

# Cerebral Interaction and Painting

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## Abstract

The research focuses on combination of novel technology and traditional art. In this paper, a novel interactive art installation (IAI) using user's thought to interact with a digital Chinese ink painting is introduced. Meanwhile, the final purpose of this research is to establish a link between novel technology and traditional arts and further to bring out traditional art philosophy by taking the advantages of novel technology. Finally, this research aims to help people understand not only the visual expression of an art, but also its philosophy and spirit through different kinds of interaction. Based on this, the theory research focuses on four parts: traditional art philosophy, artistic and cognitive psychology, traditional art, novel technology. Meanwhile, for practice, a Chinese style IAI experiment including brain waves control technology is introduced to help people better understand the purpose of this research.

**CR Categories:** H.5.2 [INFORMATION INTERFACES AND PRESENTATION]: User Interfaces—Input devices and strategies I.3.6 [Computer Graphics]: Methodology and Techniques—Interaction techniques I.3.7 [Computer Graphics]: Three-Dimensional Graphics and Realism—Virtual reality;

**Keywords:** brain waves, Chinese ink painting, interaction, philosophy, novel technology, traditional art, interactive art installation, virtual reality, sensory apparatus, sensory substitution, bionics, telekinesis, psychokinesis

## 1. Introduction

Since American scientists built the first big computer in 1940s and 1950s, people greeted the digital era. With the development of digital technology in the 20th century, digital art appeared. Artists

began to create art with the aid of computers. Using digits to translate and record information, computer can record real objects like image and voice as numerical data or create any virtual object by using software or program. Today, we can find the trace of digital art everywhere in our life, such as video game, digital film, digital photography, interactive art, digital advertisement design, 3D art, and so on. Furthermore, virtual reality technology and augmented reality technology are invented to make immerse artistic creation. Meanwhile, these two technologies are also very useful in industrial domain, military domain and other fields. And for artistic creation, IAI has a very important position. In this art, virtual reality technology is used to create interaction and immerse experiment. IAI allows various parts of the human body participate in the art by using a highly diversified set of sensors, which make people become in a certain sense a part of art.

However, with the development of modern arts, some traditional arts begin fading away from present, even if they represent an accumulation of diverse cultures for thousands of years. It is a matter to be regretted. On the other hand, most of the current digital artists focus on how to use digital technology to improve virtual experiment or create more magic effects, but few focus on re-exploring traditional art culture by using those novel technologies. Even if some people have put traditional art into digital domain, the tasks are normally reconstructing ancient artworks in the aspect of visual expression by using digital technology. Fortunately, there are still some digital experiments that focus on the expressions of philosophy and spirit of artwork when developing the virtual expressions.

“Poetic art? Sound Movement”<sup>1</sup> by Lin Pey Chwen including poems and videos, offers excellent visualization of traditional Chinese poetry and art. In this work, user's movement is captured by camera which allows user interacting with some graphic elements reflecting the content of the poem in a virtual scene.

“Formation of Consciousness”<sup>2</sup> by XXtralab exhibits an experience of Chinese ink painting by using parameter calculation and projection equipment. By touching the surface of water, some effects of ink are randomly created in the simulated water. Those ink traces float from one side of the hand scroll to another side and diffuse progressively until their disappearance. This work presents characters of Chinese ink painting and expresses the relation between nature and Chinese painting.

“Five elements”<sup>3</sup> created by Shanghai University uses concept of five elements in traditional Chinese philosophy: Metal, Wood,

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<sup>1</sup> [http://www.youtube.com/watch?v=qybmF\\_Jb\\_jQ](http://www.youtube.com/watch?v=qybmF_Jb_jQ)

<sup>2</sup> <http://www.youtube.com/watch?v=wXtdVCOBCLQ>

<sup>3</sup> <http://www.youtube.com/watch?v=jdLrpSI86R8>

Water, Fire, and Earth. They design five scenes for each of the five elements. Some bronze pieces in the scene of Metal can be “knocked at” by waving hands in front of the screen, making deferent sounds by ancient Chinese instrument. In the scene of Wood, shaking hands will bring about leaves falling down from the trees or re-growing from the branches. In the scene of Water, user can produce some waves on the screen in order to simulate the movement of water. In the scene of Fire, user’s silhouette is captured by a camera and a fire effect is then created surrounding silhouette. In the scene of Earth, conditions of a forest can be influenced by shaking hand.

