Trialogue: A Communication among Nature, Humans, and Virtual Life

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ABSTRACT

<Trialogue> attempts to set up aesthetic communication channels among nature, humans, and virtual life, and to experiment with sonic and visual interactions by digital processing for a new meaningful relationship of the three. <Trialogue> consists of three characters; Au(fish) that symbolizes nature, Hau(humans) who consists of the artists and the participants(visitors), and Vau (Virtual Life) that has a simple artificial intelligence and feelings. This is an “attempt” to make nature and virtual life the creators, in other words, to allow the subjects so they can create the artistic accomplishments. Each subject will participate in an artistic encounter where it produces distinctive sounds and images. Also, in this artistic triologue, artists try to restore an equal relationship between the three subjects by forming a new relationship between them and to define new relationships between them. <Trialogue> begins with a small concert performed by the artists with the participants, the fish, and the virtual life. For the purpose of this attempt, <Trialogue> is an experiment with the collaboration and synthesis of three areas: visual art, music, and engineering. In addition, we challenge Hau(humans) as human beings to realize the crucial difficulties in the interfaces among the three subjects. To take part in the harmony with the other subjects, Hau should concentrate greatly on <Trialogue>.

Keywords: nature, humans, virtual life, artistic subjects, equality, trialogue, communication, interaction, interfacing, unity, harmony, difficulties in interfaces

1. INTRODUCTION

<Trialogue> is an interactive multimedia installation, exhibited at Art Center Nabi, Korea in the year 2001 for two months. This project is an artistic and technological experiment where Au (nature), Hau (humans), and Vau (virtual life) establish a new and meaningful relationship through musical and visual interactions aided by a computer system. Au (fish), Hau (humans) and Vau (virtual life) are the subjects of <Trialogue>. Au is a fish, which represents nature excluding humans. Hau is a human, who refers to the artist or the participant. Vau is a new kind of being that is created through human's technology that enables Vau to have a simple artificial intelligence.

We focus on the relationships of the three subjects and focus on the theme that humans are not the sole creator of art. This project is an "attempt" to make nature and virtual life the creators; in other words, the subjects who can create their own artistic accomplishments. Each subject conducts an artistic event by producing music or images.

Also, we attempt to reestablish relationships among the three subjects through artistic communication and experimentation. In the past century, the relationship between Hau (humans) and Au (nature) has been a disharmonious one, and such a relationship is repeating even now. Nature has been treated as an object that is analyzed or used, rather than as a subject having a capability of communicating with humans. We want to have a
glimpse of Au's will by examining its movements, and providing an artistic interface through which Au can participate in our dialogue. Even if they do not recognize our messages, the attempt is needed for reconciliation between these three subjects.

Here, virtual life is given a life form and an independent will. We ponder about the relationship that the virtual life establishes with nature and humans. We also question whether the relationship between humans (or nature) and the virtual life is one subordinate or independent.

Through <Trialogue>, we try to lead visitors as human beings into experiencing the essence of the interfaces, that is, the difficulties in humans' interaction with the other elements, because by only have easy interfaces does not guarantee the human the real communication with the other elements. Accepting the difficulties in interfacing can lead humans into a true relationship with the others.

For this attempt, we tried to collaborate and synthesize the three scopes: visual art, music, and engineering. We state that art is not the sole property of an artist in an ordinary sense. Also, through the synthesis of different art genres, we experiment with the process of sounds being images and visual images being sonic as well as visual. Music and visual art are not separate, but a combined entity.

In the synthesis of nature, humans, and the virtual life, and the synthesis of sound-visual art-technology, we may suggest new ways of communicating beyond their separate existence.

In this paper, we present the concept, process, and result of <Trialogue>.

2. CONCEPT AND IMPLEMENTATION

2.1 Concept: <Trialogue> as an aesthetic orchestration is aimed at the communication among Au, Hau, and Vau

<Trialogue> is an aesthetic and technological work that pursues the importance of communication among Au (nature), Hau (humans), and Vau (virtual life), to make humans feel the difficulties in maintaining a harmonious interface among them, and to unite them by appreciating their equal relationships and status in art. It is because that a true communication can be acquired not just by using easy interfaces but by constructing equal relationships of each existence.

