On the In-application Value of Emotional Intelligence Interaction Based on Interactive Art Installation

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Abstract. The design of interactive art installation, which integrates interactivity, artistry and education, leads people to think their relationship with nature and society by human-installation interactive movement. Due to the repaid development of science and technology, the simple interaction with settled program cannot satisfy people’s demands. Instead, they want to step into the world of installation through personalized emotional catharsis. The current mode of communication will be changed by the in-application program within the interactive art installation. The single installation totally produced by artists’ thought will be replaced by the finished installation product with the participation of the audience. In this way, participants will immerse in the story plot and feel various emotional changes psychologically by sound, image and touch, which relies on the interactive art installation. The Listen is taken as the example to spread the idea of sharing the ecological nature of human beings and the world. Arduino, an open source platform, will be studied to show the change of modern interactive communication mode, exploring the impact of programming tool on the development of future interactive installation and providing some new ideas for the integration of artistic creation and science and technology in the future.

1. Introduction

1.1. Interactive Art Installation
Art installation uses some material space to show its large-scale integrated entity display art, which can display the arts directly by artists with the reconstruction of materials, leading the audience to think about the culture. However, the interaction and connectivity will be activated like the blood, connecting the art installation and human beings through the programming technology. It is like a game map that the traditional art installation just shows the infinite possibilities to the audience directly with all the start, exploration and the end, which can bring the unique world created by artists with their own thought through such a primary interactive experience. However, there is less understanding in a deeper level with the limitation of interactive method, while, in addition to the materials which has been already there and been created by the artists, there will also be the electronic equipment. In the old days, by the power of nature, it can change its form with some physical conditions like wind, temperature and gravity. Nowadays, the installation can change by itself with sensors, under the condition of developed technology of new media and interaction, changing the uncontrollable environmental factors to the rational and controllable data codes. The designers will not be limited under the traditional presentation elements, but to create a spirit behind the art installation with some rich form through the changes of sound, light, electricity and shape controlled by electronic control pane for a better display effect.
In today’s world, people can find more humanistic feelings behind the rational code with the art recognition of the programming language with artificial intelligence, which is not only the new experience of the art installation. Therefore, the immersive new media interactive installation is gradually developing.

1.2. Arduino Programming Platform

The Arduino, a development platform, can help us open the source code, which realize the intelligence of the installation design for communication between the interactive installation and human being. It can satisfy the artists who have unlimited imagination with demands of technology. There are two main parts of Arduino, which are the circuit board and the Arduino IDE. For the circuit board, hardware part, it can control all kinds of sensors and electrical appliances by connecting circuits, and for the Arduino IDE, software part, it can help developers easily meet the demands of technology, transmitting the code directly to the chip on the circuit board through the USB with the programming code on the compiler made by the developers.

With the main control board of the Arduino, the designers can use the spliced circuit board components to control various electrical appliances and sensors in series on the circuit through the socket design like building blocks which can fit the connection of multiple sensors to avoid welding. So, the main control board of the Arduino can freely assemble supporting expansion peripherals as the different designs. As the received signals are handled by the programming pre-written and the corresponding output is fed back according to the demand, the sensors on the circuit can receive various physical signals like heat, sound wave and light wave from the real space, then feedback to Arduino Uno chip, with this method, researching the behaviors of human beings and impacting on the environment and human beings. There are so many codes uploaded by developers in Arduino community which can be directly used by people who have no experience of programming. Besides, the Kenrobot, a programming environment which is totally visualized, created by many manufacturers, can help users figure out different interactions in the process of interactive design and code writing, making a complete process of interactive design and a perfect interaction.

2. The In-application Value Of Programming Language In Interactive Art Installation

2.1. The Rich Interactive Experience

The electronic components will be controlled to realize a variety of sensing methods, consisting the topological structure. Just like the communication between people, which can be received by eyes, ears, mouth, nose, hands and other senses of body, the communication between people and installation should also be carried out through sensors to get the feeling of emotion changes and personality characteristics of each other. It is said by Professor McLuhan that the medium is information and the medium is the extension of human beings[1]. In today’s development, the creative changes of humanity and art are shown by the usage of technology. As an information, the medium quickly adapts to the innovation of science and technology: it can imitate human’s behavior to receive the information, imitate human’s vision through ultrasonic, imitate human’s touch through force sensing and imitate hearing through vibration. The computer can quickly make the corresponding feedback in a super short time with sensors, analyzing behaviors of human beings, as the electronic technology is developing quickly. It can make the two-way communication between people and installation come true.