One of the most culturally comprehensive and technically sophisticated works of IAI is “Landscape Reunited – Huang Gongwang and Dwelling in the Fuchun Mountains,”<sup>4</sup> which combines art, literature, music, and new digital technology in one installation featuring five themes (Figure 1). The first one, “Landscape Transformed” is formed in 3D to depict a cultural landscape completed with seasonal transitions. Forty-two projectors are used in this work to realize a forty-meter long landscape. A sound-based interaction is incorporated into the work. For example, the audience can yell “Hello” when a butterfly rests upon the river rocks. After a second, the butterfly disappears and the painting responds with action. This theme integrates also an old Chinese game known as “Floating Wine Cups on a Winding Stream”, which allows user to pick up a floating cup from the river by touching the screen. The second theme, “A Legend in Art History”, a Chinese ink painting for storytelling, utilizes the form of a long hand scroll. With a touch on a particular period displayed in the scroll, user can hear a legendary story of this period with an animation played on the hand scroll. Next, “Secrets to Depicting Landscapes,” allows users to create a unique painting by piecing together various parts of Chinese painting. With the assistance of the built-in technical guidance, users can understand the contextual meaning of the painter’s observations and the techniques needed in creating an ink painting. Working in opposite direction, the fourth theme, in “Listening to the Painting,” light shines on an acrylic screen and slowly moves along a track



**Figure 1. Landscape Reunited – Huang Gongwang and Dwelling in the Fuchun Mountains**

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([http://www.npm.gov.tw/exh100/fuchun\\_media](http://www.npm.gov.tw/exh100/fuchun_media))

with different layers, constructing the spatial atmosphere of mountains. Meanwhile, music echoes the light, presenting a harmony of space and time. Finally, “Painting a Dialogue with the Landscape” focuses on Huang Gongwang’s artistic achievements. By choosing a hand scroll and placing it on a displayed tray, a puppet show is exhibited with the narration of the hand scroll on the screen.

In conclusion, most of the present works only use simple digital technologies, such as camera, pressure sensor, audio sensor, etc. And the visual expression of some work is limited or too abstract so that user can’t understand work’s purpose without explication of artist or guide. However, IAI is a kind of digital art that has a lot of possibilities integrating other technologies of different domains. Though digital artistic creation, those technologies can be combined together in order to offer service for our artistic creation. With different advantages of novel technologies, we can find different ways to better present traditional art philosophy and spirit. We could finally find the point between characters of traditional art and advantages of novel technology. In the same time, the attraction of digital technology can bring public to re-appreciate traditional art. For this goal, research of artistic and cognitive psychology is as well as needed in order to find a method of designing the interaction that could attract current people’s curiosity. Therefore about the research of this paper, it plans to create an IAI using brain waves control technology and other digital technology, as well as some medical sensors, to present Chinese ink painting art and explore its philosophy and spirit.

## 2. Philosophy and art

### 2.1 Chinese philosophy Qi

For understanding this IAI project and research, we first need to learn about its basis: Chinese traditional philosophy Qi.

Qi was coined in The Book of Changes which believes that nothing in the universe is static, and everything is in the process of constant change. Appended Judgments says, “Production plus reproduction is called change.” “Change” is “the birth of all things,” that is, everything in the universe is in the process of ceaseless production and reproduction. In the same time, a school of thought named Taoism developed from The Book of Changes believes that all things are made of Qi, which is in a constant state of movement and flux. Qi is a vital energy or breath. Originally the universe was in a state of chaos, but eventually the light Qi rose and formed the heavens, while the heavy Qi sank and formed the earth. The followers of this school known as Taoist believe that physical matter cannot be distinguished from its basic substance, Qi, and that thus matter and energy are interchangeable. In a word, “Qi constructs the universe”. Everything comes from Qi, is born in Qi, returns back to Qi, and thus forms a circle. Taoism proposed harmony between human and nature, and it advised “no-action,” which means intensely concentrated action without allowing unrelated thoughts or ideas interfering with the moment of being. It is unwise to oppose the laws of nature because such resistance fosters the growth of the force it opposes. Excessive force in a particular direction tends to foster the growth of its opposite. An obvious and aggressive attempt to gain power and position can produce an opposite consequence.