Until now, most art projects concerning virtual creatures and humans have placed a great emphasis on the interaction itself between humans and virtual creatures or between one virtual creature and other virtual creature. Some of these projects have placed more interest in implementing their pseudo worlds and creatures based on biological or genetic theories such as Darwin’s law and Mendel’s law. In spite of their great inventiveness and sophistication, they still regard artists and visitors as a creator and the virtual world and virtual life as their own creatures. However, we are not to control and manipulate the virtual world and pseudo life and to utilize nature but to experience the real relationship of the three.

First when considering the relationship between nature and humans, only human beings have owned their art for a long time. Also, in western perspective, nature is not the subject but the object of art or the artist. In many artworks, it seems to be regarded as simply the subject for artists. Also, in the twentieth century, humans have, more or less, broken the familiar relationship between nature and themselves in order to utilize and analyze nature. In a sense, this may mean that people have separated themselves from nature not only in art but also in all aspects of their actual lives. Thus we should make efforts to reconcile ourselves with nature. And, we believe that these desperate efforts can be started by sharing the seat of the artistic creator which has previously been occupied by
human beings and not nature. If our efforts proceed successfully, we may be able to unite nature and humans finally.

On the other hand, in the relationship of virtual life and humans, human beings technically created a new kind of being, virtual life, as a result of their utilization and analysis of nature in the twentieth century. People generally think of humans as a creator like God, and of virtual life as their creature. Although the virtual life is certainly a machine, which humans want to control thoroughly, human beings unconsciously or consciously desire for it to be more than a machine at the same time. Is virtual life a living being or not? Is it dependent on or independent from humans? This duality of virtual life, which has been recognized by humans, has a vagueness of existence. In such situations, we take it for granted that we examine the existence of humans and virtual life and construct the meaningful relationship of the two in art and technology. For this purpose, we consider virtual life and humans as an equal existence in art and extend the subject of art to virtual life.

Also, we think mankind has rarely focused on the equal status of nature and virtual life in art and technology; virtual life is derived from nature and, as mentioned above, both virtual life and nature are just objects in art. As the relationships between nature and humans, and between virtual life and humans are crucial, so is that between nature and virtual life. What is the relationship of the two? Is virtual life dependent on or independent from nature? To answer these questions, it is high time to write their story. We hope for artificial lives to be equal and to be in harmony with nature in art.

Moreover, we extend such viewpoint of ours to the entirety of the three, with “feeling” what living things are, what nature is, and what art is. Nature, humans, and virtual life are equal in <Trialogue>. At least, they are both creators and objects of art in <Trialogue>. Also, we cannot help thinking that nature, humans, and virtual life are so interlocked in almost all aspects that we cannot imagine them as separate existences in the present world any more. That is not an indiscriminate equality but a careful comprehension of nature and virtual life in art. That is why we try to participate in the communication among them.

In the practical implementation of <Trialogue>, Au, Hau, and Vau basically create their own images and music in this work. That means they are equal artistic beings in <Trialogue>. Also, each of their behavior influences those of the others with the changing of the others’ images and music directly or indirectly. This implies that they cannot be alienated but should be integrated in any way. We merely provide the artistic environment for the three, so that they can define new aesthetic relationships among themselves on their own.

In <Trialogue>, we want humans to feel the difficulties when interfacing with other beings because we think of humans as an interface between nature and virtual life. However, forgetting that they are interfaces, many humans want only convenient interfaces with other beings. The more convenient the interfaces humans have, the easier they might be able to gain information. However, the more convenient we feel an interface is, in reality, the more sophisticated the interface is itself and the more amount of information it has to process. Accordingly, humans should respect the situations of the three elements by establishing the equal relationships among them. So if humans are an interface, they are in an inevitable and difficult position where they are very busy interfacing with other beings. In order to practice it, we also prepared for a simple multimedia performance with the artist, participants, nature, and virtual life in <Trialogue>, similar to an orchestra. There, humans can use the role of a conductor as an interface.
2.2. Aesthetic and Technical Implementation of All The Parts

The figure 01 shows the overview of <Trialogue>. There are three parts: Au, Vau and Hau parts.