From the perspective of vision, it will be shown as the display screen and light group on the interactive art installation which is the result of interdisciplinary performance. To the display screen, it will make the specific operation of the audience transmit to interaction through video materials prepared by the designers with photography and animation, combining with the Processing. To the light group, it can make some changes according to people’s interaction movement with the sense of color and space design through light groups like light string and light belt to form the changes of point, line and surface, complicatedly combining with the different orders of color, lightness and brightness designed by former programming language.
From the perspective of hearing, people gradually have visual fatigue because of different expression of vision in design art, it is easy to deal with this problem by sound. People can easily get into the space made by the installation, through the layout of the sound field and the connectivity and interaction of sound, the rendering and promotion of narration can be constructed[2]. From the background rendering, in terms of hearing, the audience will step into a new space different from the real world with the ingenious arrangement of background music and white noise, analyzed by the brain’s subconscious to help the audience think and connect continuously when they are experiencing the installation. From the plot promotion, it can make the audience experience the interaction in the specific way set by the designers through the guidance of language and the progressive design of the sound field. The programming language can also locate the different position of audience to change the pitch, timbre and loudness, interacting with the audience in various way.

2.2. Realize Multi-dimensional Linkage Communication

It is the linkage communication between the real world of the audience and the conception world of the installation. It is unlimited in art galleries which are properly arranged or commercial galleries which are the high-end. The art of installation which is different from other works of art, will be shown in our daily life, maybe in a square, a park, or even in the elevator of their own community. Thus, there are some problems that we must take care of, such as who the audience is, what kind of mood he will take, whether he will carry a large number of supermarket shopping bags. For this moment, it is the most relaxed, natural and direct state of the heart without the preparation that visiting the art galleries and accepting the art and humanity. Without the guards, stepping into the world of the installation, the audience will use their naked souls to make some movement which can be fed back by the installation with so many sensors according to the visual, tactile, auditory, olfactory and gustatory sense. This kind of interaction at the realistic level has well attracted the attention of the audience. People open the interaction between themselves and the installation in a very natural state. Through the primitive way of five senses, they have confidence in such a model of art works and enter the conception world of artist with the most natural state.

It is the linkage communication between the psychological world of the audience and the artist. The psychology of the audience will be the most natural while the most complex in such an open environment of society. There are different senses to art with multiple social roles of everyone. In such a condition, the installation will welcome different people and every possibility. In the past, art of installation always considered one specific place for one specific person, with the programming language, it will greatly expand the humanistic connotation of a single installation work. A work has different ways of interaction, people can get their own inspiration from the installation according to their actual situation. For this moment, like an intelligent and information-based artist, the interactive art installation can express its own thought in different ways to different people, can take care of people with different identities in different plots and can infect people with different experiences by different endings. The art of installation is existing in our daily life, which can show the daily state of people, equally talking with the psychological world of the artist. Then the thought of a work will be understood in various ways with different values and world views. Uploading the complex ideas of the artist to the installation through the programming language, which is also the first step of using artificial intelligence in the field of art.

It is the linkage communication between spiritual world of the audience and the nature and society. Like characters which are used in literary works to figure a person, construct scenes and develop stories, people will enter into a world conceived by writers step by step, feeling the sophistication in it, which is different from traditional art installation, and it is intelligent interaction that integrates the artist’s philosophy into the works. Interactive art installation is in the same level that people will get the different feelings through different sensors with different understanding to the concept of installation and different feedbacks to the installation interaction, which can provide different behavior choices for people to fight with the social problems behind the works with the true self. As the installation is guiding the thought of people during the interaction, though there are different opinions to social problems with
different people, they will begin to reflect, begin to be annoyed and begin to think what they can do for this world, with the expended cognition of the natural society.

2.3. Enhance The Interest Of Interaction
The first is participatory. Jacucci states that every people with different characteristics will play a different role in this party of interaction, just like the video games, which means that people are not beyond the interactive installation when they are experiencing, in the installation, the world of game, every people can talk with the artist with their true feeling, exploring the infinite possibility in the world of installation themselves[3]. We can have an installation work with so many plots, which is rely on a complete story chain, because of the completing digital science and technology. Every one will find his role in these story chains with different ages, social level and experience. They can make resonance with the idea of artist in the interaction again and again, attracted by the installation with deeper thinking.