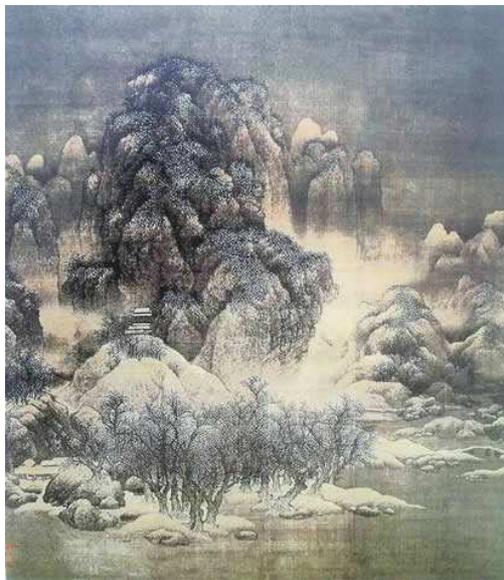
### 2.2 Chinese ink painting

Chinese ink painting (Figure 2) is a form of Chinese arts that has perfectly inherited the concept of Qi. In the beginning, Chinese

<sup>4</sup> [http://v.youku.com/v\\_show/id\\_XMzM0M0MjkxNzc2.html](http://v.youku.com/v_show/id_XMzM0M0MjkxNzc2.html)

created words by imitating objects or activities, those words use figures to present sense. And then, with the passage of time, it was divided into two branches, Chinese painting and calligraphy. But the Qi is always their basis.

Chinese ink painting presents usually landscape of nature including mountains, rivers, herbs, flowers, and animals, or with some buildings or human beings in the painting. For creating a painting, Chinese ancient painters usually spent a long time on traveling, to discover different kinds of natural landscapes. During this process, painters could get some personal senses. And based on those senses, they can then create paintings. Therefore, Chinese ink painting is not an imitation or copy of real landscape, it is painters' philosophical consciousness by using landscape to present things which maybe doesn't exist in the real world. At the end of painting, painters usually write a poem in a corner of their work to present the subject of the painting or their senses.



**Figure 2. Chinese ink painting: *Forest in the snow***  
**Fan Kuan - Dynasty Song (960-1279)**

For creating Chinese ink painting, we use Chinese brush, Chinese ink, Chinese absorbable paper, ink stone. The four elements named scholar's four jewels in Chinese culture. Painters use brush to dip ink and paint trace in the absorbable paper to create figures. When the brush touches the paper, ink progressively diffuses in the paper according to the force and method of usage of brush. Because of that, Chinese ink painting has no solid trace but fluid trace. Such characters of Chinese ink painting reflect the balance of nature, concept of integration and natural harmony.

### 2.3 Qi and human brain

Following the above arguments, natural Qi, human's spirit and Chinese ink painting can be 3 major parts of this IAI. But the question remains how to connect each other for the IAI project. In order to find out the answer, research of Chinese medicine is very helpful, which provides us the knowledge of circulation of Qi in human body.

According to Compendium of Materia Medica, the classic

Chinese medicine manual, "brain is the center of spirit". Miraculous Pivot further elaborated the relation between Qi and spirit: "When people are born, spirit is the first thing that is created, and then the brain...After blood and Qi have been together, the functions of blood and Qi have been completed, organs have been formed, spirit and Qi have settled down in the heart, soul has appeared, and then human being are formed." Correction on Errors in Medical Classics said: "Intelligence and memory do not depend on the heart, but depend on the brain. Two ears connect to the brain, and the sound heard by ears is processed by the brain. If the brain's Qi is weak, the brain shrinks. If the Qi in brain and the Qi in ears are not connected to each other, deafness will occur." Furthermore, "a baby has no memory because the brain has not been filled; an old man has no memory because the brain is empty."