The Au part consists of a fish, a fish bowl, a beam projector (called Au Simulator), two LCD monitors situated on both sides of the fish bowl (the monitors are called Hau Simulator and Vau Simulator), and a camera for image recognition. The Au Simulator shows the drawing of Au. This is the result of Au's position and speed. The LCD monitors (Hau Simulator and Vau Simulator) show the 2D graphics to Au, which are the messages for Au from Hau and Vau. The camera and image recognition system track the position and the speed of Au.

The Vau part is composed of two beam projectors for Vau 3D character and Vau Simulator. The form of Vau (Vau 3D character) changes in real-time according to the messages from Hau and Au as well as to the characteristics given at birth. The Vau Simulator is a 2D graphics that reflects the Vau's current characteristics in real-time.

The Hau part consists of humans (participants or artists), a main interface, a light pendulum, and Hau Simulator. By moving their hands over the main interface, participants or artists can send messages to Vau and Au. The light pendulum is merely a musical instrument for adding more rhythmical and interesting sounds, which has nothing to do with the interactions with Au and Vau. The Hau Simulator is a 2D graphics consisting of humans’ words, which are selected according to the activity at the main interface.

The MMS (Multimedia System) is a distributed and networked system that consists of a set of computers which communicate with each other using TCP/IP. The figure 02 shows the block diagram of the flow of signals among the computers. Each part will be described later in this paper.
Fig. 02: Technical overview

Hau, Au, and Vau, these three beings make their own sounds that represent their own languages. These sounds are different from each other as their real world languages are different, but together they make an ensemble. The sounds are dynamically changed in real-time according to the interactions among the three beings. A number of algorithms are used to generate the sounds. The figure 03 shows the technical overview of the sound system. These algorithms are all realized using Max/MSP program on Apple Macintosh computers. Each algorithm is described later in this paper.

Fig. 03: Sound engine overview

2.2.1 Au: nature

Au is a fish and symbolizes nature excluding humans. We invite a ‘Long Nose Butterfly fish’, a kind of sea fish, to be an Au (Fig. 04) to this aesthetic feast. In order that we have Au partake in <Trialogue>, we need an image recognition system, a graphic
routine through which Au can generate some images (Au Simulator), and a sound engine by which it can produce its own music. The image recognition system developed by us is capable of keeping track of Au. As a result, its position and speed are tracked, and these signals are also used for sound synthesis and small 2D graphics called ‘Au Simulator’, from which Au generates simple images, influencing the behavior and characters of Vau simultaneously.

Au is given the visual information of Hau and Vau (Hau Simulator and Vau Simulator) through two LCD monitors (Fig.05) placed on both sides of the fish bowl. On these LCD monitors, 2D graphics drawn by Hau and Vau are shown. According to biologists, most of the fishes are relatively more responsive to visual information than their other senses. Thus it is assumed that Au reacts to these graphics on the monitors and that the graphics influence its movements. For example, the closer Au moves towards the graphic of Vau, the more interested Au is in Vau. In contrast, Au prefers Hau, we think, if it approaches the graphic of Hau.
2.2.1.1 Image Recognition System

To trace Au, an image recognition system (Fig.06) is developed. The entire space of a fish bowl is captured by USB camera, and the moving objects are distinguished from the dynamic background. This is based on Multi-Agents System[1][2] and MHI (Motion History Image). Multi-Agents System recognizes the pattern or tendency of the movement of a fish or fishes, but only simple information (the position and the speed of a fish) are used in this project. MHI removes unexpected noises in the fish tanks. The results of this system are sent to each of Au Simulator, Au sound engine, and Vau brian through network sever. The system was implemented by C++ language on Windows platform.

2.2.1.2 Au Simulator: Au’s graphic generator

Au Simulator (Fig.07) is a 2D graphics generator based on OpenGL. It receives the results of the image recognition system and then generates simple centric circles, according to the position of Au. These are the drawings of Au. It was developed by C++ language on Windows platform.
2.2.1.3 Au Sound

The sound of Au is created by the ring modulation of four types of water sound samples. The position and the swimming speed of the fish determine the parameters of the ring modulator and the envelopes make the various particles of the water sounds. The figure 08 shows the block diagram of the algorithm.

