'ingenieur ne procede pas necessairement a partir d'objets anciens. L'evolution ne tire pas ses nouveautes du neant. Elle travaille sur ce qui existe deja..... si l'on veut jouer avec une comparaison, il faut dire que la selection naturelle opere a la maniere non d'un ingenieur, mais d'un bricoleur..."(20)

In engineering one tries to accomplish the best result by designing for a specific goal, preparing a blueprint, and using brand new materials and tools one chooses for the specific purpose. It could be the most efficient way in achieving the already known goal. On the other hand

it can realize only something that the human mind can foresee. Also, the blueprint should be modified each time when the environment changes.

Traditional concept of art making was not of Jacob's, but rather of Paley's. A masterpiece of art should be carefully thought of and designed by the artist, painted or sculptured, then installed on the wall or on the floor, and should be kept in its original form. A piece should be the genuine result of the artist's creativity and it should remain unchanged. There is an invisible (sometimes even visible at an exhibition) fence between the piece and the viewers. But is it the only way of making or appreciating art?

7. Gene, Meme, and Originality

Even if an artist thinks that her/his piece is the result of entirely original imagination, one always owes the source of imagination to one's experience, things one had seen, heard, read, etc. It might sound extreme if someone says because of this any work of an artist is based on a kind of shared memory or shared experience.

But in fact such point of view is possible and we are finding more works of artists based on the sharing of imagination or information. The possibility of global exchange and sharing of information on the network is about to change our culture. The key concept of network art projects by artists such as Akke Wageneer or Muntadas is that the artist designs a system which enables people to provide and exchange information on a certain theme. (See Chapter I, 1.2.)

Wageneer's "Hiroshima Project" was conceived when the Smithsonian Institute had to cancel its proposed exhibition on atomic bombs. The project is an internet web page that guides visitors to any piece of information or opinions regarding the subject, from any point of view. Rather than producing junk information on the network an artist can use her/his intuition and the skill for visual communication in designing a system to develop our knowledge through exchanging information, according to Wageneer. "The File Room" by Muntadas is also an art project in the form of creating a database. Any information regarding censorship is collected and "filed" on the network, from the case of Plato in the "philosophy" drawer to Karl Lagerfeld in "fashion". The idea is to bring up pieces of information scattered worldwide onto an open database so that such information can be accessed, circulated and used by anyone. A piece of information or knowledge should not belong to just one person; it produces new information or knowledge when it is combined with other information.

Of course it is a basic concept of publishing or making archives. But it can produce much more dynamism when brought onto the network where its global consensus lies in sharing ideas and information. And this arising awareness toward the possibility and necessity of releasing information and sharing our intellectual resources such as knowledge and imagination has been discovering its connection to "gene" as a metaphor, or "meme" as proposed by Dawkins. On one hand, though not yet much known in the West, when we see works by Japanese artists we find that such concept nurtured under the influence of the recent researches in the life science are integrated into Asian (or rather Pan-pacific) traditional philosophy, finding the resemblance in it.

A Japanese network art project named Renga which is conceived and carried by artists Toshihiro Anzai and Rieko Nakamura shows how the nature of digital technology, especially the network, can be related to genetic metaphor in the context of Japanese culture(21).

REnga originally means Japanese traditional linked verse which developed into Haiku later. Renga here is a word play. REN means link or linked, GA in its original terminology means song or poem. The same sound GA also means image(s), with a different Chinese character. Renga is carried as follows. One artist will prepare an image. The image will be sent to the other artist via network. The other artist will modify the image freely, turning it into his/her own work. Then the image will be sent back to the other. The session continues until they feel the series is saturated.

While the process itself can be seen as a collaborative painting, the concept of Renga is deeply connected to the nature of digital technology and the idea of originality. The transition of the idea of originality with digital technology is a well known fact (and might be a concern from the business point of view), but it can be viewed from a different point of view in our Asian culture. It will be discussed later.

Renga is a process to share someone else's imagination. Instead of limiting the source of imagination to that of oneself, there are different elements that grew out of different imagination. On the other hand, one is obliged to start from what is there, and produce something different from it according to one's own imagination or necessity of expression. This is a bricolage, not an engineering. A Renga artist (except for the first image to be used as the "seed") does not start from drawing a blueprint of what she/he plans to produce. It is interesting to know what it brought to a participant to the International Renga session that took place during SIGGRAPH 94 in Orlando. "I usually don't paint such piece. But the image sent to me provoked something in me that I hadn't realized until then. I never thought that I had such imagination. I couldn't help painting this piece. It was me who painted - but it was not just me. " As in case of bricolage or in evolution, referring Jacob's statement, an artist might discover an image that was unable to foresee. In fact it is interesting to see Renga sessions. Colors and motifs originating from different imagination would survive, transform, crossed or melt together while weaker elements might disappear. The images produced through each session are different from what each artist would make by oneself. Anzai and Nakamura developed a concept of a "gene pool" of imagination. In their "Ninohashi Renga" (1994) project supported by InterCommunication Center and "Visual Jazz" (1995) which was performed realtime such "gene pool" was prepared and used.

8. Gardener of Eden

The concept of gene is thus treated as a metaphor in case of Renga from artistic point of view. It has nothing to do with genetic algorithm. British artist William Latham started using computer originally to visualize his hypothesis that any existing form should be explained as a combination of primitive forms and deformation that follows. (See Chapter I.5.3.) Latham had made hand drawings on wall-size sheets of paper to show the map of the evolution of form(22). He

started working with researchers at the IBM Science Research Center and found that by applying the hypothesis proposed by D'Arcy-Thompson (which was also a basis of Yoichiro Kawaguchi's approach) to computer generation of images a simple algorithm can produce a variety of organic shapes by selecting different parameters in modeling and rendering. (See Chapter I, 3.3)

By interpolating between different forms which were composed of the same number of components, Latham created amazing series of animations where organic forms change from one to another. Such animation, such change of form is impossible to make without using computer and applying algorithmic approach, because it is beyond the capability of our imagination, or capability of designing. According to Latham this is the reason why he uses the computer. He puts his position as a gardener of god(23). It is Latham, the artist, who makes the choice according to his esthetics, but the creation is not a hundred per cent on his own. He is a gardener who selects the right species and help them grow. And the selection is according to his esthetics because this is an art project that employs computer technology for the creation of beauty, Latham says. His most recent project is a CD-ROM version of his program. A user can make a selection for a series of parameters to design a virtual creature of Latham. Or, is it a creature of the artist, or the user? The question is still open.

9. Beyond the Imagination

The power of genetic algorithm was most visually proven by Karl Sims when he produced the series of works including "Primordial Dance", not to mention his most recent projects dealing with the evolution of movements of virtual creatures. It is commonplace knowledge that any image on computer screen can be described by equations and numbers, but no one had thought that the evolutionary change of equations could result in eyes-taking development of images. Starting with simple equations, some of the images developed into organic figures which are difficult to imagine how they could have been calculated. As Sims is both a computer graphics researcher/software engineer and an artist, the process of evolution he made - or the way he helped his program to evolve - according to his own esthetics brought about amazing results.

"Genetic Images" is an interactive version of the same system. (For images see Chapter I, 3.4 and 5.2.) That is, instead of the artist himself visitors to the exhibition would make the natural selection from the images by choosing several favorite images that will survive as parents to the next generation. When asked why he made the evolution process open to the public, Sims answered that he was curious to see other possibilities of evolution through other series of selection. Although his esthetics - or the capability as the gardener - had been proved by the resulting images, he came to notice that the process of evolution was limited to the direction his esthetics allows each time he made the experiment. The result of "going to public" was interesting enough when it was first shown in Paris, at Centre Pompidou. Some images which were of different types from what Sims had achieved by himself were discovered. An evolution of images would grow a different branch if it takes place in a different environment, i.e. with a different user.

From the point of view of art making, this work illustrates the interesting possibility that interactive art offers to the artists not only to the visitors. An artist can design a system instead

of designing the final product, to offer a joy for visitors to participate in art making, but at the same time also to merit from one's own work to see what the artist him/herself would not have imagined, with the assistance from the visitors. It is not an easy task to design an interactive piece with an efficiently working system and good user interface to bring people in, but when it works artists can also enjoy the results.

Christa Sommerer's and Laurent Mignonneau's artwork "Gemma" is a three-dimensional design engine that allow users to make selections from parameters to create a virtual insect-like animal. (See Chapter I,3.4.) The fact that it is real time, which means that the 3-dimensional configuration of a creature takes place in front of the user's eyes in fully rendered image, carries a startling experience. It is not necessary to discuss here about their earlier pieces -- I have already written very often about the way the artists integrate the goal and the design of their pieces, employing natural human interface, and they write about their own works. But such possibility of the realtime gardening -- or what should it be called in case of animals? -- opens up new field of imagination.

Artists are the specialist in visualizing imagination which go further than that of most of the ordinary people. But an artist might have a dream to create what is even beyond his/her own imagination. Automatism was used by DADA artists tried to capture what lies below the consciousness. (See Chapter I,1.2.) Happenings and use of media technology were method taken by FLUXUS members. There are different approaches to achieve the goal, typically from psychological approach and technical approach. Interactive art is forming an arena where these different methods meet and are integrated. It is natural, if we think of the fact that they are originally different activities that belong to the same human specie.

10. Genes in Japanese Poetry

Going back to the issue on the concept of originality, Japanese short poem or WAKA contained gene-like concept quite early. Waka gave birth to another important form of Japanese poem Renga which developed into HAIKU later. Actually there was much influence from Chinese literature in the foundation of such poem, but it spread among normal people(25). First official anthology of Waka includes many poems made by normal anonymous people from all over the country. These short poems were not necessarily the expression of their feelings but were also used as a tool of communication either to convey polite greetings or passionate affection, or even political messages.

But how a poem with only 5-7-5-7-7 syllables (which might be a composition of six to ten words) can convey so much meanings?

Actually it was exactly the reason why Waka served as a useful tool of communication. Instead of being a poem that stands by itself with meanings that come directly from its components, a Waka would consist of words that have different meanings behind them. In a sense, Waka was a multi-textural non-linear form of literature. Because of that a Waka could mean much more than what was literally said.

For example, if a name of a place (either in Japan or in China) is mentioned in a poem, it doesn't only mean the place itself but it provides a link to all the previous contexts included in the earlier poems that referred to the same place. Such particular names of places made an important part of "makura-kotoba". "Makura-kotoba" (which literally means "pillow word") is used as the first part of a poem (makura means pre-positioning) and opens up the link to metaphorical meanings and other poems as mentioned. Besides names of particular places certain adjective phrases established themselves as makura-kotoba. By doing so a short poem can mean many things.

Making a poem or replying to a poem was thus a serious match of intelligence, with esthetics and knowledge to make the best use of such genes. The emperor's court enjoyed rather peaceful time for more than hundred years in 10th to 11th century. Noble men did not have to show their ability in fighting. Earning a fame in intelligence became an important part of the career. Having one's poems selected for the Royal anthology of WAKA or winning at a WAKA match in the royal court was a serious business. It is also known that a noble family would hire an intelligent woman as the tutor for their daughter, so that she would win the chance to a wife of the emperor or crown prince, and her father would seize power.

Lady Murasaki who wrote "The Tale of Genji" was one of those tutors. Lady Seisho who was one of the earliest essayists known for exceptional intelligence and sense of humor was actually a tutor for a noble lady who was a rival to Lady Murasaki's mistress. Knowledge in literature was an important part of the court, and thus of power politics. To serve for such purpose there were publications at that time already. It was a kind of database. They contained all possible references for each word, how it was used in previous poems and thus what it could mean beside its original meaning. The idea of such database had been founded previously in China. China was the first country in the world that introduced an open examination given by the state to be hired as a state official. Anyone from any class could become an elite if one could succeed in the examination, for which literature was an important part.

What would happen to the idea of copyright or originality in a society where poem is a part of communication and is recycled as a part of a database of metaphor?

A good poem will be cited, not as a whole but just as a part of it. Citing the whole poem does not make the match of intelligence. A word from a good poem would start to have its own meaning, and would be used over and over, gradually changing or enriching its original meanings. In a sense, it becomes a gene in the literature. A good, useful gene will be used, modified, and keeps on living in different forms. It could become a makura-kotoba, for example. Finally the origin of such gene might be forgotten because it becomes a part of the environment. On the other hand, a bad or banal poem would only remain as it was, without being referred or cited.