Based on the above observation, there is a close relationship between Qi and brain, as well as between brain and spirit in human body. Therefore, a possibility is to use brain, or human consciousness, to participate in the IAI, to interact with natural Qi which can be exhibited through the Chinese ink painting. And in order to break limitation of traditional technologies applied in IAI creation, brain waves detection technology which is normally used in medical domain has been introduced into the creation of this artistic project. The brain waves technology is used to capture user's mind which is a kind of human's Qi, interacting with a digital Chinese painting to create life or influence life. Through these interactions the user understands the relationship between human's Qi and natural Qi and also the concept of Qi and its philosophy, the character of Qi and harmony between human and nature.

### 3. Experiment design

Because of the above-mentioned reasons, a conception of experiment can be designed at this phase. The final objective is to verify feasibility and innovativeness of the combination between art and novel technology for exploring the real value of traditional art. In the case of the paper, the experiment is an IAI combining of Chinese ink painting and medical sensor. The whole IAI is a complex project which includes a lot of researches concerning creation of interaction scenario, technology of brain waves and other sensors, technology of 3D, research of philosophy, psychology, Chinese ink painting and its spirit, research of artistic



**Figure 3. First demonstration**

visual expression and so on. However, the first demo of whole research is already done (Figure 3). It is simple but technically, the feasibility of interaction between brain waves and painting has been perfectly approved. Based on this, the next step is to focus on research of art, as well as philosophical and cognitive psychology research, in order to better ameliorate the scenario of interaction. Meanwhile, other 3D technologies and other medical technologies will be as well as introduced in this research.

### 3.1 Technology design

#### 3.1.1 Electroencephalograph

First at all, for obtaining thought, a machine detecting human's brain waves is necessary. Normally in medical domain, doctor uses a kind of detective machine named electroencephalograph (EEG). Brain waves signal is very weak, this machine can amplify this weak signal in order to make it editable. Thus, the principle of EEG is simply to amplify brain waves signal. The basic component of EEG machine is an amplifier, it can amplify weak EEG signal. However, the amplifier parameters chosen to record the EEG have a large impact on the quality of the data derived. Central acquisition parameters are the sampling rate, the gain (vertical resolution), the highpass and lowpass filter characteristics, and the notch filter that can be used to eliminate residual mains noise. However the brain waves signal is an electrical analog signal which can't be edited in computer. Thus after the amplifier and noise filter, a converter is required to convert analog signal to digital signal in order to make the brain signal programmable in computer.

The first step for capturing the brain waves is locating conductive mediums in different positions on the surface of scalp. Materials such as platinum, gold, silver, or silver/silver chloride are used for EEG surface electrodes. In order to minimize noise and artifact problems, surface electrodes must be affixed to the scalp by adhesive conductive paste. Brain waves signal go through these electrodes and get into the amplifier. Indeed, as long as people think something, different brain signals will be released from different cerebral regions. Each electrode captures the signal of its location. As result, we get different cerebral data. By analyzing those data, different cerebral activities can be finally identified. (Figure 4)

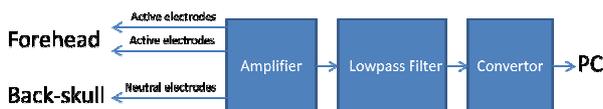


Figure 4. EEG circuit

The above is the principle of EEG. For creating the IAI project, character of brain waves must be also required for further study. Human brain waves can be roughly divided into four types, each providing us with a level of physical as well as mental consciousness. The first type is called beta, which travels at a rate of twelve to sixteen cycles or pulses per second. When your brain is transmitting beta waves, you feel alert. The second type is called alpha, and travels at a rate of eight to twelve cycles or beats per second. When your brain is transmitting alpha waves, you feel creative. The next type, theta waves, travels at a rate of four to eight cycles or beats per second. When your brain is transmitting theta waves, you begin to feel drowsy. The last are delta waves, which travel at a rate of one to four beats per second. When your brain is transmitting a predominance of delta waves, you are at some level of sleep.

