A Study of Intergenerational Parent-Child Relationships Based on an Interactive Installation

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Abstract. Today, parents' time spent in families is constantly compressed and parent-child communication time is decreasing. Besides, inappropriate communication patterns commonly exist in intergenerational relationships. Consequently, parent-child relationship problems occur frequently. The creation "Hear Your Voice" uses interactive installation as a medium, combined with sensing technology and programming language, to explore the patterns of intergenerational parent-child relationships in social relations. It aims to achieve consistency, harmony, and communicability in intergenerational parent-child relationships, which can better adjust parent-child conflicts and minimize the differences brought by intergeneration.

Keywords: interactive installation · sensing programming · parent-child relationship · communication

1 Overview of Interactive Installation

The interactive installation is a vital pattern of new media art, which changes people's behaviour by reconstructing spatial elements and senses. This type of interactive experience refers to the human-computer relationship established within a particular environment, which allows the mutual transmission between users and the interactive installation [1].

Compared to traditional ones, interactive installations emphasize interdisciplinarity by integrating computer language, psychology, art design, sociology, and other disciplines. It explores the connection between structure and light-shadow, reality and image in the exchange of time and space, indicating the artistry of multimedia integration.

2 Concepts of Sensing Technology and Programming Language

Digitalization, intelligence, and networking have become the trend of scientific and technological development. The implementation of interactive installations is based on the combination of sensing technology and programming language [2].

X. Yuan et al. (Eds.): ICEKIM 2023, AHCS 13, pp. 2026–2033, 2023.
https://doi.org/10.2991/978-94-6463-172-2_226

Sensor technology, together with communication technology and computer technology, constitutes the three pillars of the information industry and is a significant symbol of today's scientific development [3]. It can sense surroundings and convert analog signals into digital signals through certain media. As a programming language, Arduino is a convenient and flexible open-source electronic prototyping platform that can sense the environment through various sensors. In addition, it is possible to design more forms of interactive installations based on Arduino in combination with other devices, such as processing and sensors.

3 Applications of Sensing Technology and Programming Language to Interactive Installations

Installation characteristics feature interactive installations. An interactive installation collects information mainly through the user's non-direct contact with the installation. It is usually achieved through infrared sensors to enable the computer to analyse human behaviours in a minimum amount of time. Consequently, it implements the information exchange of human-object, object-human, object-object, and virtuality-reality.

The programming language is the focus of the whole interactive installation and is fundamental to the human-installation interaction [4]. It primarily includes the establishment of a database, the processing and calculation of received information, the generation of graphic images, etc. Under the control of various codes and programs, an interactive installation can produce multiple expressions according to diverse information variations.

4 Theoretical Framework

4.1 The Satir Family Therapy Model

The Satir Family Therapy Model is a treatment model created by Virginia Satir, the first American family therapy expert [5]. Family therapy is a new psychotherapy approach that addresses problems from three aspects: personal system, interpersonal relationship, and family of origin. The ultimate goal of family therapy is to boost a person's self-esteem and improve the way family members communicate with each other.

As shown in Fig. 1, Virginia Satir uses five communication categories to identify behaviours, i.e., Placating, Blaming, Super-reasonable, Irrelevant, and Leveler [6]. While the first four categories are responsible for most family conflicts, the Leveler represents the best communication category. Three survival models are concerned to distinguish these communication categories, namely, Self, Other, and Context.

Virginia Satir believes that families using Leveler communication can prepare children to discover their values, accept other values, make changes in response to changing circumstances, and master good communication skills. This communication category helps parents and children express their thoughts and feelings, further understanding each other's needs and weakening intergenerational differences.