A poet should feel happy if a part of his/her poem is used in a different poem by someone else. An appreciated poem will be recorded and printed with the name of the poet on the official publication from the court (such publication was regularly accomplished) besides being remembered by others. But at the same time it should be decomposed and reused by others to prove its metaphorical strength.

It is difficult to say either such tradition influenced and prepared the way Japanese attitude toward originality, or it comes more deeply from Japanese or Asian culture. Judging from

the fact that Asian countries share similar attitude toward copyright, it is likely that either Asian culture or Pan-Pacific culture cultivated such tendency.

11. Self and Other

In the early 1970s the video artist Takahiko Iimura created an installation with two video cameras and monitors shooting and showing each other, asking "who am I " and "who are you" to each other(26). It is a most basic question in philosophy as well as in art put exactly in its right context using media technology. It is an example of what media technology has brought to the artists - the possibility of extracting such question (life's big question...) and show it in the most explicit way. Interestingly enough, in this case, the question is one of the major issues in modern biology as well.

Japanese traditional notion of self and other is different from that of the West. The difference reflects in media art as well. (See Chapter I, 3.4.) The artists Katsuhiko Hibino and Noriyuki Tanaka respectively carried an experimental project using the network. Fragments of their illustrations were uploaded on the biggest Japanese commercial computer network and users were invited to download the images, to make one's own image(s) using them. It was an open competition where the artists were jury members. Hibino also had an open workshop during one of his exhibitions. by connecting his studio and the exhibition space with computer network and a telephone line. The artist invited visitors to a remote collaboration while talking on the telephone line. Hibino carried these experiments because he was curious how people would interpret and modify his images, using the pieces of his imagination as seeds.

Noriyuki Tanaka is known for his collaborative works with Shinsuke Shimojo of CALTECH which brought art and cognitive science together(27). Creating a space where a visitor would realize his/her unconscious ego, expectations, or automatic way of cognition, is the purpose of Tanaka's artwork. With Tanaka's two images uploaded on the network users of the net created different resulting images. One of the most interesting works came from an architect who by using 3D computer graphics made a virtual installation of Tanaka's works.

For Tanaka the project was interesting to experience how his imagination would go through changes through other people's imagination. The resulting images are mixtures of imaginations of the artist and the users. The artist experimented the idea even further in his CD-ROM publication then. "The Art of Clear Light"(28), a CD-ROM which contains photographs Tanaka took in different places is not just a photo album of an artist. It contains a piece of software that shuffles the images in the CD-ROM and overlay each of them on top of images from a different folder on the computer. A user is invited to bring in his/her own photographs or drawings into the folder so that each image will be mixed with the artist piece of work.

This is a totally different approach to show an artist's works. An artist usually insists to show one's works in their complete form, without being damaged by any sense. Noriyuki Tanaka insists that his images should be seen as mixed with user's! From the point of view of a user, Tanaka says, when he/she sees one's familiar image (i.e. a photo one has taken, for example)

through the half transparent layer of a different image the artist had prepared, it means that the user sees the scene through the artist's layer of thought -- or, the two consciousness (of the user and the artist) mix in the scene and produce a new meaning. Merging one's self with others to see what is beyond. It is what the title of the publication means, according to Tibetan Buddhism.

Art projects to bring an experience to step beyond one's self are carried by artist Kazuhiko Hachiya as well. In his work "InterDiscommunication Machine" Hachiya made a parody of InterCommunication Center(NTT/ICC) in its naming, and a parody of high-end expensive virtual reality in its system designing. ICC is named after the concept that the new media technology would connect people creating new channel of communication. InterDiscommunication Machine shows that technology can serve to cause discommunication among people. Actually the aim of the work is to promote communication between two visitors by physically relocating the normal communication channel. With this piece of art, each of two visitors(users) is asked to wear a special equipment. It exactly looks like a kind of HMD with a screen and a set of headphone with a transmitter on one's back. What you see is only the screen. (See Chapter IV, 3.3.2.)

What one sees on the screen is the space in front of him/her from a different point of view. It is, in fact, the space seen from the OTHER person. What you see is what the other person sees, what you hear is what the other person hears. A small video camera and a microphone on top of the helmet shoots the supposed view and collects the sound around a visitor. The image and sound are transmitted wireless to the other person's screen and the speaker.

Although the technology used is very simple, this system allows the exchange of one's view and the soundscape with that of the other person. In a sense it is an extremely low-tech virtual reality. It is difficult to imagine what would be such an experience unless you try it. You should look around for yourself on the screen to reach the other. If you see yourself it means that the other person now sees you. You should understand the space around you by guessing what the other person is doing - because you can see it only through the other person's eyes. Shaking hands is already a big deal. People say "try to see things from other people's point of view". When it comes true, seeing things from another person's point of view is not that easy. Gradually you get used to a sense of having one's tele-existence that belongs to another person's coordinate system. It is a strange feeling to merge one's world into someone else's cognitive space (29).

Another project Hachiya realized after the invention of this machine was "Mega-Diary" which took place as a part of network art projects sponsored by InterCommunication Center. A hundred users of the network were invited to write diaries for a hundred days respectively, which would be open on the network. Anyone can read others' diaries. By reading others' diaries daily one starts to have a feeling of one's life mixed with others' lives. One starts to virtually live and experience other people's lives. Personal experience and emotion will be mixed with other people's.

Here again, the theme of the project is to experience a merging ego. "Reading others' diaries was a strange experience," one of the participants said. "But after a while I felt like living their lives even though I had never seen them -- we just happened to be on the same network. They became closer than my parents with whom I live. Someone always wrote about the dish he cooked. I felt like virtually eating those dishes. I watched TV that I didn't watch in my real life, enjoyed

playing games in a game center I have never visited... When we finally met after the hundred day term was over, it was a kind of *deja vu*."

Hachiya's works will be discussed in Chapter IV (3.3.2) again in a different context.

12. Towards Cultural Bio-diversity: Summary on Life and Art

It is not easy to define the relationship between art and science, or art and technology. What lies underneath of them is culture, but art, science and technology also play important roles in culture. Even with the research of complexity it would take time to make a working model of it.

Working and making researches in the crossing point of art, science and technology, having lived in different countries, I am more and more aware of the necessity of understanding the current status of these fields in relation to the cultural background to have a better use of different elements or resources we have, i.e. genes or memes we have altogether on the earth.

Japanese are well known for their efficiency in working in groups. It is why Japanese industry succeeded. On the other hand Japanese are not very good in making decisions on one's own responsibility. Seeking more value on collaboration rather than individual goal makes a totalitarian attitude easier, which was unfortunately proven in our recent history. Our tradition in putting less importance on personal right on art pieces should be a reason of the problem on copyright issue, such as copying software. But the same tradition might bring new possibilities on network, allowing free transaction of imagination. It is a different approach, coming from different background.

There is a word "bio-diversity". An ecosystem with a rich variety of species is more stable and would survive through drastic environmental changes. Species which had developed to fit the environment would have difficulties when something changes. Minor species might find the new environment more comfortable and would become prosperous. If there are no such species all species might die. As is known in case of the regeneration of forest, the ecosystem itself is the combination of different species.

I believe in the necessity of the cultural bio-diversity. Each culture has its own tradition. Through its history a society would generate its own culture; the whole complex of art, society, way of thinking, way of working, etc. which are connected together with the same backbone and nerve system. Every now and then there would be a prevailing culture that orients the global fauna, but when a big change happens to the environment it is such diversity of culture that helps finding the way to modify the rule and keep the global society adapt the new condition. And the environment is in fact changing rapidly and globally. The new way of communication such as network is changing our way of thinking and way of living.

We need to keep our cultural biodiversity so that we keep our capability in confronting possible confusions in our society. We need imagination to foresee our future. Art and science can work together to bring such imagination.

13. Conclusion

In this chapter I examined how fields of human activities, namely science, art and technology, are related to each other around the theme as "life". Science and technology influence people's vision, accordingly changing culture, which then influence science and technology again. Art is also within this cycle of influence, while artists also find new meanings in scientific or technical innovation and make contributions. I conclude that maintaining a richer variety in our media culture is indispensable in the fast changing media environment, and the cross bleeding between different areas is the key issue to grow what I call cultural biodiversity.

notes

1. There are much to be told about the rich history of pre-cinema equipments and the applications. Such technology as magic lanterns was the new medium of that time and was used both in showing realistic images and illusions. It was even used for scientific education.
2. Kusahara, M., Sommerer, C., Mignonneau, L. "Art as Living System" 1996
3. Shakespeare, William, "The Tempest"
4. Schrodinger, E. "What is Life? The Physical Aspect of the Living Cell", p.2.
5. The word "animation" used also as in computer graphics motion pictures signifies that anima is endowed to something which was originally not living. In that sense, we are still using the Greek philosophy?
6. Emmeche, C., "The Garden in the Machine" (1994) p.25.
7. For example, in a popular traditional Buddhist belief in Japan, animals are included in the reincarnation system. Animals were believed to be born in certain forms because their previous lives hadn't earned them lives as human beings in their next lives. While faithful domestic animals and pets might reincarnate into human beings in their next lives, human beings who had problematic lives might reincarnate into animals in their next lives. Even after the war children were told that they might turn into some other animal in their next lives if they don't behave better, and old people would hope that their beloved pets might have chances to be reborn as human beings someday. The most painful part of this religious belief was that women were ranked under men (yet above beast, luckily) in this reincarnation hierarchy.
8. In short, traditionally there was no crucial boundary between lives of human beings and lives of other animals in Japan. It is often said that Japanese way of treating pets or robots is different from that of the West. The above explanation will give an explanation from the tradition.
8. IMAGINA 93 Proceedings
9. The mathematician Benoit Mandelbrot and the computer graphics researcher Richard Voss are the major contributors in this field.
10. Specific participants included Peter Oppenheimer who used simplified plant life cycle models to create imaginary plants, and Craig Reynolds who developed the models of bird and fish migration (his VOID algorithm has been used in films such as "Batman Returns" and "Cliffhanger").
11. Fascination with the mechanism can be seen strongly in Greek culture; the sketches of automatic mechanisms thought to have been designed by Hero of Alexandria, the mention of the working spaces of the gods of blacksmithing as well as the existence of the wooden horse of Troy in the Iliad.
12. Actually these creations are chimeras of already existing species which are merely artificially manipulated with foreign DNA, though different from a living form created from a complete void.
13. There were several celebrated automata makers in Japan as well. Japanese learned the technology from China in 7C. Introduction of mechanical watch from Europe made it possible for the manufacturers to learn more about the technology and apply it to different types of automata. Japanese automata developed mainly in and around Nagoya area. Sophisticated large-scale automata (automatic dolls) became the delight of festival cars in regions around Nagoya. Automata were made for inhouse use and for attractions. "Tea-serving Doll" and "Shooting Doll" are such examples. One of the most famous automata makers was Hisashige Tanaka who later founded a company of precision machinery which developed into Toshiba.
14. Barnouw, E., "Magician and Film", Bailly, C., "Automata at Bagatelles" pp.15-16.

The magician also opened the Theatre Robert-Houdin. During this time the magic of the magicians, hand in hand with the popularity of the automata, had become an important part of the theatrical stage set. It was the time that magicians started introducing scientific discoveries such as electromagnetism. This parallels the transition from magic to optical illusions, and the eventual transition into film while magicians such as Georges Melies became involved in making films. They originally started using the medium to shoot their stage magic so that the film can be distributed to different theatres to meet the increasing demand of their shows, but eventually discovered the optical magic and founded the basis of special effects today.

15 This doll was made in 1769 and was called by the name "The Iron Muslim" because of the attire of the doll sitting in front of the chess board.

16 Kempelen, Wolfgang Ritter von, "Mechanismus der menschlichen Sprache" Vienne, bei J.B. Dagen, 1791, cited from "Automata at Bagatelles"

17 "Automata at Bagatelles"

18 Descartes, "Introduction to methodology"

19 Dawkins, R. "The Blind Watchmaker"

20 Francois Jacob "Le Jeu des Possibles" Librairie Artheme Fayard, 1981

21 Anzai and Nakamura have been using computers for painting and networking professionally since 80s. In early 90s there were few networks including Anzai's own that functioned as meeting places for media artists and researchers where discussions on the concept of originality in digital era continued, along with MOO and MUD which was carried without even knowing how such ideas were called.

Many of the artists who joined Digital Image (the largest artists group using digital medium which was founded in 1990 and had its first exhibition in 1991, the co-founders include the author herself) overlapped with the members of such networks which were inter-related. Because of this network art projects among these artists launched in 1991.