Normally, for creating a good IAI, artist needs to activate deferent behaviors to participate in interaction. It means a nice scenario of interaction is necessary. In this case, more identifiable brain waves mean more editable behaviors. Thus, mature product of EEG is a better option than manually built EEG which normally produces much strong noise and can only detect strong brain waves signal.

#### 3.1.2 Technical procedure

A mature product named EPOC (Emotiv cop.) is a neuroheadset instrument which is portable, safe, powerful and wireless. EPOC has 14 electrodes and a two-axis gyro for measuring. It is capable of detecting user's thoughts, feelings and expressions. (Figure 5)



Figure 5. Neuroheadset (EPOC)

In current phase of project, two kinds of thought are designed to participate in IAI, injection of Qi and recovery of Qi. In addition, two kinds of facial expression have been as well as used such as blink and smile. The two-axis gyro is used to control the movement of arrow by moving head.

On the other hand, there are three steps for creating Chinese ink painting. The first is creating 3D elements such as plants, rocks and flowers in 3Ds MAX. After modeling those elements, we create next Chinese ink texture for them. For realizing this step, ramp map can be used for adjusting its parameters. And then, final step in 3Ds MAX is to create animations for growing plants and flowers.

When the elements have been prepared, the next step is to create animation effects in Adobe After Effects (AE). In this step, we create effects for some necessary elements and diffusion animation for Chinese ink animation in order to simulate Chinese ink characters.

Finally, all of the elements are integrated into Flash for final composition. In this step, we create interaction according to interaction scenario which has been set in the beginning for guiding us how to create IAI. In Flash, there are still some 2D elements must be created, with the help of Adobe Photoshop if necessary, such as Chinese paper background, seed, bee, mountain and some else accessories. In addition, all of the interactive animations are also realized in this step, as well as some color adjustments. In the end, final important step is to program interactive script by using ActionScript 3.0 and link brain waves control technology to our digital IAI. (Figure 6)

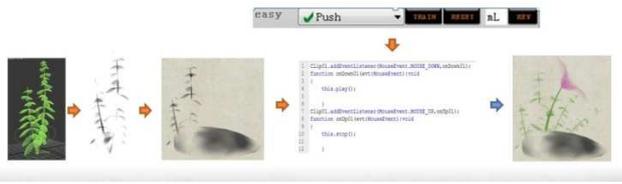


Figure 6. 3Ds MAX – AE – AS3.0 (+EEG) – Final work

## 3.2 Interactive design

In this part, two things will be introduced: how to integrate brain waves control and interaction scenario.

### 3.2.1 Integration of brain waves control

In the above paragraphs, we have learned the function of EPOC neuroheadset and creation of Chinese ink painting. However, how to establish the link between the two things? For solving this question, we need to learn EPOC Control Panel and EmoKey.

EPOC Control Panel is the basis of application of EPOC neuroheadset, it owns 4 sectors: Expressiv Suite, Affectiv Suite, Cognitiv Suite and Mouse Emulator. For this IAI project, the Expressiv Suite, Cognitiv Suite and Mouse Emulator are necessary.

The Expressiv Suite details the facial expressions and non-verbal communication capabilities of the EPOC Neuroheadset. The facial expressions which are displayed include horizontal eye movements to the left and right, normal eye blinks, left and right sided winks, clenching the teeth and smiling.

The Cognitiv detection suite evaluates a user's real time brainwave activity to discern the user's conscious intent to perform distinct physical actions on a real or virtual object. The detection is designed to work with up to 13 different actions: 6 directional movements (push, pull, left, right, up and down) and 6 rotations (clockwise, counter-clockwise, left, right, forward and backward) plus one additional action that exists only in the realm of the user's imagination: disappear.

The Mouse Emulator Tab in the EPOC Control Panel allows you to activate the neuroheadset's gyroscope and link it to the control of your computer's mouse cursor.