![Block diagram of Au's sound synthesis algorithm](image)

2.2.2 Hau: humans

Hau means humans, especially, the artists and participants in <Trialogue>. Although strictly speaking, even humans are included in nature, we cannot help categorizing humans as different beings in <Trialogue> because they have been very unique in nature and have intentionally interacted with nature more or less. As mention above, Hau also has an equal status in <Trialogue> as with nature and the virtual life. Contrary to the fact that traditional artists dominated their own works, Hau as an artist of <Trialogue> does not control it, but interacts with nature and Vau virtual life or makes virtual life interact with nature as a conductor in an orchestra in order to harmonize with them.

The behavior of Hau is also deeply related to that of Vau and Au. Hau can interact with them by Hau’s interfaces, made by us, that generates their own graphics and sounds. At the same time, Hau also needs to concentrate on the graphics and sounds of Au and Vau to harmonize more with them in this orchestration.

In the interaction with Vau, as people’s behavior or thought can influence that of other people or can be influenced by them, so can that of Hau according to Vau’s independency on Hau. Through one of Hau’s interfaces, Hau can influence Vau’s characteristics. In the interaction with Au, Hau sends Hau’s graphics and sounds to Au. The Hau’s graphics are shown on the monitor on one side of the fish bowl. We assume that Au prefers Hau to Vau if it moves closer to Hau’s graphics.

2.2.2.1 Hau’s Interfaces

There are three functions of Hau’s interfaces: human interfaces among Au, Hau, and Vau, a type of musical and graphical instrument for Hau, and local lightings for the entire <Trialogue>. The highlight of Hau's interfaces is the fact that Hau can operate them by using light.

Through Hau’s interface, people as participants in <Trialogue> can interact with Au and Vau, and generate sounds and graphics. We prepared two user interfaces for Hau. One is a main interface (Fig.09) and the other is a light pendulum (Fig.10), which is easier than the first. The main interface has three main parts, each of which is again divided into two sub-parts. Each of the main parts represents one of the main characteristics of Vau: hairiness, hardness, and transparency (Fig.11), and two sub-parts of each main part represent the extremes of each of its characteristics. For example, the two sub-parts of ‘hardness’ consists of the extremes of ‘hardness’ and ‘softness’, while hairiness consists of hairiness and non-hairiness, and transparency consists of transparency and opacity.
The main interface roughly consists of three light sources, a lot of light sensors, and a microprocessor board (Fig.12). Each of the light sources are situated over each of the three parts of the interface, and the light sensors are on each of the sub-parts. When Hau moves his or her hands over one or more sub-parts of the main interface, each sub-part that senses a hand movement generates signals. These signals are sent to Vau and Hau Simulator (2D graphics sent to Au, discussed later), and also used for sound synthesis.
The light pendulum, composed of a light source, a pendulum hanging from the ceiling, and ten small plates (Fig.13) with light sensors placed on the floor, is an independent element for Hau. That is an easier interface than the main interface. It makes rhythmic sounds according to the movement of the pendulum. This is merely a musical instrument that does not influence Vau or Au. This was prepared to add a more musical and interesting sound.

![Fig.12: A microprocessor board](image1.png) ![Fig.13: The part of the light pendulum](image2.png)

Technically speaking, about 70 light sensors are used and two microprocessor boards are developed for Hau’s interfaces in order to convert electric signals from the light sensors to standard MIDI (Musical Instrument Digital Interface) signals. The boards can send Hau’s movements over light sensors to a computer. Also, the reason why we chose MIDI protocol is that MIDI is a worldwide standard protocol mostly used in music devices including computers. This means that this converter can be used in many other projects without any modification. The boards can process 33 light sensors. We implemented it using Motorola MC68HC000 Core, TI TLC2543c 12 Bit Resolution ADC, AMD Mach 211(CPLD), Xilinx Spartan(FPGA), RS-232 Serial Communication, CDS Light Sensors and so on. And for H/W Programming, we used MC68HC000 assembly language, ABEL, VHDL and C Language.

Also, Hau’s interfaces greatly act as local lightings in harmony with other elements of <Trialogue>.