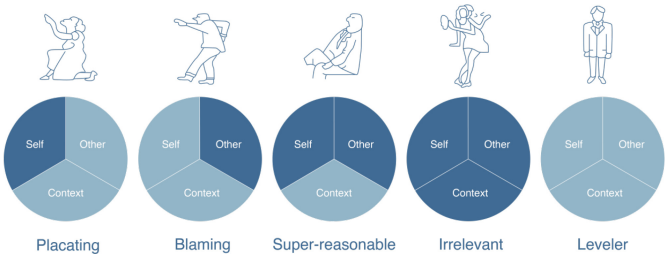

Fig. 1. Five Communication Categories by Virginia Satir (http://dremblog.blogspot.com/2020/10/working-for-four-seasons-leadership.html)

4.2 Nel Nodding's Care Theory

Care theory begins with the family. An Individual should primarily learn to understand the meaning of care before learning to care for people he cares for and eventually learn to care for strangers [7]. The care theory will help create a loving and caring atmosphere in public and private spheres.

The basic idea of Nel Nodding's care theory is to respond appropriately to the needs of each individual, establishing and maintaining caring relationships [8]. This process facilitates intergenerational continuity and stability. Given its interactivity and dynamic nature, a caring parent-child relationship will be disrupted if either party neglects it. Consequently, the intergenerational parent-child relationship may not be reconciled.

5 "Hear Your Voice": Design Practice of Interactive Installation

5.1 Context

The frequent occurrence of parent-child relationship problems is mainly caused by parents' inappropriate communication methods [9, 10]. The mutual incomprehension between parents and children increases parents' pressure. Meanwhile, the majority of parents avoid communication responsibilities and attribute their irresponsibility to intergenerational issues and busy work schedules. Intergenerational relationships refer to the dynamic relations between aging parents, adult children, and grandchildren. With increasing independence between parents and children, the parent-child intergeneration relationship will be relatively simplified. As a result, the parent-child relationship tends to be more independent, equal, and respectful. Besides, the frequency of parent-child interactions will be somewhat increased, and the status of children in the family will be strengthened.

"Hear Your Voice" is an interactive installation with the principle of improving intergenerational parent-child relationships and promoting the learning of mutual communication. This product uses programming technology to connect sound interaction and parent-child interaction. The target population of this installation is children aged 4–12 and their parents. The interactive installation is placed at the entrance of an elementary school or a kindergarten.

5.2 Voice and Drawing Collection

Children's voices and drawings were collected through offline field research and online questionnaires. The offline field research was conducted in Xuejun Primary School and Hangzhou Gongda Kindergarten, Hangzhou. Firstly, we established initial trust with the children by talking about their favourite topics. Secondly, we distributed drawing tools to them through a game and let them draw their inner thoughts freely. Thirdly, they were asked to vocally explain the meanings of their drawings, which were recorded.

Online questionnaires were used to collect children's drawings and the ideas they wanted to convey in each drawing. The sounds and drawings were input into the corresponding installations via processing and Arduino technology.

5.3 Creativity of "Hear Your Voice"

The interactive installation "Hear Your Voice" takes advantage of parent-child interactivity and hides the essence of communication in the installation. Specifically, children's thoughts can be further explored in the process of collecting their voices and drawings online and offline. When parents answer the telephone, a communication link is formed between them. This installation addresses issues that children may be embarrassed to express themselves face to face, and parents cannot simply understand children's needs by asking. In practice, answering the telephone indirectly can break the communication barrier between parents and children. Additionally, parents may cherish the opportunity of listening and communicating more via telephone messages.

5.4 Preliminary Preparation

The whole installation is divided into hardware devices and appearance devices. The hardware devices include a printer, breadboard, DuPont cable, Arduino UNO development board, and HC-SR501 human infrared sensing module. The appearance devices contain a telephone booth, mailbox, telephone, postcard, and pen. It is worth noting that the infrared sensing, physical sensing, and other technologies are utilized to stimulate the operating procedures of the device by recognizing signals.

5.5 Implementation Process of Interactive Installation

As shown in Fig. 2, eight different sounds and the corresponding drawings were collected and programmed into related devices. When a parent enters the installation, he/she will be randomly connected to a voice from a distant child. Then, the printer will print a voice-related postcard, i.e., the corresponding drawing. After answering the telephone, the parent can write their feeling on the postcard and put it into the mailbox.