For our IAI project, the major is Cognitiv Suite. Although a serial pre-configuration actions have been set and cannot be changed, but we can still train those actions to adapt our personal brain waves. The Cognitiv training process enables the EmoEngine to analyze your brainwaves and develop a personalized signature which corresponds to each particular action, as well as the background state, or "neutral". As the EmoEngine learns and refines the signatures for each of the actions, as well as neutral, detections become more precise and easier to perform. Therefore, according to this point, we get two ways to develop the Cognitiv Suite function in order to adapt our IAI project. The first one named similar thought: after some experiments, an interesting phenomenon is discovered. Some brain waves in fact have some similar characters, such as push and inject, pull and take back. In this IAI project, when user imagine injecting Qi to the painting in

order to give life, his brain wave of injection resembles the action of push. Therefore, behind our application, we can train user's injection thought associating to the push action which has been preset down application. The second is brain wave replacement: because Emotiv Company has preset the functions of Cognitiv Suite and the preset actions can't be added or deleted. However, we can still train them. Therefore, there is a method to replace those preset actions by using training order to remember our personal thought instead of existing action name. For example, although an action named push, we can insert still another thought for it during training process. As a result, this action holds its ancient name push, but has a novel thought content which has been trained and replaced.

Currently, the thoughts and training works have been done. Next, how to link thoughts to IAI project? For this question, a function named EmoKey (Figure 7) must be introduced.

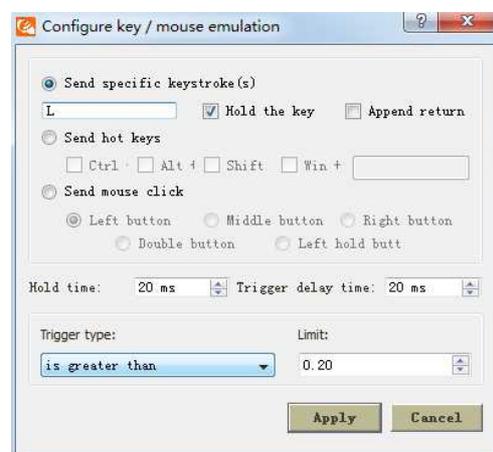


Figure 7. EmoKey

EmoKey lets you create profiles that define how detections are mapped to keystroke combinations. EmoKey links the Emotiv technology to applications by easily converting detected events into any combination of keystrokes. According to above explication, keystrokes are able to become a medium to save detected events, thoughts or facial expressions. By using EmoKey, a detected thought such as push can be associated to a key button such as L or to a mouse key such as left button. When this thought occurs, the associated key button will be activated. Above is one side of the link, brain waves and keystroke. The other side is keystroke and application. By using ActionScript 3.0, listening event can be created in order to detect keystroke event. For example, we have previously set a movie clip named growing plant and established a listening event such as when detected the key button L pressed, play the movie clip growing plant or execute a sentence. Based on this concept, association between brain waves or our thoughts and the application can be indirectly established.

In addition, EmoKey can not only map thought or facial expression to keystroke, but also allows us configure some parameters such as event mode including "occur" or "not occur", as well as a function named qualify control. Qualify control allows us to set a value which defines when the associated key button is pressed and what is the press mode. For example, the press mode named more than... and a value such as 0.5 have been

previously set for an action of pressing left button, which has been also associated to a user's thought known as push, then when the user thinks push, the left button infect cannot be pressed at once. The left button can be just pressed only when the force of concentration gets over 0.5. This function brings us more possibilities to create interactivity.

### 3.2.2 Final Interaction scenario

Users use their mind to control Qi, to inject Qi into the painting as giving life to plants and animals.

Human's Qi and nature's Qi can integrate and influence each other. Injecting our Qi to the nature levels up the natural life, and Qi of natural life also nourishes our Qi in order to make our life stronger. However, the digital Chinese ink painting and users exist in two spaces. How to express the interaction between the painting and us?