### 2.2.2.2 Hau Simulator: Hau’s graphic generator

Hau Simulator (Fig.14) creates some words according to the performance of Hau. Each of the words is deeply related with characteristics of Vau. For instance, if Hau inputs signals concerning Vau’s hardness through the main interface, Hau Simulator outputs such words that are related to hardness in English, Korean, or Chinese as weightiness, burden, inertia, stability, inflexibility, and so on. We categorized a lot of the words to six groups: hardness, softness, hairiness, non-hairiness, transparency, and non-transparency. Hau Simulator outputs the words on one monitor placed on one side of Au’s fish bowl, too. It was developed by C++ language on Window platform.

![Fig.14: The images of Hau Simulator](image3.png)
2.2.2.3 Hau Sound

There are two algorithms used for creating Hau's sounds. One is controlled by the main interface, and the other by the light pendulum as mentioned above.

The synthesis algorithm for the main interface consists of three saw tooth waves and a comb filter. The pitches of the saw tooth waves, their harmony, and their envelopes are controlled according to the movement of the participant's hands above the main interface. The figure 15 shows the block diagram of the algorithm.

The synthesis algorithm for the light pendulum uses the formant data of human vowel sounds such as 'a', 'i', 'e', and 'u' to imitate the human language. As the pendulum moves, the light sensors triggers the vowel sounds. The figure 16 shows the block diagram of the algorithm.

\begin{figure}[h]
\centering
\includegraphics[width=0.5\textwidth]{fig15.png}
\caption{Hau Sound}
\end{figure}

\begin{figure}[h]
\centering
\includegraphics[width=0.5\textwidth]{fig16.png}
\caption{The sound of the light pendulum}
\end{figure}

2.2.3 Vau, virtual life

Vau, a simple virtual life, is a metaphor for polymorphism and integration in the world. These are the main zeitgeists, which can be shown by the integration of many specialized fields such as the humanities, sciences, technologies, and so on, along with the collision and fusion of the Eastern and Western culture, and the fall of boundaries in art. In addition, Vau is a symbol of a new species of life, whose existence should be considered by us.

Vau has basically ameboid 3D forms and its diverse forms are derived from the ameboid form because its amorphous forms can reflect the multiplicities of our times very well. It has several qualities: its degree of independence on Au and Vau, three characteristics (hardness, hairiness, and transparency)(Fig.17), two simple emotions (good and bad), and sub-characteristics (distortion and anger)(Fig17).

Its inborn independency and characteristics are randomly given at birth. The inborn independency from Au and Hau is fixed for its lifetime but its characteristics can be
influenced by Au and Hau. During its lifetime (fixed to 2 minutes), the characteristics keep changing based on four elements: its degree of inborn independency from Au and Vau, its inborn characteristics, the activity of Au, and the performance of Hau. In detail, Vau’s degree of inborn independency is the amount that Vau is independent from the behavior of Vau and Hau. Vau’s inborn characteristics are its initial characteristics at birth. These can be temporarily changed by Au and Hau, but if Au and Hau do not influence Vau, it will return to its original characteristics.

For example, if Vau is born having a strong independency from Au or Hau, it will change its characteristics as it wants, being less responsive to the behavior of Au or Hau. However, when it has a strong dependency on the others, its characteristics will easily change according to the others’ behaviors. This situation means that Vau has a right to act according to its own will (its independency) and we recognize Vau’s independence as an equal being in art. Although we designed Vau, we never want to dominate it as its creator in <Trialogue>. We are neither its god nor its master, but just want to harmonize with Vau and Au artistically.

Vau has sub-characteristics: distortion and anger. When one of Au, Vau, and Hau are in disharmony, Vau will think badly of it and anger will distort its body and turn it red.

2.2.3.1 Vau brain

The brain of Vau (Fig.18) has certain rules that determine the changes of its characteristics according to the four elements as mention above: its degree of inborn independency from Au and Hau, its inborn characteristics, the activity of Au, and the performance of Hau. (Fig.19)

Vau brain randomly assigns a different degree of independency and the new inborn characteristics whenever Vau is newly born. The independency is fixed at birth and is not influenced by Hau and Au. Vau brain receives signals from Au (its position and speed) and the signals from the main interface of Hau as inputs. And then it figures out if Au, Hau, and Vau are in harmony or not based on the calculations of its inputs, the inborn independency, and inborn characteristics in order to change its current characteristics, forms, emotion, sounds, graphics, and 2D graphics (Vau Simulator). Immediately afterward,
it sends the calculated results to a network server program. All the processes of Vau brain were developed by C++ language on Windows platform.