A three day international Renga session was organized connecting the EDGE at SIGGRAPH 94 and artists on network in Japan. An image would go through the modification at SIGGRAPH with artists visiting the space, then the final piece of the day will be sent to Japan at the end of the afternoon. In the morning in Orlando the image sent back from Japan will be uploaded and the same procedure is repeated. Another international session was held during ISEA 95 between Montreal and Tokyo.

22 William Latham "The Evolution of Form" O Museum

23 Ibid.

25 Takaaki Yoshimoto "Tanka-ron"

26 Takahiko Iimura Newsletter

27 Noriyuki Tanaka "PAGES"

28 Noriyuki Tanaka "The Art of Clear Light" DIGITALOGUE

29 "Ars Electronica Festival 96 MEMESIS"

Chapter III Telerobotics and Telebody in Art

1. Introduction

The role and importance of telecommunication technology in making and appreciating art has been more and more important. In this chapter, I will focus how its impact on our perception of body and space has raised and has been visualized in art, including what telerobotics means to our perception and to art.

We are not yet witnessing all the impact that telecommunication technology has brought to art. In some part, the change is already quite visible. Web galleries are everywhere, helping people to enjoy art, theoretically opening opportunities to yet unrecognized artists, and trying to establish the art market on the web. Museums and art centers such as Walker Art Center (1) or ICA(2) have expanded the venue of art, experimenting the new role of museums.

Yet, the above mentioned development is happening mainly on the level of distributing art. Telecommunication technology has brought significant changes both in terms of media and methodology of creating/appreciating art, and the issue of art.

Artists using telecommunication I have already mentioned in the earlier chapters have been working on these new possibilities in of creating and appreciating art. Their works are different from what is often called web art, because the concept of their works come from, or triggered by telecommunication technology itself.(3) Through their own methodologies and imageries, they deal with issues such as, the way telecommunication changes the relationship with others or with the environment, modifying our perception and eventually changing our mental model of the world, and ultimately, bringing new possibilities in the way we recognize ourselves.(4) In short, telecommunication technology has brought both tools/media/methodology/space for art, and themes of art (i.e. issue of life to be dealt by artists). These elements are all interrelated.

From this point of view, one of the important issues that telecommunication technology has raised is the relationship between our body and consciousness.

The relationship between body and mind has been a big issue of philosophy in the West. Mike Featherstone and Roger Burrows point out that since the epoque of the Enlightenment, body and mind have been regarded as separate entities in the Western philosophy, and this has brought the neglitation of body in the Western culture while prepared the basis for the development in science and technology. Featherstone and Burrows argue that this idea was connected to cybernetics, and formed the ground for the sense of disembodiment in today's cyberculture. (5)

In fact, what telecommunication technology has changed notably is the relationship

between our body and the environment. As was pointed by McLuhan and others, media technology changes the subjective distance between one and the other by virtually "extending" one's sensory organs. This means that the way we locate our bodies in the environment inevitably goes through a modification. (6) As I stated earlier, the way we see the world is inevitably constraint by our physical entity. Technology adds features to our body, changing our perception of the world.

An example can be seen in the way we see the universe, or our globe. Now many people share the same image of the Earth; our blue planet Earth viewed from the space. But how many of us have EVER seen such image with our own eyes? Although there are only very limited number of people who have seen it with their very eyes, we now share the image of the blue Earth, seen from the orbit of a spacecraft. The image has served to create a global understanding about the world we share. Ecology, for example, is a concept that owes a lot to such global image we share today, thanks to the combination of telecommunication and imaging technology. In this case, we have extended our sight to hundreds of kilometers above the earth.

Such change also raises a philosophical question. When one says "I know the Earth looks blue", what is the level of knowledge he/she has? According to a classic standard, what the words "to know" means can be classified into several categories, from a direct hand-on experience to the level of "I heard what someone heard" indirect knowledge. (7) Recording /reproduction technology such as photography, film, video, tape recorder, etc. have already blurred the boundary of level of directness. What about telecommunication technology? What I see through a video conferencing system, or a web cam, or what I touch via telepresence system -- will they belong to my most direct knowledge? Thus, virtual extension of body would eventually change the nature of epistemology. As robotics combined with telecommunication technology has grown to telerobotics, we are facing the telecommunication version of epistemology -- we will call it telepistemology.(8)

To understand what is the impact of telecommunication on our life in terms of our perception, instead of trying to answer them directly I will mainly analyze artists' works using telecommunication, specifically, how digital telecommunication technology has been changing the relationship between our body and space. I hope such analysis will eventually help designing a better interface between our body and space.

One technology I will focus on in this chapter is telerobotics. Even though it was originally developed with the demand from the industry and military, telerobotics technology offers an important arena for experiments and analysis in art because of its nature. Telerobotics technology establishes a new way of relating the body and space via telecommunication.

While the notion of body in virtual space or cyberspace has become an important theme in media study, there is not enough cross talk between discussion in the domain of virtual reality and in the domain of contemporary art. The main focus of this chapter is to analyze how technologies such as telerobotics, teleconferencing and the Internet has been changing art, and how art, on the other hand, visualizes the way these technologies change the meanings of our body and sensory organs.

There is a specific feature in common among the artists I will discuss here. Instead of using a traditional medium such as painting or writing, or filming, they use the media technology

itself -- the technology they are examining -- to visualize what it would bring to us.

2. Telerobotics and Art -- Presence, Absence, and Knowledge in Telerobotic Art (9)

2.1 Introduction

Representing a "here-and-now" (or a juxtaposition between "here" and "there") through bodies, subjects, and the space they occupy has become a major theme of art in the post-modern era. Insofar as contemporary art visualizes problems from the unconscious, this suggests a problem in contemporary life concerning the reality of time and space. Today's telecommunications technology gives us unprecedented abilities to observe and manipulate distant objects -- including distant people.

In so doing, it raises questions about our relationship to those objects we manipulate, how we can know those objects, and ultimately about our relationship to ourselves -- our minds, our bodies. Telerobotic art explores these issues by presenting experiences and situations that test our conceptions of presence and absence, seeing and being seen, manipulating and being manipulated.

In this chapter, I examine how recent works of telerobotic art raise and address these telepistemological questions. I will focus in particular on six artists and works that actively explore these themes: *Light on the Net*, *Tillie the Telerobotic Doll*, *Rara Avis*, *Telegarden*, where I can see my house from here so we are, and *Ping Body*. All of these works address, in various ways, questions of knowledge, experience, presence and absence that are raised by contemporary telerobotic technology.

2.2 Art Theory and Technology : Here-and-now in Reproduction Age

This theme can be seen as a response to questions raised by Benjamin and developed by Sontag.(10) (See also Chapter I,1.1.) Reproduction technology such as photography changed the meaning of art by taking away the aura that marked the essential feature of paintings and an important part of their value.(11) A photograph treats time and space differently than traditional painting does. A work of photography proves that the person (photographer) was there, then. Photography records what is "here-and-now" and delivers that moment and space to the viewer.

The history of reproduction technology saw another milestone with the advent of modern telecommunications. In its provide infancy, television was a real-time technology that transformed "here and now" into "there and now." A framed portion of space which really existed somewhere (generally in the studio) was broadcast in real time to viewers. Figures on the television screen were not physically present in the space where they were viewed (typically a living room), but

viewers could assume they existed somewhere -- in a different space, but at the very same time, that is, now. With video and magnetic storage, however, even this became unclear. One can no longer assume that the scene one is watching is currently taking place somewhere. With blue screen technology and digital special effects, it is no longer even certain that the scene one sees on the screen has ever taken place.(12)

Being here and now means being present with the physical body, not merely communicating via electronic signals or optochemical material. Art performances using the body (consider Yves Klein and Jackson Pollock) can be regarded as an early recognition of these concerns -- an attempt to realize an art of presence, rather than absence.

Our culture is undergoing a truly drastic change in terms of our physical and psychological relationship with space and other bodies. Digital technology (computer graphics, virtual reality, telecommunications) has brought us the notion of disembodied presence. We can no longer simply believe what our eyes see and our ears hear. Telerobotics makes it possible to represent oneself in far-away places through a network. But how do others know that the robot is operated by a real person? And how do we know that the robot is representing the world accurately back to us?(13)

In this chapter I will discuss select works of art related to telerobotics and telepistemology, works which examine the way we experience and understand space, distance, presence, and our bodies in the context of digital technology.

2.3 Space and Time in Telecommunication Age: the History

Telecommunications art goes back at least to the 1980s, or even to late 70s. In his *Good Morning Mr. Orwell* (1984), Nam June Paik used satellites to connect various remote locations.

Kit Galloway and Sherry Rabinowitz, who are known as the founders of the first Electronic Cafe in Santa Monica, realized such concept even earlier in "A Space With No Geographical Boundaries" (1977) where artists from different continents virtually performed on a single screen. (Fig.1-2) In 1980 Galloway and Rabinowitz made a public interactive performance, *Hole-in-Space*, where people in New York and in Los Angeles figured out the workings of large screens and cameras with sound speakers and microphones installed on the street, and started using them. (14) (Fig.3)

In the early 1990s, telecommunications technology began to combine with robotics. An early project in telerobotics art was realized by a group of researchers, artists and engineers, Van Gogh TV in Germany, who connected viewers' telephones to a television studio.(15) In an interactive television project *Piazza Virtuale*, which continued for 100 days during the Documenta in 1992, various ways of interaction to control or create image and sound were realized, including those with multiple users. In one of the programs viewer/participants used push-phone numeric

keys to control the movement and zooming of a robot camera in the studio. (Fig.4) The resulting image appeared immediately on the viewer's television set. The project strongly reflected the group's vision of a networked, widely accessible shared reality.



Fig. 1-2 A Space With No Geographical Boundaries 1977



Fig. 3 Hole-in-Space 1980



Fig. 4 Piazza Virtuale 1992 remote controlled TV camera

2.4 Earlier Works of Telerobotic Art

The Internet vastly expanded communication and cooperation as artistic themes. In 1994 two telerobotic art projects were realized on the Internet: the Mercury Project (1994) by Ken Goldberg, (16) which allowed users to dig for buried objects in a remote sandbox(see <http://www.usc.edu/dept/garden/>), and Kac and Bennett's "Ornitorrinco in Eden", which enabled remote participants to share control of a wireless telerobot. (see <http://www.ekac.org>) I will analyze Kac's works in more detail in the later part of this chapter.

Another project was Masaki Fujihata's *Light on the Net*, originally produced in 1995 and redesigned and permanently installed in 1996. Via the Net (<http://light.softopia.pref.gifu.jp/>) the visitors find a live image of the entrance hall of a building in Gifu Prefecture, with 7x7 matrix of light bulbs. By clicking on any of them one can switch a bulb on or off. (Fig.5-6) The design is simple and beautiful. The live image is in fact a clickable map, which instantaneously reflects the change. Log file shows the history of visitors. The piece was designed to be a spiritual meeting place on the Net, where one's visit leaves a trace on a physical object.

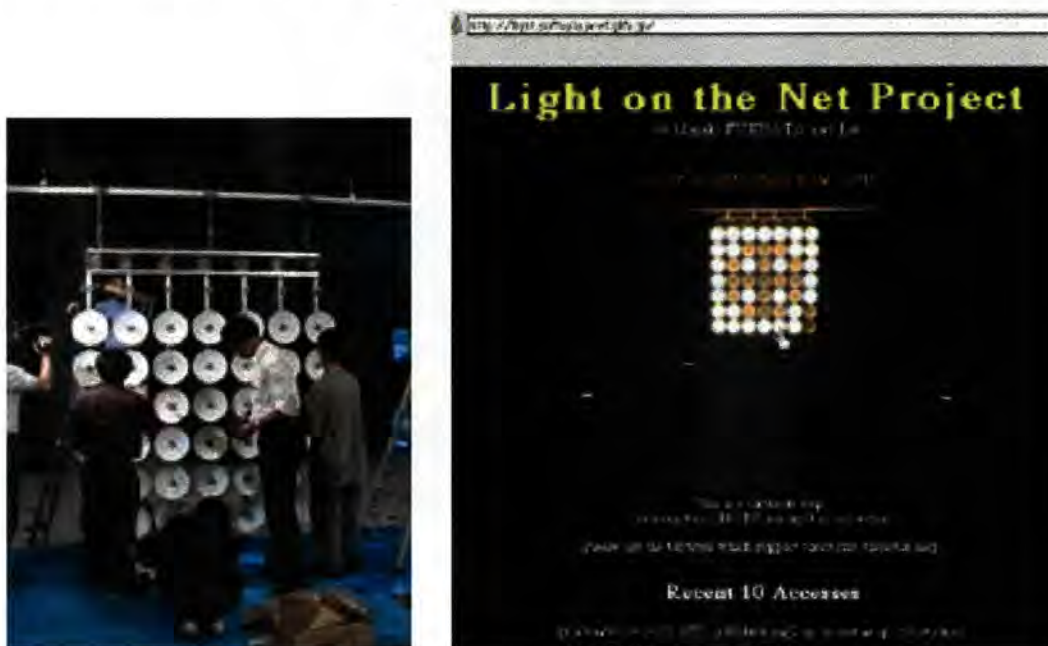


Fig. 5 - 6 Light on the Net

Fujihata also created the *Global Interior Project* (1995), which consists of 18 white cabinets on the exhibition floor, and a number of personal computers at remote locations all networked via ISDN line. (17) Through the computers, by means of avatars, users can navigate a virtual world which contains 18 rooms corresponding to the cabinets. Each room depicts a theme (e.g. language, memory, religion, sex) which is represented by an image that corresponds to a physical object in the real world, that is, in one of the cabinets. These objects are all made of LEGO blocks. Identical elements in artificial colors form different objects in unnaturally jagged forms. Every time someone enters or leaves a virtual room, the door of the corresponding (real) cabinet opens or closes with a loud bang, showing -- or hiding -- the object inside.