The second is subjectivity. To be the medium to spread the ideas of artist, the installation can get some personalities with multiple helps from technologies, through sound, light and vibration as well as the skills of learning to listen, observe and predict. The technology is connected with the installation, making the interaction between computer and human being become a reality. In the past time, works of art were generally observed and interpreted by people with the abstract communication between the artist and the audience. The works contained the creative spirit of the artists to show their personal ideas subjectively. Nowadays, there are more and more works which are not finished in the exhibition galleries to be completed with the creation and understanding of the audience through the integration of technology and art, which means that the artist is not the only creator of a work. As a result, the installations can analyze the movement and language of people and then do the reflection with the subjectivity given by the interactive installation with the technology of sensors[4]. It means that there will be an easier way to connect with the personal emotion of the artist in a art work, which can perfectly integrate the complex and changeable inspiration of them into the installation works, so as to let the audience speak to the artist.

The third is uniqueness. The old saying of Shakespeare goes that when there are a thousand audiences, there are a thousand Hamlets. The audiences who enter the installations are different from mood, character, and acceptance of new things with different developments, plots as well as choices. As a medium for artists to communicate with the audience, the installation represents the communication between artists and the audience, in order to achieve spiritual resonance. When human beings are interacting in the installation with the thought of the artist, it is the discussion of two souls. We can always show different personality characteristics and reflect different mental states when we are facing different objects, causing the result of a thousand Hamlets by the reason of humanity, which contains the uniqueness of the art installation works during interaction. There will be a different ending in the experience of each person’s different participation.

3. Design And Application Of The Listen
3.1. Preliminary Creative Ideas
Background. The ecological and natural environment have been destroyed during the development of industry. People have destroyed the organisms that originally shared the ecological and natural home directly or indirectly by cutting down forests and reclaiming land from lakes, causing irreversible adverse effects such as air pollution and global warming. According to the data of IUCN, among the 59508 species with known global living conditions, 19265 species are endangered, accounting for 32.4% of the total. The Listen is an interactive installation with the idea of protecting the shared natural home and saving endangered animals. When people are close to the installation, through programming, they can answer the phone call from wild animals, speaking to the nature and listening to the declining nature from the perspective of wild animals. It can connect the installation with the specific movement of the audience by lighting interaction and sound interaction in the same story.
Creation. For The Listen, it uses a big tree which means life as the main body, the microphone as the communication link between human and nature, attracting people to answer the phone to listen to the voice of nature, which is calling on people to take care of the protection of nature and wildlife. On the one hand, as an emissary of nature, the microphone conveys the aspirations of endangered animals; on the other hand, as a product of human beings, it also allows people to communicate with nature in their most familiar way. The behavior will lead to the interaction of installation by connecting each step with human’s actual operation, making the plot scene of the whole installation develop from vigilance to familiarity and making the communication effect more popular than the interaction without programming.

![Figure 1. Preliminary draft.](image)

3.2. Preparation
Combined with the real trees, the whole installation will use the programming software and the layout of external hardware of the entity to realize the interaction between the installation and the audience with light bulb, light band and microphone with built-in audio. Ultrasonic sensor, acceleration sensor and physical button will be used in the installation to develop each plot by identifying biological signals so that people can get the feeling of interaction with the effect of lighting and sound.

![Figure 2. Flow chart.](image)

3.3. Programming
Through the programming, the lights on the tree showed the breathing-like brightness changes at the beginning, with the natural audio such as the sound of insects, birds and waves played by the microphone on the tree. The ultrasonic sensor which is attached to the microphone can feel someone closing to it, and within 20 centimeters, the phone will ring to attract people to pick it up through the signal sent out from the receiver.

There is also an acceleration sensor on the handle of the phone, which will send out the signal when someone picks it up, then the audio will start to show the story. After that, a voice of invitation will be played, “please press the button on the microphone and join us to protect the earth!” When someone presses the button on the phone, which means he or she would like to join in, the light band on the microphone line will give some feedbacks with the light spreading upward to light up the light band. The white light in this area will no longer flash but become normally on.
Figure 3. Changes in lighting and sound effects during the interaction.