![Fig.18: Vau Brain](image1)

**Fig.18: Vau Brain**

![Fig.19: The elements to influence the characteristics of Vau](image2)

**Fig.19: The elements to influence the characteristics of Vau**

### 2.2.3.2 Vau 3D engine

Vau 3D Engine was made using DirectX and using C++ language on Windows platform. This 3D Engine can change the forms of Vau and moves according to the results determined by the brain of Vau through.

NURBS modeling technique is basically used to make Vau’s forms. Control of its NURBS curb and the resolution of its polygonal model are used for implementing its hardness and softness. A simple physical system including gravity, acceleration, and so on was implemented for its hairiness. Alpha-blending technique is used for its transparency.

### 2.2.3.3 Vau Simulator, Vau’s 2D graphic generator

Vau Simulator (Fig.20) is the representation of the world’s view of Vau, so it generates 2D images that reflect Vau’s characteristics and emotions. We design a proper 2D engine, which consists of the image manager and the image processor. The image manager has the list of categorized images, which are based on the past and present such as various people’s lives, paintings, landscapes, seascapes, living things, wars, cosmos and so on stored in a hard disk, and selects one of them according to the the results of Vau brain. The image processor has a number of processing tools such as blurring, masking, alpha-
blending, and so on (listed below), and it selects one of them to modify the image chosen by the image manager. All these tasks are done in real-time. Vau Simulator was implemented by C++ language on Windows platform, too.

The processing tools are: vector mapping, blurring, Gaussian blurring, masking, deselecting, inversing, alpha blending, rotating, brushing, smudging, clone stamping.

![Fig.20: The images of Vau Simulator](image)

### 2.2.3.4 Vau sound

The sound of Vau is created from the multiplication (ring modulation) of three waveforms: sine wave, saw tooth wave, and white noise. The characteristics of Vau determines the amplitudes of the waveforms, which changes the timbre of the result sound ranging from noise to simple periodic wave. The figure 21 shows the block diagram of the algorithm.

![The block diagram of Vau sound synthesis algorithm](image)

### 2.2.4 Network sever

We implemented the Java network server on Windows platform in order to link Au, Vau and Hau together, and to test this project easier using TCP/IP. It is a kind of network manager. The server analyzes each of the messages from all of the clients, modifies it properly, and then transfers to all target clients that need it. It contributes to reducing the complexity of each of above-mentioned clients and maintaining and repairing <Trialogue>, too.

### 3. INTERACTION

The point of <Trialogue> is to make an interaction among Au, Hau, and Vau. And, the essences of the interaction in <Trialogue> are equality, harmony, and Hau's difficulties in interfacing. We design the entire interaction of <Trialogue> based on the above. Each of them is so intertwined with the others that we cannot separated even one of them from the entire interaction in <Trialogue>.
In order to achieve the equality of the three in <Trialogue>, all of the parts have its own graphics and sounds to interact with the others as an artist. As a result, the graphic and sound of the three can influence that of each other. (Fig.01)

In the aspect of harmony, Au is a harmonious being in itself, so Vau and Hau need to try to observe Au. Vau dislikes disharmony although it sometimes creates disharmony. Vau hopes that Hau will lead itself into consonance with the entire interaction. If either of Hau or Vau destroy the harmony in <Trialogue>, Vau will become angry. For the purpose of the consonant interactions, the focus should be placed on the fact that Vau's characteristics, Au's movements (changing position), and Hau's performances (inputs of the main interface) are in correspondence. (Fig.22)

In their practical protocol, the two characteristics of Vau (hardness and transparency) are deeply related to the front view of the fish bowl of Au. To be more precise, the x-axis of the front view of the fish bowl corresponds to the degree of the hardness of Vau. The y-axis corresponds to the degree of the transparency of Vau. If Au is in the middle of x-axis of the front view, the degree of transparency will become minimum and the image recognition system will send the result to Vau brain. In contrast, if Au moves closer to either sides of the bowl, the degree of transparency will be maximum and the image recognition system will transfer the result to Vau brain. Also, if Au is on top of the y-axis, the degree of the hardness will be minimum and the system will send the result to Vau brain. However, if Au completely approaches the bottom of the front view, the degree of the hardness will become maximum and the system will transfer the result to Vau brains. The figure 22 explains the relations between Au's position and Vau's characteristics very well. The connections of the two implicative show that Vau is derived from the space of Au, that is, nature.