What do they signify? Does a LEGO missile represent war? Do these toy lego models in the real space, looking quite unreal and jaggy, are more real in the 3DCG model we saw in the virtual space? How about the people we meet as avatars in the virtual space?

What do we know about these abstract ideas? As I stated at the beginning of this chapter, telecommunication leads us to the question of epistemology. (See Chapter IV, 3.2 for Fujihata's other works.) Although it does not use the Internet, Global Interior Project provides a clear example of a central dynamic in telerobotic art: actions in a virtual space bringing about changes in the real world.(18) The juxtaposition of the virtual and the real plays an important role in telerobotics art, both aesthetically and epistemologically.

Many telerobotic art installations make it possible for us to "see" through the eyes of another -- a doll, a mechanical bird, a robotic gardener, a robot made of junk -- through our interaction with a virtual world presented on a video monitor. But how do we know that this virtual world corresponds to the real one? And how does our position -- both in the real world and in the virtual one -- affect our experience of ourselves and our world? These are central questions for telepistemology and telerobotic art.

2.5 Artworks and Approaches by Artists

2.5.1 From/to Body to/from Robot (19)

Eduardo Kac realized *Ornitorrinco in Eden* in 1994 and *Teleporting an Unknown State* in 1996. It was one of the earliest telerobotics projects, realized simultaneously with the early work of Ken Goldberg. (See 2.5.3.)

When Eduardo Kac showed his piece "Teleporting an Unknown State" at SIGGRAPH 96, the public may have wondered how one could transfer sunlight via the Internet. (Fig.7-9) If enough amount of light were not provided, the young plant, which was planted in the total darkness in the SIGGRAPH Art Gallery, would die.

In this project any participant from all over the world can capture the "photons" using one's own web camera and "send the photons" via Internet. The signals will be transferred immediately to the computer at the exhibition site thus giving power to a projector hanging on top of the young plant. It was only the participants' collaborative will that would keep the plant alive and growing. This plant grew from a seed without knowing the outer world and real sunlight. (20)

"Teleporting an Unknown State" can be compared to Ken Goldberg's "Telegarden" in the sense that it involved a real plant, and that visitors from the network shared the responsibility in taking care of it. However, there is something very different in "Teleporting an Unknown State". It is an element that can be associated with the latter part of the title, "Unknown State". While non-material subject-issue such as photon or network is the medium or vehicle for such physical phenomenon as people sending enough light for a plant, strong desire for commitment toward physical entity and the involvement of one's own body is observed.



Fig.7-9 Teleporting an Unknown State 1996



Fig.10 Ornitorrinco in Eden, 1994



Fig.11-12 Rara Avis, 1996



It might be related to the fact that Kac was born and grew up in Brazil and then moved to the USA. Certain similarity can be observed with Stelarc who was born in Australia and lived in Japan for a while before he started using electronic technology in his performances. Confrontation to different culture inevitably brings a concern toward one's identity including the role of physical body. Also, artists such as Kac or Stelarc would say that they do not fully believe in the Utopia of cyberspace. In appreciating the works of Kac, we cannot leave the real and physical world with our own bodies, plants and animals.

Looking from the point of view of telerobotics, no mechanical or kinetic output was realized by participants via the Net in "Teleporting an Unknown State". Yet, the nature of physical (in this case optic) interaction it involves and the clever way to transmit such physical interaction over the Net can be regarded as another possibility in telerobotic art. However, among projects by Kac who is known as "telepresence artist", works such as "Ornitorrinco" and "Rara Avis" are more directly related to the notion of telerobotics.

In the "Ornitorrinco" project, which started in 1989 and was shown in many different

configurations until 1996, participants could move around a small robot using a live video conferencing connection. (Fig.10) "Ornitorrinco in Eden" took place in 1994, and was, together with Goldberg's "Mercury" (1994), the first telerobotic artwork on the Internet. The main issue in this project was the participants' experience and the process itself in real time over real space. The robot reacted to each of the input from participants rather than being programmed for certain goal or action, realizing "democracy" in the multi-user environment, according to Kac. Again, such awareness about democracy and real time/space shows Kac's basic attitude toward technology and interactive art as well as for society.

In his recent works the entities that are telerobotically manipulated are no longer plants or animals. The double positioning of one's body in both real and virtual world causes a split of consciousness. In Eduardo Kac's *Rara Avis*, the visitor's identity and position are trapped in an endless loop involving inside and outside, freedom and captivity, manipulating and being manipulated.

In "*Rara Avis*" (1996), a visitor walks into a triangular room and finds a bird cage in front of him/her. (Fig.11-12) There is a group of monochrome birds in the cage and a colorful large telerobot macaw. There is a VR headset on the pedestal. When the visitor wears the headset, one discovers that he/she is seeing through the eyes of the electronic macaw. The visitor would recognize oneself on the Head-Mounted Display screen through the Robot-bird's eyes, seen from inside the cage. As the viewer moves one's head the same movement takes place with the macaw's head thus causing change of the view on HMD. The fence divides the free space that opens to the outer world (remember, the room is triangle shaped) from the captured state inside the cage that leads to a narrow end. The configuration of the space, which reminds me of an installation of Bruce Nauman, is metaphorical both in psychological and social aspect.

From an epistemological point of view, telerobotic technology places the viewer both inside and outside the cage. It is said that we receive approximately 90% of the information we get from outside through our visual system. And our cognition is formed based on the input we get. Then, the consciousness of the viewer, in this case, should be floating in the cage, while his/her body remains outside the cage.

The work brings up questions about the reality of our life through contradictions, as is shown in the contrast between monochrome real birds and the colorful artificial (robot) bird in the cage. In our daily life we take it for granted that we live in a single, real world, with a single body and consciousness -- but is our condition really that secure?

With the advent of the Internet, virtually living in another community (or another space) is becoming our everyday life. Having another 'self' in another world as an avatar is also possible. But then, where do we live -- where are our bodies? Is the reality of life attached to the space one belongs with the physical body, or to the space one's consciousness belongs to? Or do we belong to different spaces at the same time in a loop of switching realities? With his life belonging to different cultures in the real world, Kac visualizes the problems we will face in near future with the layered metaphors in his work. *Rara Avis* is a work that can really be read in multidimensional ways.

2.5.2 A Doll's Eye View

Reliance on tracking and surveillance techniques has resulted in a culture that has a peripheral vision that extends beyond normal human physiology. In many cases, there is a merging of human and machine capabilities that create new beings, cyborgs, whose virtual reach, and in this case sight, is extended beyond physical location. Identity becomes intangible on the Internet and Tillie's face becomes a mask for the multiple expressions of the self that links each person to another. (21) (Lynn Hershman, press release for Tillie, The Telerobotic Doll, 1998)

Tillie, a typical feminine-looking doll, stares at you from the web site of the San Francisco based artist Lynn Hershman (Tillie, The Telerobotic Doll, 1998). Each of Tillie's eyeballs moves slightly as you move the cursor on it. (Fig.13)

Click on one of her eyes and an image of a gallery wall appears in a window below. It is what the doll sees in the gallery-in the physical space where she sits. The doll's eyeballs have been replaced with cameras that send images to the Internet.

Through Tillie's eyes you can look around the gallery, turning her head to get the view you want. You can also visit the gallery itself, and watch the physical Tillie in front of you. You will see your own image physically reflected in Tillie's eyes, but you are also being watched by countless unknown Internet users behind her, who are using Tillie's face as a mask and watching you through her eyes. The gallery becomes a bit of a peep-show, or a one-way mirror.

As Hershman states, "voyeurism and surveillance tactics have become extensions of our 'I'. Cameras have become both eyecons and contact lenses" (Lynn Hershman, "If information that does not move, it ceases to exist as anything but potential" 1997, from press release for DOMINANT CULTURE, Lynn Hershman c. 1995- 1998). Web camera is also used in Hershman's recent work "Difference Engine 3" shown at ZKM in 1998-99. (Fig.14) VRML is used to create a virtual world users can navigate through. A user can choose an avatar and through the eyes of the avatar he/she virtually travels through the museum in Karlsruhe.



Fig.13 Tillie 1998



Fig. 14 Difference Engine 1998-99

The concept here is a continuation from Hershman's earlier work "Room of One's Own" (1986) where a visitor looks into a peep box to find a miniature room of a woman. But then he/she discovers an eye that looks back at the voyeur from a TV screen by the bed. The eye belongs to the voyeur him/herself - a hidden video camera inside the box "shoots back" (a term used by Steve Mann) the eye of the visitor and displays it on the screen.



Fig. 15 Roberta the Telerobotic Presence

The piece deals with Voyeurism and gender, but it further raises questions on the viewer's (in double meanings) identity in the situation like a series of nested boxes. This theme goes back further to her earlier projects such as the performance/ installation in room 47 of THE DANTE HOTEL or the creation of ROBERTA BREITMORE. (22) In the Dante Hotel, visitors became involved in the life of a virtual persona who lived and left her trace in the hotel room through physically visiting the room and stepping into the space which was empty. In case of Roberta people (including the businessmen who issued a credit card for her) believed her existence through well-prepared documents, letters, evidence photo and newspaper ads for roommate, without stepping into any physical space Roberta appeared in the photo. Relationship between seeing and being seen, real persona and shadow persona are represented at the intersection of real space and virtual space.

Use of web camera in Tillie changed the notion of space in the virtuality.

In Hershman's works, to see and to be seen overlaps above the crossing point of the real personality (= viewer/visitor) and the virtual personality in the virtual space - in the hotel room, or in the peep show box, or in the virtual Netspace.

Web camera is an extension of one's gaze, voyeurism in this case. By connecting two physical spaces using web cameras and making possible to manipulate the 'view' of the other space, the boundary between the reality and virtuality of the space - and the view inside the space - disappears. As Tillie herself is both a real doll and a virtual one on the netspace, the viewer oneself becomes a virtual persona from the other end of the connection, becoming an agent of him/herself.

2.5.3 The Distant Garden

Since Eden, the garden has been a metaphorical space, especially in Japan. The stone garden of Ryoanji Temple invites visitors into meditation while physically it is just a set of stones and pebbles. I was born and grew up in central Tokyo by an old garden named Rikugien - one of the most famous and typical landscape gardens where visitors would walk along carefully designed winding paths which lead them through an unfolding experience in old Japanese and Chinese literature. Every rock, stream, tree and arbor refers to a certain scene in a poem or legend. Both in Ryoanji and Rikugien, as well as in other metaphorical gardens, what one sees and experiences is something beyond the physical entity the garden implies. The garden, the real space, is the field of imagination and/or discovery.

I call such space a field. A field, in physics, is a space which implies potential force or energy that would be applied to objects that enter the space. In mathematics, a field is an abstract multidimensional space filled with vectors. A field in biology is a piece of land where ecological interaction takes place between species. A field is a powerful interface for imagination, communication, and interaction between the real and the virtual.