We need thus a solution to feel our Qi injected into the painting, and let users understand this is a kind of their own energy. Based on this, in the digital painting we need to make Qi and all the changeable elements visible. For example, life and death are expressed as a circle of Qi. Concentration of Qi makes life appear. To the contrary, death makes Qi scatter and return to the nature. Therefore, with injection of Qi into the nature, we can make more and more life appears, which means gathering of Qi construct life. And then, the environment becomes more and more vital. The Book of Change mentioned Qi is a vital energy which can be transformed between different materials and influence them. According to this argument, with more powers of nature, our Qi also becomes more and more powerful. According to Taoism, "if we want to change the nature, no matter how small an action, we always lead the nature to a bad direction." For example, catching an animal kills the animal; cutting down a tree ruins the forest; blowing a gale destroys the environment, like butterfly effect. All things born in Qi and die in Qi. In this painting, the biggest storage is the earth. After the death of life, Qi returns to the earth. If people continue to use their Qi to interfere the nature, their Qi disappears finally.

Although the current demo that has been completed until present is just a small part of the interactive scenario, the whole painting will be a complex project. The entire painting is divided into distant, medium, and close view. The distant view is assigned to the mountain, the middle view to the forest, and close-range to the animals and some typical plants. All can interact with users. In the foreground there is a river. Some clouds and birds hover in the sky.

Initially, the scene shows sky and ground with a gray color. When user injects his Qi into the screen, the nature's Qi is activated, and grows out from the land in the form of seedlings and keep growing up to plants. Qi around these plants also grows out from the land in the form of green grass. The vapor exhaled by the plants is then released into the atmosphere and forms clouds. The more Qi is injected, the more plants and clouds are formed, leading to rains in the scene washing away the dusts and cleaning up the background. The color of the painting then becomes richer and more vibrant. As another form of Qi, the rainwater, once soaked into the ground transforms itself into all kinds of the elements for life. On the other hand, the Qi evaporated from the water in the ground can be absorbed by the user, and thus makes the user's Qi stronger. Meanwhile, the plants bear fruits and die at the end of life. Nutrition of the fallen fruits is also a form of Qi and can be taken in by the user. While the dead plants give part of

their Qi to new life and return the rest to the earth. The middle view of scene is also active when the Qi is strong enough, the forest forms, birds fly in the sky and insects appear in the ground. The insects bring the seeds from the forest to the foreground, and new plants appear in the foreground. Rivers are finally formed in the close view the outflow of many rains. And new species lives in the river after the users inject Qi into it.

Chinese traditional music is also applicable as the background sounds for the interaction, which allows the user to emerge into the environment and the ambiance. A series of sounds for different behaviors are also set in the scene.

### 3.3 Art design

This IAI project adopts Chinese ink painting as major artistic style. Normally, Chinese ink painting presents as white and blank. However, this IAI project also uses other colors for exhibiting conception of giving life. On the other hand, background of the IAI is Chinese absorbable paper texture, because Chinese ink painting is painted with this kind of material in the real world. And because of characters of absorbable paper, appearance of object in this painting accompanies with an animation of diffusion. In the real, when ink drop into the paper, it will diffuse progressively, which cause Chinese painting has no solid trace but fluid trace. Chinese painting normally has a short poem in the corner of painting, as well as a stamp of painter. For our IAI project, this poem is replaced with a changeable guide which tells user how to start the interaction and help user understanding content of IAI. This is also a way of integration of Chinese calligraphy art. For the visual expression, the major rhythm is tranquil and mysterious which makes the landscape like a world out of our world. Because Chinese ink painting is not simply imitation, it is presentation of painter's feeling and spirit. And the