When involved in relations with Au and Vau, the role of Hau is to harmonize Au with Vau. When concentrating on the activities of Au and Vau, Hau should help Vau to unify the three by matching Au's position and Vau's characteristics with Hau's main interface. In this trialogue, Hau takes it for granted that Hau feels the difficulties when interfacing with the others. Nevertheless, trying to overcome the situation might be another concord in art.

![Image](image.png)

Fig.22: The relation of the main interface’s input and Au’s position to influence Vau’s characteristics
4. USER FEEDBACK

<Trialogue> was demonstrated at the Art Center Nabi gallery, in Korea during the months of November and December, 2001. It received over eight hundred people. During the exhibition, we found out how the visitors interacted with this work as humans (Hau), and gained useful feedback from them.

Although many visitors first felt difficulties with the graphical and musical information from <Trialogue>, they were able to quickly adapt to the main interface of Hau and concentrate on interacting with Au and Vau. Compared with the main interface, the visitors generally played the light pendulum intuitively as was our intention. In the opening performance, the visitors and artists enjoyed interacting with Au, Vau, and the other visitors.

Many of the visitors were greatly surprised at the fact that Au, Hau, and Vau create their own sounds and graphics and that they could interact with each other. Also, they were deeply interested in the fact that the two interfaces are capable of creating mysterious sounds by lights. Moreover, they were satisfied with the following points: the unique appearances and intriguing behavior of Vau, the aesthetic design of Hau’s interfaces, and their interesting interactions with Vau and Au.

Some earnest visitors were able to well appreciate the metaphors of <Trialogue> without any help. It was difficult for some visitors to understand the interactions of <Trialogue> due to its excessive communication. Nevertheless, the overall reaction of audience was positive. Therefore, that shows that <Trialogue> was welcome enough by the visitors.

5. CONCLUSION & FUTURE WORK

To sum up, <Trialogue> is an artistic and technological work to pursue interactions among Au (nature), Hau (humans), and Vau (virtual life). <Trialogue> begins with suggesting that the three be equal creators of art, that is, the subjects that can create the artworks. Such equality makes us realize that humans are to become an earnest interface to harmonize the three subjects like a conductor in an orchestra, and that they encounter the difficulties in interfacing the three subjects.

In the future, we have several plans to upgrade this version. In the aspects of its communication, trialogue in itself, as a type of communication, has difficulties due to the interactions of the three elements. Despite enough consideration to the concepts of <Trialogue> and its aesthetic and technical implementation, we did not approach it with perspectives having communication theories. Thus we would like to collaborate with several communication and information theorists on its next version to strengthen the communication part.

When considering its conceptual aspects, we have understood the meaning of nature from the perspectives of the western philosophies such as from Greek to modern philosophies. However, while developing and exhibiting this work, we realized that we would need the eastern thoughts such as Taoism and Confucianism, together with the western thinking, in order to apply the various aspects of nature to this work. In particular, we expect that the eastern philosophies would give us new opinions on the existence of virtual life, too.

In the aspects of performance, we are looking forward to converting <Trialogue> to a multimedia ‘performance’ rather than ‘exhibition’, which contains music, visual art, dances, dramas, etc., along with the interacting elements of humans, nature, and virtual life. To achieve our goals, we need to prepare for various aspects. First, we should design the new structures of its storytelling that can include all the above-mentioned elements.
For example, such structures have some principles and practical methods that can link visual elements such as forms, colors, etc. to musical elements such as notes, cords, rhythm, etc. The structures also have some methodologies capable of connecting visual and musical elements with various dancing motions and actions of actors or actresses. Next, based on the structures, we will need to develop the new physical interfaces as instruments for professional visual artists, musicians, dancers, and actors or actresses, etc., which can manipulate images and sound in real-time.

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FOOTNOTES

1. Art Center Nabi: http://www.nabi.or.kr
2. Max/MSP: http://www.cycling74.com