Historically and psychologically, gardens carry a sense of secrecy: Eden, the Garden of Eros where Psyche sneaks in, "The Secret Garden"-a classic novel and film. Secrecy is also a feature of many gardens in China and Japan. Visitors to Kyoto, for instance, are disappointed not to see anything while walking on the street. All the beautiful gardens are hidden behind high walls. It is the same in China. A garden is an extension of a private, inner space into the outer world. Like skin, a garden belongs both to the outer open space and to one's inner life. It was with the arrival of civil society that gardens became open spaces, often surrounded by fences instead of walls. Gardens in the United States and Canada are generally open. A typical garden in front of a suburban house surrounded by a low hedge or fence serves both as proof of the owner's status (that is why most of them look alike) and as the interface for communication with neighbors.

The Telegarden (1994), (<http://telegarden.aec.at>) by Ken Goldberg and Joe Santarramana and their collaborators, brought back the thrill of secrecy to the garden. (Fig.16-17) What is the feeling of owning a flower or a vegetable in a garden that one has never visited, and will never visit, yet taking care of it telerobotically and watching it grow? Only a limited number of people know about the garden and are allowed to (telerobotically) enter. Even though it is a "common" among users who share the garden, it is still a secret garden. Like the stone garden of Ryoanji Temple, which visitors are not allowed to step into, the Telegarden is to be seen only from inside.

In a sense, the secrecy of the garden is in the garden itself. Worms, ants, and other strange creatures might be hiding in the soil. Children spend hours watching them or digging the ground to catch them. And one always finds unknown plants growing, possibly carried in by birds. It is the rich soil, the earth itself that provides continuous wonder.

A garden is field of possibilities, and so is the Telegarden. This Internet telerobotics art project is not merely an opportunity to garden via network. The garden is a field that elicits

communication among its users. Goldberg and his colleagues describe the Telegarden as an experiment in creating a planned virtual community, one in which the virtual space invites participation and encourages return visits. The Telegarden is a telerobotic art installation accessible via the World Wide Web in which remote visitors can participate, manipulating an industrial robotic arm to control a color CCD camera, plant phlox, eggplant and other flora, and water their own and others' seedlings (Telegarden WWW page).

Users can participate only if they reveal their names and email addresses, and communicate with other users. Each user accepts responsibility for maintaining the garden and respecting others. Telegarden is not a simulation. Users are dealing with live plants growing in a real garden. The garden on the Internet is a "commons" in the traditional sense (as in "Boston Common"). It literally offers users a common ground. A Commons elicits and requires communication among users.

In this respect, the "Telegarden phenomenon" has something in common with Tamagotchi, which is a virtual pet in one's pocket. Tamagotchi became very popular because it served as a communication tool among children. But the joy also came from the classic thrill of owning something live in one's pocket -- like many schoolboys used to have. The problem with Tamagotchi is that it has nothing to do with real life, and it was a very simple and poor simulation of life's complexity. Telegarden is based on life in a real (but remote) physical space. Tamagotchi is virtual, Telegarden is distal.

The distal nature of the Telegarden is precisely what makes it interesting from a telepistemological point of view. The Telegarden is real, but (unlike a traditional commons) we never actually see, feel, or hear the garden itself: It is too far away for that. Our knowledge of the Telegarden is technologically mediated, and that introduces a disturbing doubt: How do I know that the Telegarden really exists? Perhaps the Telegarden web site is simply sending me pre-stored images of a garden that no longer exists. How do I know that the Telegarden community exists? I think the Telegarden provides a high-tech commons where I can interact with other users. But how do I know that those users really exist-that they are not fabrications of the artist, or even mere "virtual" personas cleverly programmed to mimic on-line chat? (23)

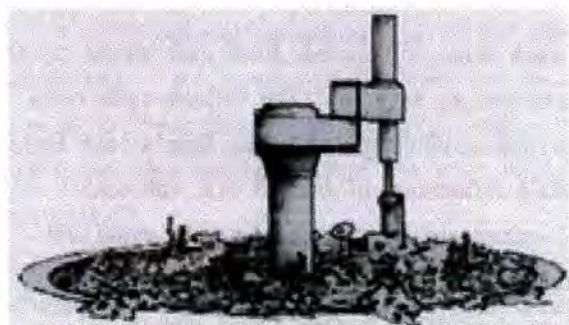


Fig.16 Telegarden 1994



Fig.17 Telegarden in Ars Electronica Center

2.5.4 Hall of Mirrors

Among the line-up of interactive installation works selected and exhibited at the Interactive Media Festival 95 (it will be remembered as one of the best shows of interactive art in the 1990s), Ken Feingold's "where I can see my house from here so we are" was unique. In the middle of a large floor there was an arena divided into three sections by low, mirrored walls. In each section lived a metal robot which Feingold had built out of junk-like materials—dishes and bowls from a Chinese restaurant supply shop, a molded metal head modeled after an old ventriloquist puppet (or was it a fortune-telling machine?), and a mechanical drive with wheels to move the robot around. The three robots looked identical except for slight differences in color.



Fig.18-20 where I can see my house from here so we are 1995

Each robot was controlled by a visitor/user in a personal, curtained booth. The booths were located in three corners of the floor. (They were supposed to be installed in remote sites and connected via ISDN, but practical constraints forced them to share the same floor, divided by curtains so that users could not see the arena or each other directly.) Users saw the arena on a projection screen from the point of view of "their" respective robots. Users also heard sounds transmitted from the robots, and when users spoke into microphones, the robots opened their mouths to speak. Joysticks allowed users to manipulate their robots, driving them within their respective segments of the arena.

Driving them to do what? To communicate with each other, of course. Each user would try to find other robots in the arena to communicate with. It was not an easy job: The infinite reflections of the mirrored walls produced innumerable robot images and a labyrinth of walls. One would look for buddies (through the robot's body and eye) only to find reflections of oneself (i.e., of one's robot). With the limited sight provided by the little CCD camera in the robot's eye, one could not get an overview of the arena. Users would manipulate the joystick hopelessly without knowing if they were moving the right way or not. People got lost in their robot bodies. Other visitors

watching the arena would observe a robot turning away from its buddies only to talk to itself on the outer wall.

Feingold's installation draws our attention to the enormous difficulty of acquiring knowledge by telerobotic means. From its description, Feingold's installation seems to embody the telerobotic dream: using the Internet and a robot to discover a foreign environment and communicate with others. But the reality is a horrible failure, at least as an attempt to acquire knowledge about the robot's surroundings. It is extremely difficult to use these robots to discover anything. We are constantly lost and confused, trying in vain to know where we are, who we are communicating with, what we are seeing, etc. The dream of Internet telerobotics as a tremendous expander of our knowledge falls apart amid a reality of confusion and loss of control.

Feingold's telerobotic installation continues work he had been doing even before the Internet. In one of his earlier works, *The Surprising Spiral*, participants traveled through time and space (through video that the artist shot during his travels) by turning pages of a thick book which served as the interface. But like the robotic installation, this one came with a catch: Participants often saw no direct correlation between their inputs and the changing scene: An algorithm mixed user inputs with inputs from previous users, preventing a clear one-to-one correlation between inputs and outputs. Some participants complained, but it was part of the artist's point.

Traveling through unfamiliar lands is always a problem. Isn't it an illusion that we are on our own and free to travel the virtual world as we like? The work was a commentary on control issues in interactivity and today's digital media. Feingold explains:

The structure of the work is such that the viewer/participant cannot know what effects their actions will produce. What I learned was that many who encountered this work were frustrated by their inability to "get what they wanted," to control the work. Interactivity is, in many ways, about affirmation of the human action by a nonhuman object, a narcissistic "it sees me." But beyond that, there is the desire for control, for mastery over the non-human entity. I also learned that it is a rare viewer who feels comfortable in the role of public participant in an interactive work which has no clear "goal." People always seem to ask the same questions when the "destination" of the interaction is unclear -- "How is it structured?", "Is it random?", "How can I get what I want (or see what I want to see)?", "Am I doing it right?", "What will happen if I do this or that?"

[It] pointed something out to me very clearly - that people expected unambiguous interaction. It actually disappointed me tremendously, as I expect the audience, and audiences turned into participants, to bring to interactive works the same capacity for abstraction, metaphor, and ambiguity that are well deployed and comfortable when viewing painting, or other artworks.

(Technology in the 90s presentation, The Museum of Modern Art, NY, Ken Feingold April 7, 1997)
(24)

2.5.5 Wired Flesh

Stelarc, the Australian performance artist, gives unforgettable performances. While other artists use telerobotics to move some type of mechanism, such as a camera or robot, Stelarc uses it to move his own body. His body is the object, the mechanism to be manipulated remotely. The involuntary body, or the externalization of body, is the central theme of his works.

"[Stelarc] has devised an "Internet body upload system" that enables audience members to reach out and touch him in ways AT&T never imagined. In *Fractal Flesh-Split Body: Voltage-In/Voltage-Out*, a performance that took place November 10-11, 1995 at Telepolis, an art and technology festival organized in Luxembourg by the Munich Media Lab, Stelarc plugged himself into muscle-stimulation circuitry controlled by a Mac. The Mac, in turn, was connected, via the Internet, to Paris's Centre Pompidou, Helsinki's Media Lab, and Amsterdam's Doors of Perception conference. By pressing a color-coded 3-D rendering of a human body on a touchscreen, participants at the three sites jolted the artist's (literally) wired body into action. Blipped across the net through a high-speed link to the computer in the performance space, their gestures triggered Stelarc's muscle-stimulators; low-level bursts of voltage, zapping through electrodes attached to his limbs, caused both arms and one leg to jerk involuntarily into raised or extended positions."

[Mark Dery, essay from <http://math.lehman.cuny.edu/tb/stelarc.html>]

Stelarc's performances raise, in a particularly immediate and striking way, one of the central problems in telepistemology: a telerobotic version of philosophy's problem of other minds. I attended one of Stelarc's performances at the Maribor Media Festival in Slovenia (1996). It was a strange experience to act as a sort of marionette operator manipulating a real human -- especially for me, since I have known Stelarc for many years. Although Stelarc is an old friend, there was a strange absence of reality for me. When I gave him electric shocks to jerk his limbs, it was like manipulating a machine or a robot. It was hard to accept that I was causing him pain, even though I saw his body writhe and jerk. There was, after all, no feeling of pain in my side or my arm.

In some respects, this resembles an old problem in philosophy: How do we know, purely on the basis of their physical behavior, what is going on in other people's minds? But the problem here is slightly different: The technology furthers the sense of remoteness of unreality of the pain. I would never hit Stelarc or shock him with a cattle prod -- in these low-tech cases, his pain seems all too real. But somehow the mediation of a network and a computer monitor make Stelarc's pain seem more remote, less real. The installation even encourages this, by shielding the user from Stelarc's view and presenting her with a clean, user-friendly interface design that seems designed to avoid any personal feeling. I have no doubt that Stelarc would feel pain at the other end of a cattle prod, but how do I know what he feels at the other end of a network designed to insulate me from his pain?



Fig. 21-26 Stelarc performance "Pinged Body" at ICC

The distance that technology imposes between us and other minds reached a new level with a recent Stelarc performance "Pinged Body" in ICC (Tokyo, 1997) and elsewhere. This time, there was no direct control of his body by the audience. Stelarc was connected to the Internet. A search engine was constantly checking traffic on several pornographic and body-related web sites and giving the numbers to the engine which activated the stimulators. So the "master" was the Internet itself. Stelarc's body became a slave of information on the Net -- the invisible distillation of the desires of people across the globe.

Stelarc's performances may be extreme, but they raise issues that are becoming increasingly universal in the world of email, telerobotics, and the Internet. It is well documented that people behave very differently on the Internet than they do in person. They are much more willing to say and do things that are angry, hurtful, and obscene. Stelarc's performances offer a deep insight into this phenomenon. As technology mediates our interaction with each other, it also distances us from their thoughts, feelings, and emotions. This distance gives us -- as it gave me at the Stelarc performance -- an odd, disturbing sense of boldness and disregard.

2.6 What Telerobotics Means to Art

In all of these artworks, we see how telerobotic technology expanded the opportunities for media art. Art makes us discover or realize something in our lives which is important, but we tend to forget or overlook. What, then, are the thoughts these telerobotic art works provoke? By enabling users to interact telerobotically with distant environments, artists force us to examine the relationships between proximal, distal, and virtual spaces. Experiencing correlations and gaps between the proximal and the remote makes us think about the nature of the media society in which we live -- and the mediation of knowledge and experience that is its hallmark.