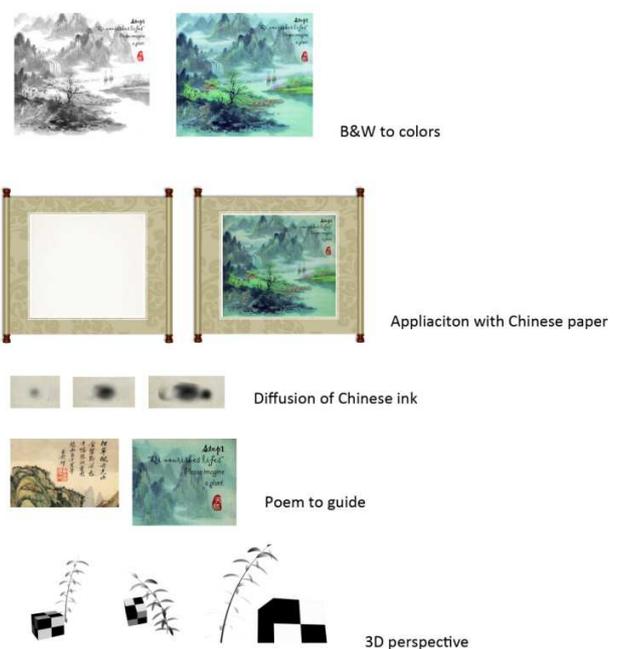


Figure 8. Art design

traces of Chinese ink painting are fluid render the painting with a soft visual expression and all elements present abstract style. Above is the art design for imitation of Chinese ink painting. However, 3D technology has been introduced in this project, which must be also considered as a part of art design. Traditional Chinese ink painting is 2D art which has just one face. Then how to imagine the space and aspect of three dimensions for objects is a problem. It requires designer owns skill of 3D art creation to recreate objects with correct perspective and Chinese ink texture. In the end, the art design includes as well as music. First, the background music is a famous Chinese traditional music known as "High Mountain and Running River" which has a slow rhythm, played by Guzheng. This style of music corresponds with our painting rhythm. The echo between music and painting helps user better experiment the IAI and feel its spirit. And then, some sounds will be also created for different activities. (Figure 8)

#### 4. Conclusion

Until present, the research of hybridization between traditional art and novel technology has finished a first demo which successfully integrated the brain waves control in digital artistic creation and simulated a scene of Chinese ink painting. The Chinese philosophy Qi has also introduced down this experiment according to the interactive scenario. However, still a lot of changes and ameliorations need to be done. The framework of current experiment is too simple. Limitation of technology and insufficiency of psychological analysis are two large part need to be profoundly researched. In the future, advanced 3D interaction will be realized, which means user walks in the painting like walking in the real nature. With 3D virtual camera, user observes aspect of objects in perspective space. Meanwhile, the augmented reality technology will be able to be used in this project in order to integrate some real elements into the virtual space.

On the other hand, some other physiological sensors will be able to be adopted into role-playing, such as using pressure, cardiac rhythm, body temperature, humidity, movement capture, breath sensor and muscle force sensor, etc. The concept of Qi in Chinese philosophy and Chinese medicine is not only limited to brain and consciousness, but also applied in the whole body as a system of channels (also called meridians). Qi in the channels is connected to the organs of the body and is the living force that causes the organs to function. There are five different types of Qi in the body: Essential Qi (jing qi), Original Qi (yuan qi), Gathering Qi (zong qi), Defensive Qi (wei qi) and nutritive Qi (ying qi). Furthermore, Qi also exhibits a circulation that is called Qi field. Future research will deeply explain the deeper meanings of the philosophical concept of Qi by using other advanced technologies and introducing entire organs into the IAI system. In all, the final goal of this practice experience is to mobilize all of the body to participate in the interaction for present the concept of Qi.

Another large part of this research: artistic psychology and cognitive psychology. They are very important for this research, which will guide us to design IAI. Even if the philosophy, technology, traditional art have been perfectly researched, we cannot still achieve our purpose without user. Although the

purpose is exploring philosophy and spirit of traditional art by using novel technology, but in the end, the essence is to let user understand those philosophies and spirits. If user cannot understand both of them by using our IAI, our research will be useless. Because of this, the research will focus on psychology in the next step and after that, this IAI will be re-designed adapting result of psychological research.

A successful digital artwork needs to balance the weight of art and technology, using advanced technologies to present spirit and philosophy. For achieving this point, user's understanding must be also considered as an important factor. The combination of novel technology and traditional art is not a simple research. It is a research of multi-disciplines. However, with the exploration of potential of digital art, the traditional art will be more and more brilliant in the future.

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