When five groups of lamp groups are collected and high voltage is input into five I/O input ports, the overall interaction effect of lamp groups is triggered.

```c
void loop(){
    digitalWrite(natureSound,HIGH);
    humandetect();
    if (cm < 20){
        digitalWrite(ring,HIGH);}
    else if (cm >= 20){
        digitalWrite(ring,LOW);} 
    z = analogRead(0);
    delay(3000);
    int zz = analogRead(0) - z;
    if (zz > 0){
        digitalWrite(animalSound,HIGH);}
    int button1 = digitalRead(button);
    if (button1 == HIGH){
        digitalWrite(ledbar,HIGH);
        digitalWrite(zongOUT,HIGH);
        analogWrite(redPin,255);
        analogWrite(greenPin,255);
        analogWrite(bluePin,255);}
    int zongIN1 = digitalRead(zongIN);
    if (zongIN1 == LOW){
        ledbreath();}
    else if (zongIN1 == HIGH){
        for(int b = 255;b>=0;b--){
            analogWrite(redPin,b);
            analogWrite(greenPin,255);
            analogWrite(bluePin,b);}}}
void ledbreath(){
    for (int a=0; a<=255;a++) {
        analogWrite(redPin,a);
        analogWrite(greenPin,a); analogWrite(bluePin,a);
        delay(10); }
    for (int a=255; a>=0;a--) {
        analogWrite(redPin,a);
        analogWrite(greenPin,a);
        analogWrite(bluePin,a);
        delay(10); }
void humandetect(){
    digitalWrite(trigPin,LOW);
    delayMicroseconds(2);
    digitalWrite(trigPin,HIGH);
    delayMicroseconds(10);
    digitalWrite(trigPin,LOW);
    cm = pulseIn(echoPin,HIGH)/58.0;
    cm = (int(cm*100.0))/100.0; }
```
void loop() {
    int zongIN11 = digitalRead(zongIN1);
    int zongIN22 = digitalRead(zongIN2);
    int zongIN33 = digitalRead(zongIN3);
    int zongIN44 = digitalRead(zongIN4);
    int zongIN55 = digitalRead(zongIN5);
    if( (zongIN1==HIGH)&&(zongIN2==HIGH)&&(zongIN3==HIGH)&&(zongIN4==HIGH)&&(zongIN5==HIGH) ){
        digitalWrite(zongOUT1,HIGH);
        digitalWrite(zongOUT2,HIGH);
        digitalWrite(zongOUT3,HIGH);
        digitalWrite(zongOUT4,HIGH);
        digitalWrite(zongOUT5,HIGH);}}

3.4. Final Assembly And Presentation
The installation will be set up in a public community park, where it has many school students passing as well as some office workers who just get off the bus and are ready to walk home. The layout and decoration on the entity tree will begin as soon as the light group, telephone, sensor and main control board are assembled.

3.5. The Connotation
There are five installations with earphones which correspond to five continents in the world playing sounds from the environment of endangered animals unique to different continents, such as sea breeze,
tree swing and bird song, telling the story that their better life in the past has been destroyed by the human’s behavior with declining ethnic groups and unguaranteed life. People will think about the ruined life of endangered animals which are rarely concerned by the public through the earphone, listening to the voice of nature and enjoying a moment of silence in the noisy city life. After someone finishes the programming process, he or she will be guided by the voice to choose to join to protect the ecology and wildlife, avoiding environmental pollution, treating nature well and respecting the life of sharing nature in his or her future life, which is a direct call to human beings to protect nature. It is an urgent condition which needs emotional resonance of people. When someone chooses the “Join in” button, the light band from the phone connection will emit light to the tree crown, and then the light group corresponding to this part of the tree crown will change from flash to constant brightness, which will be an incentive mechanism to push people who have not experienced interactive installation to join in our team of nature protection. Finished the five parts and lightened them all, it means that people from the five continents will join hands to protect nature, meanwhile, the whole installation will activate sound and light effects, becoming a green symbol of natural life.

4. Conclusion
The interactive installation integrated with the technology and art will have much more potentials because of the programming as the days of developing new media and interactive sensing technology. The intelligent hardware design and development platform like Arduino will obtain more attention of designers from the art field and invite them to join in the digital era. Such innovation can bring the deeper emotional communication between the art installation and the audience. Besides, it can connect the art with technology to drive the digital replacement of multi-industry in the future of artificial intelligence. It is a pioneering behavior historically.

References
[1] McLuhan, M. (2000) Understanding Media: The Extensions of Man. The Commercial Press, Beijing.
[2] Shen Jiajun. (2020) The space display of the sound interactive media installation——Taking an exhibition of Xiangshan Art Commune as an example. Art and Design, 7: 63-55.
[3] G. Jacucci et al., (2010) ParticipArt: Exploring participation in interactive art installations. In: 2010 IEEE International Symposium on Mixed and Augmented Reality - Arts, Media, and Humanities. Seoul. pp. 3-10.
[4] Gu Yaqi, Liu Sheng. (2020) Form, Dimension and Context: On the "Space" Reconstruction of Immersive New Media Installation Art. Art & Design, 7: 72-74.