3. Telebody - Body and Telecommunication

3.1 Introduction

Our concept of body has changed through history, both according to scientific knowledge and philosophical ideologies, and the influence they have had on culture, which, in turn, influence science and technology. Also, there are different but related approaches in thinking about body. That is, body can be seen either as a physical object, an organic system, a mental model, etc. Actually, notion of body is a social matter as well. For example, the idea about the ownership of one's own body changes notably in different societies. Slavery is an extreme case. Altogether, what body means to each person -- to one's self or identity -- differs according to the above mentioned issues and elements such as religion, culture, science, technology, politics and gender, among others. (25)

Development of media technology has brought a big change to the notion of body. The complex network of influence among technology and science, philosophy, religion, fashion, etc. is forming a new vision and status of body in our contemporary culture. Today, digital media technology has been changing our way of seeing body in many ways. We observe different ways of seeing human bodies in our media environment according to the way the technology relates to the body. Body can be regarded as an image, a virtual object, or even as a data set, instead of a physical, real object that is alive in the real time/space. Body is no longer "as it is", as a biological and physiological entity that belongs to the domain of animals. A body can be enhanced and extended, not only with tools and technologies but also with supplements such as artificial organs embedded inside the body. Also, technologies such as telecommunications, digital entertainments and virtual realities have brought us a new feeling that a virtual world exists within the computer or in the Net, where minds can go in, leaving the bodies behind.

How do we understand these phenomena and relate them within the media culture? What are the roles of the technology and the culture? These questions should be answered to find a better solution to place our bodies in more comfortable positions in the digital society.

3.2 History and Reasons of Disembodiment

We can classify the above mentioned phenomena into the following list.

i. Body as an image -- with imaging technologies

It already happened with the advent of photography. Body has become a recorded image without a physical entity. With the arrival of electronic media, bodies can be "live" images. We observe anonymous actors and actresses on TV commercials playing a similar role. What matters is only their physical body, detached from the personality, voice, or name.

ii. Body as a virtual object -- with reproduction technologies

Such body for appreciation that can be recorded, reproduced and looked at, independent

from its ownership.(26)

iii. Body as a data set -- with digital reproduction technologies

Digital technology de-materializes human body to a set of data. We have many real human bodies and virtual characters on the Net: Both are there as data sets, regardless of their originals and the identities. Akira Gomi's CD-ROM-based artwork "Yellows" depicts what is happening to body and identity. (27)

iv. Enhanced body -- with tools incorporated in body

We are all cyborgs, according to Donna Haraway and others. Our body, or even life, is often enhanced or supported with medical artifacts embedded in the flesh. Is there any clear boundary between such body and a body enhanced with high-tech equipments? Or, will there any clear boundary between the Robocop and a person who has his/her body parts replaced by artifacts that are much powerful and stable than organs made of flesh? In fact, Steve Mann consciously experiments himself to be a cyborg connected to the Internet. (29)

v. Extended body -- with tools and telecommunications technologies

Tools extend our body, both physically and virtually. The feeling of virtual extension of body was observed since early forms of telecommunications technologies such as radio or telephone, with which the sense of space and the location (and size, transparency, etc.) of one's body has changed.(30) However, digital telecommunication has changed the relationship between our body, space and time in a drastic manner, as I have argued in the earlier part of this chapter.

vi. Lost body -- with telecommunications and other digital environments

In the age of the Internet, "the other end of the telephone line" is no longer clear. Our body is extended, but we do not know where are our extended eyes, ears, etc. Our body can spread in the space without physical entity, or it can be lost in the space, without knowing exactly where it is. Moreover, while the real space is measurable, there is no sense of scale in cyberspace.

vii. Immersed body -- with cyberspace and other digital environments

Immersion typically happens while playing a game or online chat, or other entertainments. In subjective sense the mind loses connection to the body, which is left in the physical space.

As we can easily see, these are related to and overlap each other. There are both technical elements that work on objective level, and social, cultural elements that work on the subjective level that produce the above status. The subjective elements are in their nature similar to what we already knew with "analog" media such as photography, film, TV, etc. However, digital technologies have not only enhanced these elements far beyond what analog media technologies could have done, but also changed the way we regard body and space. Objective elements such as telecommunications technologies and virtual realities or mixed realities, have brought new dimensions in the relationship between the body and the environments. From a wider aspect, these are a part of the fundamental changes that has been taking place in today's world in the way we see body and life, with other -- yet related-- elements such as genetic engineering.

The phenomenon known as disembodiment has occurred as the consequence of such situation. As can be seen in the above list, our notion of body has been changing. The existence of one's own body can be forgotten (or lost, as an image) during immersion into the cyberspace -- namely while enjoying video games, web chat, web surfing, etc. Disembodiment had been taken

positively in cyberpunk culture, which, in turn, has influenced the way we see our body today. In other words, the sense of disembodiment has become a new state of human beings in today's media culture. But how does disembodiment takes place, and what will be the impact of such phenomenon to our real life?

We can start with a practical observation. According to existing analysis, the use of screens promote the sense of immersion to the viewers by raising a feeling that there is a virtual space behind the screen. With such feeling -- the screen is a window and there is another world on the other side of it -- viewers might imagine to step into the other side, as the boy in the film "Pleasantville" does. This imagination has a long history that goes back to our experiences and imaginations on water and mirror. (31) Screens trigger such old and universal memories of us.

Meanwhile, video games have proven that there is a different kind of experience in terms of body and space. Besides the effect of the screen, the sense of involvement -- interaction with the computer, with virtual characters or other real players, personal attachments to the characters or the story, etc. -- plays an important to promote the immersion. (32) A user may feel so immersed in the virtual world "inside the screen" that he/she might feel like being "sucked into" or even want to "dive into" it. These elements can be effectively combined in virtual reality environments to create a feeling of the existence of another world. Films such as TRON or MATRIX are based on the supposition that we already understand such feeling. (33)

However, the combination of screens and the sense of involvement can bring the sense of disembodiment even in case of text-based telecommunication. The real time feature and one's involvement can create a sufficiently strong sense of immersion, as is known with the cases of MUD. (34) Janet H. Murray in her book analyze these cases to find the importance of the sense of involvement and the existence of "story" in the experience.(35) These elements should be taken more seriously in designing a highly immersive environment using virtual realities or mixed realities technologies.

On the other hand, disembodiment as a phenomenon can be seen as a result of a long term change that has taken place in our culture over the centuries. In the West, since the era of the Enlightenment, separation of body from mind had become the basis of our culture, enabling modern science, technology and philosophy to arise. Today, genetic engineering and digital technologies are almost accomplishing the process by decomposing body to information and material, and reinventing mind with digital information.

Edward Hall, in his essay "Man as Extension", discusses the way tools speed up the process of evolution of a species by evolving the tools instead of waiting for the nature to modify physical bodies, by taking examples of bowerbirds and human beings. (36) Schievelbusch, in his book "Geschichte der Eisenbahnreise. Zur Industrialisierung von Raum und Zeit im 19", analyzes how railway changed the relationship of one's body and the space outside the train. (37) Schievelbusch, by examining what happened to the perception of the people from various sources including literature, diaries and illustrations from the epoque, pointed out that the process of transition took time until everyone could enjoy the flying landscape.(38) Today, nobody would complain that a train runs so fast that his/her vision gets confused while watching the outside. We

have found the new way of using our vision system to enjoy the flying landscape.

Similar adaptation process is taking place with telecommunication technologies. (39) People have started applying the everyday language concerning our body to the way we "act" on the Net. For example, we say "go there" or "bring it" when we talk about files, servers or email messages without knowing (and caring) where files really are, and without physical involvements of our bodies. (From a cultural study point of view, it will be interesting to see how the way we see the space and action in the real world can be reflected in the virtual world. The way we describe certain action is different according to the culture. For example, "I'll come up to you" in English is equivalent to an expression "I'll go to your place" in Japanese. When we construct a virtual world inhabited with avatars and agents, such "action" that usually takes place in epistemological level could be represented by images of virtual characters moving in the space.)

Kathleen Hayles criticizes Norbert Wiener as being indirectly responsible for disembodiment, by neglecting the role of body in his cybernetics theory which influenced contemporary philosophy and biology. (40) The process that the growing "mood" for neglect of body was formed in the society can be described as follows in a simplification. In Postmodernism a text written about a matter is regarded as the equivalent to the matter itself. According to genetic biology, human life consists of a series of DNA codes. Also, human thoughts and emotions are formed by the set of binary status in the brain. Then, human beings can be regarded as a compilation of information. The idea has spread and has become a part of the contemporary culture. Gene technology is in a sense proving the idea. It is in such a context that Hans Moravec imagined downloading the entire set of information from a person and uploading it on a machine, so the machine would behave, react, and feel exactly like the person used to do. "Turing test" was a case where the body was regarded totally meaningless. (40) According to Hayles, these ideas have prepared the basis of disembodiment even before the Net provided us with an infrastructure. (41)

We can push the logic even further. Disembodiment of human is followed, consequently, by embodiment of information. If both a physical body and the mental activity that takes place inside the body can be reduced to a set of information, "incarnation" of information into a physical body and mind is also possible. Virtual pets and robots, which I will discuss in Chapter IV, is an examples of embodiment of information. (The distinction between human beings and other animals is another issue that reflects cultural differences. As long as we discuss the issue from the Western point of view including Postmodernism, only human beings are considered.)

But as Hales criticizes, our perception of the world cannot exist without our physical body with certain size, lifetime, etc., and as Hall says, we are here as the result of long process of evolution that took place on our physical bodies. Or as Margaret Morse asks "(w)hat cyborgs eat?", we cannot live without physical body. On the other hand, the new notion of body that digital technology has brought us such as disembodiment and cyborg, reflect our hopes and imagination such as unlimited freedom of movement or freedom from the real body with too much troubles. How do we reintegrate our consciousness and body with digital technology?

Researchers and engineers are seeking the solution by developing technologies such as tangible interfaces or mixed reality environments. Artists deal with the issue with their own approaches. Telepresence technologies makes it possible for a human to be virtually in another

space, such as perceptually existing in a remote place via telecommunications, manipulating a remote machine in exactly the same manner as one would manipulate a machine at hands. Interacting with a remote robot in such manner is called telerobotics. Accordingly, I would like to name TELEBODY for a body made of flesh and blood and yet is manipulated in the similar manner as in telerobotics.

Actually STELARC's performance is a telebody performance. However, I included it in telerobotic art, because the concept of his work is in being a cyborg himself. In the following part of this chapter, how artists deal with the relationship between body and space will be discussed. Also, issues about communicating with tactile sense will be introduced.

One very interesting telebody project in this field is Simon Penny's "Traces", of which the prototype was shown at Ars Electronica 99. The piece utilizes connected CAVE environments. The volume of a person in one of the caves will be sent to another, resulting in a rather vague volume rendered images. The users are supposed to interact through their virtual bodies, which are sent over the network to the remote site. Unfortunately the work was still in progress.

3.3 A Topology of Body and Space - Paul Sermon's Telematic Performance(42)

During the 1990s, a series of telecommunication art projects was conceived and created by the British artist Paul Sermon. Although the basic technology is simple and essentially the same as what has been used for commercial purposes, Sermon's pieces led to important discoveries about telebodies.

The following is the description of the work by the artist himself.

"Telematic Vision" is an installation that exists within a telepresent space, located between two large blue sofas that are geographical separated. A video camera, situated directly in front of one sofa, sends a live image, of a viewer/user sitting on it, to a chroma-key "blue-box" video mixer. Another camera situated in front of the other sofa sends an image of the second sofa and another person to the same video mixer. The two sofa images are mixed together, putting the two dispersed viewers/users together on the same sofa and telepresent screen. The combined image is finally fed to a series of monitors that surround each sofa, making it possible to control the body at a distance from all angles around each sofa.

In many ways the sofa and the bed amount to much the same thing, they can transform themselves into each other, as a "sofa/bed". The semiology of the bed, that proved to be so effective in "Telematic Dreaming", is also present within the sofa and is equally as effective. Where "Telematic Vision" and its sofa differ from "Telematic Dreaming" and its bed, is in the scenario and theater of its spectacle. The sofa finds itself between the bed and the television, whilst it retains the semiotic reference to the bed, it also refers directly to television. The television and sofa are caught up in an inseparable scenario. In "Telematic Vision" the sofa is the seat from which the spectacle of television is viewed, and the only spectacle that is viewed is the audience

who sit on the sofa.

In both works, "Telematic Dreaming" and "Telematic Vision", the viewers/users can only communicate by visual gestures, vocal contact is not possible. They have to adopt the role of silent performers, without them the installations are only vacant spaces of melodramatic potential."

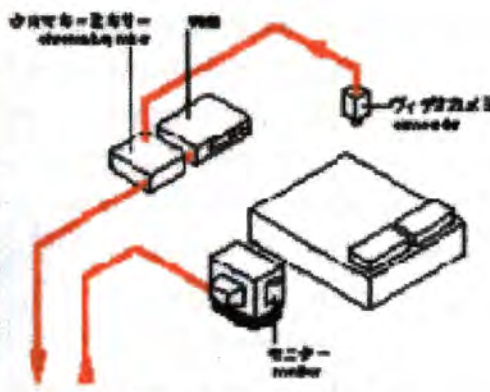
(Paul Sermon, Exhibition Catalog)

The pieces work well, and visitors enjoy them. When these pieces were shown in Tokyo, we discovered nursery school kids rushing into the exhibition space as they waited for their bus every morning. The pieces are entertaining as well.

While the issue here is about the body, and that how we would be able to share our bodies in cyberspace, a real "touch" does not take place with his pieces. There is no force feedback either. And that is the point of his works. What the nature of the experience? What is virtual and what is real here?



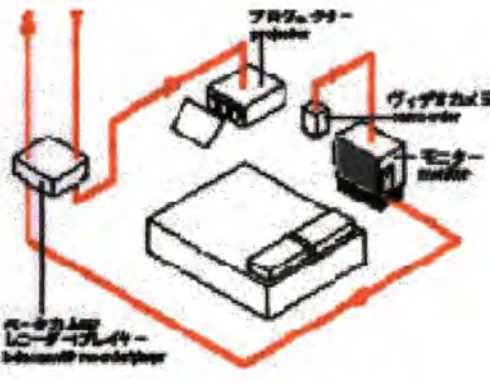
Fig.27 Telematic Dreaming



Bed and the system, Spiral Gallery



Fig. 28 Telematic Dreaming



Bed and the system, ICC Gallery

Or I can put my question in a different way.

Is the body capable of being transported via computer communications? At what level of existence can we sense the reality of the virtual body lying around or sitting in virtual space?

At this point, I believe we have begun to embrace doubts about virtual space, which is thoroughly dominated by the visual, and electronic space, which overflows with ambiguous signs and filmic images. Multimedia, should enable us to manipulate filmic images, text and sound on

our own.

Virtual reality still mostly relies on the visual senses (and in a highly dissatisfactory state, at this point). Both are engaged in an attempt to mount a communications system in which we cannot even send visual images at a satisfactory speed, and they are still a far cry from the claims they advertise. It is surely distrust of the membrane of the substance-less visual imagery created by electronic signals that has precipitated a nearly abnormal rise in the interest in skin and corpses, as well as the desire to return to a material physicality of body. Within this context, if we are to question the meaning of the body in relation to virtual space, is it possible to demonstrate anything more than a simple transposition of sensory faculties -- specifically, the replacement of the sense of touch with that of sight?

The tele-conference system is a mechanism that symbolizes business in an information society. Yet in the hands of Paul Sermon, this mechanism becomes a highly paradoxical matter. In Sermon's work, instead of using a non-existent shared space for the practical purposes of business talks, primitive forms of communication or desire such as non-verbal gesture and bodily contact temporarily and ambiguously create intimate, personal and risky relations between complete strangers. Selection of the other party is nearly impossible here. The thrilling relationship with the person on the other end, materially close yet far, and most likely someone who one will never actually meet, lasts only during the interval of the performance. It is as though this performance has opened a small hole in the space of daily life and joined the gap with ISDN links.

The overlapping of the familiar sight of the TV monitor with reality deconstructs the meanings held by these everyday landscapes. In Telematic Vision, the couch potato state of sitting alone in front of a TV and staring at the screen is transformed into a scene likely to appear in an old American home drama -- that of an affectionate couple or a happy family, seated on a sofa of classic design, watching TV together. And yet, the teleconference system which plays out nostalgic scenes of "sweet home" is both a tool of business -- the diametrical opposite of family -- and a member of the same class as the TV game, which invested the TV monitor with a different meaning and drove scenes of family togetherness into extinction.

Within this series of works that employ the teleconference mechanism (including Telematic Seance), Telematic Dreaming surely has the most powerful impact because of the dissimilating effect of the bed, a sign shared by everyone. By putting audience participants in that familiar situation from TV drama of getting into bed with someone one has just met, this work drives one, or the member of the audience before one's eyes (the performer), into a state of bewilderment. Members of the audience are placed in the positions of the actor who plays out a bed scene on stage or before a camera, or the voyeur who peeps in on the acts of others. This is a secret act taking place in a public space, and that public space is a virtual space that does not exist in reality.

Furthermore, despite the fact that the body is the only means of communication therein, the body of the other party is ghost-like, without substance. This contradictory situation not only confounds the audience, but also, after first releasing them from the logic and restrictions of daily life and dismantling the various elements of

signatory identity and the biological environment of the body, it enables experimentation with and enjoyment of the role the body plays in communication. The virtuality of the space enables it to maintain both theatricality and the context of daily life at the same time.

In the interstice between material physicality and an informational space in which electronic signals collide, Sermon reverses the meanings and sensibilities tied to daily life and provides us with an opportunity to think about the essence of communication. Commercial applications like bringing a shopping bag into virtual space and filling it with items for purchase picked up with a 3D mouse are nothing more than a proxy for real experience, but a good artist is capable of liberating people from such patterns of daily life and creating a topos wherein they will discover something about themselves.

3.4 Body Interface - Fantastic Phantom Slipper

In 1997 I was part of a group (Akihiko Shirai, Masaru Sato, Yuichiro Kume and Machiko Kusahara, Tokyo Institute of Polytechnics) that realized a project named Fantastic Phantom Slipper. (43) The piece was a mixed reality entertainment that employed phantom sensation for the force feedback on feet. The system consists of slipper-like wearable devices, optical motion capture and a hemispherical floor screen with a video projector.



Fig. 29 Fantastic Phantom Slipper System and the slippers

With the first version, the user was invited to stomp on a computer generated image of mice that ran around the user's feet on the floor. The location and the movements of the slippers were detected by the computer. If one succeeds in hitting the mice, phantom sensation would be generated by vibrators in the soles of the slippers. Movements of the mice under the slippers are transmitted to the feet, by calculating the magnitude of vibration. Each slipper has two vibrators. As the "center of gravity" of sensation moves, sense of a moving object is produced, even if the virtual object is between the pair of slippers. It is similar to a phenomenon which is known as "phantom limb".

The concept of this work was in exploring the virtual world with one's own body, feeling virtual objects with physical sensation. "No more mouse!" was the idea behind the story that mice were to be kicked. One of the goals of the project was in developing a natural and intuitive interface. By designing an interface using an appropriate metaphor and one's own body in the manner we know from experience, we tried to establish a consistency between the real, physical world and the virtual world.

This piece was shown at the second VRSJ Annual Conference in 1997 and at SIGGRAPH97

Enhanced Realities. (As SIGGRAPH 97 took place in Orlando, in the midst of the Disney kingdom, we were asked to use cockroaches instead of mice.) Through these demonstrations it was clearly observed that the use of natural body action in the manner we know well in the real world is effective in promoting intuitive interaction. In fact, the sense of moving object under the user's feet helped increasing the sense of location in cyberspace.

A similar approach has been taken by Myron Krueger in his piece "Small Planet". A user can fly over the earth and to another planet where one would walk through the landscape and meet alien beings. The navigation is made possible by "flying" with one's own arms, as most children do. Since we remember such experience (to "become" an airplane and fly around), the navigation is intuitive enough. Even though the airplane was developed only in the last century, it is already part of the universal body experience for kids.

What we learned through the development of Fantastic Phantom Slipper is the intuitivity of such body-related behaviour. The importance of applying appropriate metaphors is without doubt quite important in designing interface, either for physical interface such as switches or software-based interfaces such as web page design. However, the intuitivity required and at the same time available with body interface is more direct and quick. More study on the culture of body-related behaviour will be useful in the development of interface.

3.5 Tactile Renga - A Process of Rediscovery of Color (44)

3.5.1 The Outline of the Project

Tactile Renga is an experimental art project carried by three artists including one who is visually impaired. Applying Renga method which will be described later, two artists Anzai and Nakamura who digitally paint, exchange images with Mitsushima who paints using tactile sense.

In Renga method, an image produced by an artist is sent to another artist to be modified into another image. By repeating the process a series of digital paintings are created. Each painting is the result of interaction between an artist's imagination and those of others who preceded. (See Chapter II,7.)

Through the session which continued for 10 months, 14 images were produced. Each artist discovered the difference between seeing and touching, and started exploring the limit. At first black and white images were mainly used. Consequently they developed a conversation, literally, on the meanings of color - both via images and email they exchanged.

The session, which was both a collaboration and a challenge between professional artists to bring up images one would not otherwise conceive, eventually became a process of re-discovering the meanings of color. Color started to play important roles in visualizing and communicating one's imagination. Color also became a key for retrieving a lost memory and developing it into an image. (Fig. 30) In fact, discovery is the essence of Renga method.

3.5.2 The method and technology used for Tactile Renga

Tactile Renga started with two images sent from Mitsushima to Anzai and Nakamura respectively. This project was conceived as two parallel sessions. Actually the two lines started to mingle later.

Mitsushima made drawings in his style. He cut figures out of adhesive thin sheets of plastic with a knife, and attached them on a piece of paper according to the composition the artist had in his mind. Thin plastic tapes, also adhesive and vary in color and width, would be added to "draw" lines. (fig.31-32) Mitsushima also uses colors according to the concept. These tactile drawings were physically sent to the other artists via normal mail delivery service. Using flat bed scanners these images were digitized. Anzai and Nakamura respectively worked on these images on their computers, inspired by the original drawings and sought for their own imagination that arose from them. In the process Mitsushima's drawings were decomposed and used in different contexts, or certain part of his image developed into something else.



Fig. 30 Memories from the Age of Seven
by Mitsushima



Fig. 31



Fig.32



Figure 33 Tactile Renga between Mitsushima and Nakamura

When digital images were finished, they were translated to tactile forms. Two systems were used for this purpose.

A handy computer-controlled plotter/cutter for design use cuts the same kind of plastic sheets that Mitsushima uses. The hi-tech machine precisely cut the line that separated figures from background, without cutting the lining sheet. A very low-tech work for a human being (namely Anzai) to peel the background off the lining followed. The resulting sheet with figures attached to the lining allowed Mitsushima to "see" the image as well as to use the figures for his work, by peeling them off from the lining.

The other was a thermal copier which produces black and white embossed prints. A compact low-cost model was used both by Anzai and Mitsushima. As a plotter/cutter output would be destroyed as Mitsushima takes the figures from it, the embossed copy plays the role of a reference copy. Nakamura did not have any of these machines. Her images were sent to Anzai via internet to be processed.

The adhesive plastic sheet and its embossed copy were sent to Mitsushima. Email explaining about the image followed. Usually the conversation was based on telecommunication since they live in different cities.

This process was repeated. As one can see from the images produced, the session which started hesitatingly gradually became more dynamic. Colors and textures started to appear. Mitsushima answered in blue images of braille to Nakamura's mistaken braille. Blue is the color Mitsushima knows. Encouraged by the use of color by him Nakamura started to follow her instinct on the use of color.

3.5.3 What happened during the Tactile Renga

Modifying another professional artist's work is psychologically hard for any artist. However, such conflict between respect and challenge makes Renga interesting. Digital technology allows artists to play - and think - at the border of original and copy.

In this project, the translation from visual form to tactile form was essential. Nakamura felt like the image she made on her computer was the original piece, while the plastic or embossed outputs were just tactile copies for Mitsushima. That was one reason why she started using colors and texture more freely, while Anzai was aware of the final output and remained cautious in using colors. (fig.33)

However, when she used colors for the pair of socks because she did not want to compromise after all, she had to explain the colors and their meanings.(fig.34) She even painted some texture on the heart in the same picture which came from the peach skin, of the peach she ate on the train.

As she tried to explain she discovered that what she meant with these colors were not merely colors. The pair of socks with vivid colors her grandmother knitted for her, or the soft skin of sweet peach she ate on the train - they are memories accompanied with excitement and warm feelings, also with tactile sense as well as visual or other senses. It was a new way of seeing colors

for her. Also, after this experience the issue of original and copy in different forms (visual and tactile) came back to her. It is also about the relationship between the creator and the appreciator in art.

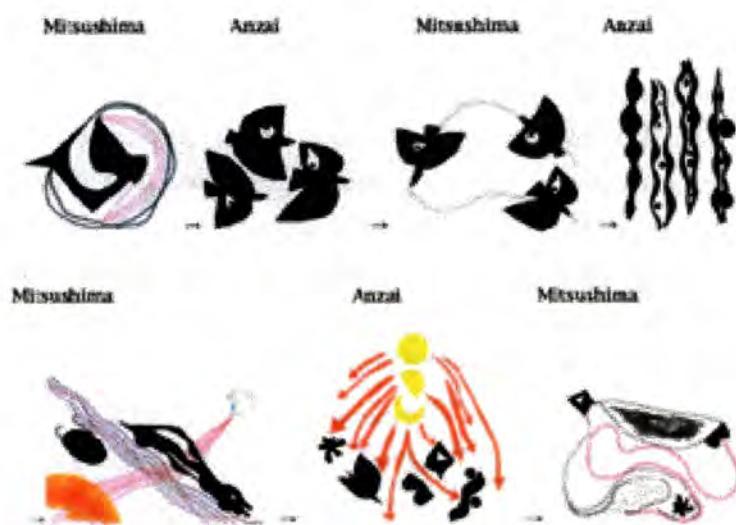


Fig. 32 Tactile Renga between Mitsushima and Anzai



Fig.33 by Anzai



Fig.34 by Nakamura



Fig.35 by Anzai

After Nakamura "violated" the rule Mitsushima totally surprised Anzai by applying color in a manner that cannot be represented on the 2D screen of a computer(fig.30). Plastic cut-outs are attached to a transparent sheet instead of a piece of paper. The moon is in three layers. A white full moon and a waned moon in his memory before he completely lost sight are on the different sides of the transparency. Between them is the blue moon which he knows from stories.

Drawing or seeing a picture by touching is a time-based process, Mitsushima says. It is something he realized through this project by working with other artists, and what now seems important to him. It is a different process from seeing an image.

The three moons in layers in Mitsushima's drawing realize the time-based moon in his memory. The layers have different meanings when seen, touched, and understood as a story..

One can see that images become more and more free with rich contents. Mitsushima also starts using his medical tool to give additional texture. The conversation between visual images

and tactile sense went further to liberate one's imagination, triggered by colors.

3.5.4 Seeing colors and imaging colors

After this experience Mitsushima feels his horizon as artist has expanded. His recent personal works reflect his new approach to memories, and especially to colors.

Perception of color is primarily a physical and physiological phenomenon. But color is also personal, since there is no way of seeing a color in the way another person does. It is personal from another point of view as well. What a color triggers in one's mind depends on one's memory and the social code. In that sense color is also a social phenomenon. Tactile Renga revealed such role of color in the artists' unconscious way of using it. Furthermore, by re-discovering color in one's mindscape, artists found new expressions of their imagination.

4. Invisible teleporting

Russian web artist Olia Lialina creates interesting sites. They are web-specific artform with clever ideas and design. But at the same time it is her commentary to the medium. For example, you can go to "teleport" page to find Agatha (the main character of her web project) on the screen. You click her, but nothing seems to happen. Her image flashes, but stays there. You click, and again click. The figure flashes every time, but nothing obvious happens - except the location of the server indicated on the top bar of your browser. A careless visitor might miss it.

While you kept seeing exactly the same image, you were virtually traveling ("teleported") from Russia to Hungary, Slovenia, U.S. or Austria. And Agatha remained there all the time. While the project illustrates how we share the virtual space on the Net (the project was made possible in cooperation with artists and art foundations from these countries), it also gives us an opportunity to think about the nature of space and identity on the Net from several aspects. Agatha looks the same all the time and in fact digitally she is the same, except the fact that the image data are copied and stored in different servers in different cities.

On the Net we are in fact traveling all over the world, virtually teleporting ourselves from one server to another or one country to another instantaneously, without noticing when we cross a border. For example it often happens to us in daily practice such as downloading a piece of software from a mirror site. Of course it is one of the best features of the Net. Such experience does not employ our bodies, but according to what McLuhan stated, it means that our bodies are there because our sensory organs are there.

Let us think about the meaning of such experience from another aspect. One thing Agatha tells us is that what we see on the Net might belong to different places even when they look identical. They might even belong to different cultures. Truly the Internet allows us to travel without noticing borders. What happens then, when we get used to travel all over the planet without even being aware of where we are? Is it what is called the globalization thanks to

telecommunication technology? I don't think so. While to have no legal or physical boundary is important for the digital community, even increased awareness and respects to different cultures is crucial to make the community global. Each culture has its own system of perception, logic, and the way of thinking which have developed along the history and in relation to each other. Such system forms the basis of its social structure in the real world, and is naturally reflected on its corresponding part of the cyberspace. Realizing such system would help us not only to understand a different culture but also to enrich our digital community through offering different points of view. In the following chapter I will discuss the system behind Japanese way of seeing the world, and the way it is reflected in digital culture.

5. Conclusion

In this chapter I analyzed how telecommunication technology is changing the way we know the world and relate our body to the world, raising new issues of epistemology. Development of image reproduction technology and telecommunication technology, among others, have changed the way we see the body, and communicate with others using bodies. Artists have used telecommunication and telerobotics technology to open new aspects of space and body. When the natural use of our senses is combined with communication technology, we can reinvent our physical capabilities.

note

1. <http://www.walkerart.org>
2. <http://www.ica.or.uk>
3. According to the recent usage of words among the activist artists and curators, web art means mainly online galleries, possibly with certain interactivity in navigation or real time image generation/manipulation by the user within the framework the artist had prepared.
4. In the earlier history of media art, what some artists did with the advent of film, and what some did with the arrival of video technology, was exactly the same. Andy Warhol used film to shoot his friends just continuously without any plot. The video artist Takahiko Jimura used video to take himself into an endless loop of feed in/feed back images.
5. Featherstone, Mike & Burrows, Roger, editors, *Cyber Space, Cyber Bodies, Cyber Punk - Cultures of Technological Embodiment*, SAGE Publications, London, Thousand Oaks, New Delhi, 1995
6. Carolyn Marvin analyzed how early telecommunication technology such as telegraph or telephone changed the way people dealt with the space in her book "When Old Technologies Were New". Marvin discusses the change that happened in "locating the body in electrical space and time". Shunya Yoshimi, Mikio Wakabayashi and Shin Muzukoshi analyzed how media technology such as telephone or radio changes the society by changing the way individual relates oneself to the world, including the notion of body in space. Carolyn Marvin *When Old Technologies Were New*, Oxford, 吉見俊哉、若林幹夫、水越伸 メディアとしての電話 弘文堂 1992, 水越伸 メディアの生成 同文館1993, 水越伸責任編集「20世紀のメディア」 ジャストシステム 1996
7. Edward Twitchell Hall, *Beyond Culture*, Doubleday & Company, Incorporated, 1976
8. The word telepistemology is coined by Ken Goldberg, in the book *The Robot in the Garden: Telerobotics and Telepistemology in the Age of the Internet*, edited by Ken Goldberg, Cambridge, Mass.: The MIT Press, 2000
9. This part of the paper was published in the above mentioned book, pp. 198-212.
10. Susan Sontag, *On Photography*, Farrar, Straus, and Giroux, New York, 1977.
11. On the aura, see Marina Grzanic, "Exposure Time, the Aura, and Telerobotics" (*The Robot in the Garden: Telerobotics and*

- Telepistemology in the Age of the Internet*, edited by Ken Goldberg, Cambridge, Mass.: The MIT Press, 2000, pp. 214-224).
12. Margaret Morse relates television to virtual space in her book *"Virtualities: Television, Media Art and Cyberculture"* Bloomington: Indiana University Press, 1998.
 13. On the telepistemological version of the problem of other minds, see Judith Donath, *The Robot in the Garden*, Ibid.
 14. <http://www.ecafe.com/>
 15. <http://www.vgtv.com/>
 16. <http://www.usc.edu/dept/raiders/>
 17. <http://www.flab.mag.keio.ac.jp/GIP/index-j.html>
 18. <http://www.aec.at>
 19. This part was originally published on Leonard Almanac, MIT Press 1998. Updated version was published in 2000, Kibla, Maribor
 20. Eduardo Kac, *Teleporting the Unknown State*, Kibla, Maribor, 1998
 21. On virtual persona, see Judith Donath, Ibid.
 22. Lynn Hershman's earlier works such as *Roberta*, *Room of One's Own* and her latest work *Difference Engine 3* are deeply related to the issues such as self, others and virtual persona, to see and to be seen, and the relationship between the real world and virtual world. See <http://www.lynnherhshman.com> for her previous works and essays. *Difference Engine 3* can be seen at <http://www.zkm.de>
 - Also see Machiko Kusahara "Are We Still Enjoying Interactivity?" (Publication of *Prix Ars Electronica 99*, Springer, 1999)
 23. On the telepistemological version of the problem of other minds, see Judith Donath, Op. Cit.
 24. <http://www.kenfeingold.com/>
- I would like to thank to the artist in giving permission to access to his text for the lecture.
25. Marina Grznic has given lectures, on what body could mean politically in the art movement that took place in the communist Yugo Slavia.
 26. See Toshiharu Ito. Photography was used for portraits and carte de visite -- but also, immediately it was picked up by the popular entertainment industry as a medium for appreciating body as images, namely, of nudes. Numerous postcards, stereoviews, peepshow and other photographic images were consumed as entertainment. Stereo photo, which was very popular, even made bodies into virtual 3D objects. It also goes back to Walter Benjamin, see Chapter I.
 27. In the CD-ROM, normal girls pose in nude in front of the camera, with neutral faces, with belonging data given for each of them such as name, age, etc. Akira Gomi, *Yellows* series from *Digitalogue*. 1993
 28. Donna Haraway, *Cyborg Manifesto: Science, Technology, and Socialist-Feminism in the Late Twentieth Century*"
 29. www.medialab.mit.edu
 30. Edward Twitchell Hall, *Beyond Culture*, Doubleday & Company, Incorporated, 1976, pp.25-40
 31. There are stories such as Narcissus and Echo, Alice in the Wonderland, etc. that depict such idea. Jurgis Baltrusaitis extensively discuss the metaphor in *Le Miroir*.
 32. Erkki Huhtamo discusses extensively about the meaning of the screens in the sense of immersion in his essay *Seeing at a Distance: Toward an Archaeology of the "Small Screen"*, *Art@Science*, Springer, 1997
- The distinction between these two elements become clear when we think of different combinations of different kind of screens, interactions, graphics, etc.
33. The well known logo of Scott Fisher's Telepresence Company features a man diving into the sea. According to Fisher, the image represents what virtual reality is.
 34. When I started using the Net in 1984, there was no such feeling since it was too slow and nothing was possible in real time. But eventually the community started to grow and BBS services became available. From 1989 to 1998, I spent much time on the Net, participating various activities and even launching and running our own network with students, which we used day and night. There were moments I clearly remember, when I felt like my body was not in my chair; only existing was my consciousness which was floating in the space that spread between my place and others' who were online, in the night sky over the city of Tokyo,
 35. Janet H. Murray, *Hamlet on the Holodeck*, Steling, New York, 1997
 36. Hall, Ibid.
 37. Wolfgang Schivelbusch, *Geschichte der Eisenbahnreise. Zur Industrialisierung von Raum und Zeit im 19. Jahrhundert*, Frankfurt am Main: Fischer Taschenbuch Verlag, 1989 [1977]
 38. Ibid.
 39. About the historical case studies on old media see Margaret Morse, Erkki Huhtamo, Caroline Marvyn, Shin Mizukoshi.
 40. About the impact of information theory and Wiener's concept on art and on the notion of life, see Chapter I and II.
- N.Katherine Hales, *How We Became Posthuman*, The University of Chicago Press, Chicago & London, 1992
40. Ibid.

41. Ibid.

42. This essay was originally published on the website of the following exhibition, and then included as a part of the exhibition catalogue of "The Museum inside the Net: IC95", net version 1995, Machiko Kusahara "Telematic Dreaming" InterCommunication Center NTT Publishing, 96.2

43. Akihiko Shirai, Masaru Sato, Yuichiro Kume, Machiko Kusahara Fantastic Phantom Slipper, SIGGRAPH98 Augmented Realities (1998), Akihiko Shirai, Masaru Sato, Machiko Kusahara, Yuichiro Kume Fantastic Phantom Slipper, VRSJ 1997

44. This paper was accepted and presented at ISEA2000 in Paris, December 2000.