5.6 Programming Implementation

The telephone booth door is equipped with an HC-SR501 infrared sensor module, which can monitor people's approach in its 20 cm sensing range. When a parent enters the sensing range, the infrared sensor pin outputs a high level. After a conditional judgment

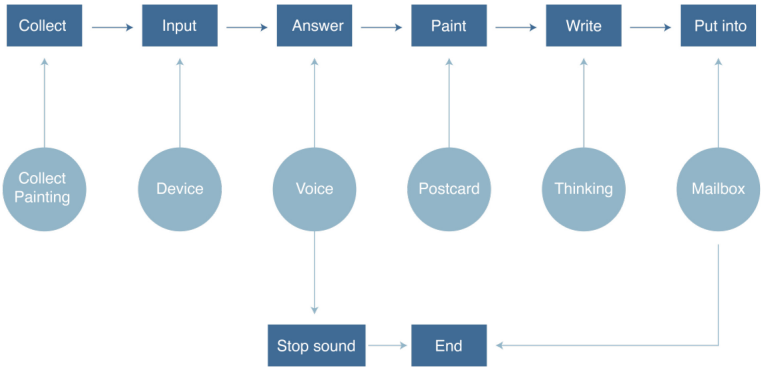

Fig. 2. Procedure of using the Interactive Installation (Drawn by the author)

```
#include <PCM.h>                //This program requires the PCM librarynt
 irSensorPin1 = 7 ;             // Connect the infrared sensor pin at the door
int irSensorPin2 = 8 ;            // Telephone receiver connected to infrared sensor pin
bool irSensorOutput1;              // Door infrared sensor output signal
bool irSensorOutput2;              // Telephone receiver infrared sensor output signal
int SW = 2;       //Print pin
int led = 13;
//Configure variables for dithering delay and press switch:
int is_switch_press = 0;
int debounce_delay = 300;

int i = 0;
const unsigned char sample[] PROGMEM = {
125, 128, 130, 126, 127, 128, 127.....
  };          //Ringtone transcoding
```

```
void setup() {
  pinMode(irSensorPin1, INPUT);
  pinMode(irSensorPin2, INPUT);
  pinMode(SW, INPUT);
  Serial.begin(9600);
}
void loop(){
  irSensorOutput1 = digitalRead(irSensorPin1);   // Read infrared sensor output
  irSensorOutput2 = digitalRead(irSensorPin2);   // Read infrared sensor output
  is_switch_press = digitalRead(SW);
  if (irSensorOutput1 == HIGH) {    //If someone is detected at the door, the infrared
sensor outputs a high level and starts to play the phone ring
 Serial.println("A");
       for(i = 0 ; i < 3700 ; i++){
       sample[i];
       }
       delay(10);
 }
```

Fig. 3. Application Program of Infrared Sensor Module (Drawn by the author)

statement, the corresponding code playing the telephone ring will be executed. The telephone ring is played through a connected speaker to attract the parent to answer. As shown in Fig. 3

After the audio is finished, processing will select the related drawing and start to execute the printing operation. Arduino will receive the instruction and execute the printing program. Finally, the printer will print the corresponding postcard for the parent to write. As shown in Fig. 4

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5.7 Final Assembly and Presentation

As shown in Fig. 6, all components were ready for feedback after assembling the phone booth, mailbox, telephone, printer, sensors, and main control board. The installation was placed at a school gate, where parents frequently pass by. The telephone booth device is expected to attract parents to hear children's voices.

```
import ddf.minim.*;
Minim minim;
AudioPlayer d;
AudioPlayer r;
AudioPlayer m;
AudioPlayer f;
AudioPlayer s;
AudioPlayer l;
AudioPlayer c;
AudioPlayer d1;
import processing.serial.*;
Serial myPort;
char input;
void setup()
{
  size(1150, 500);

 minim = new Minim( this);
 d = minim.loadFile("d.mp3");
  r= minim.loadFile("r.mp3");
   m= minim.loadFile("m.mp3");
    f= minim.loadFile("f.mp3");
     s= minim.loadFile("s.mp3");
      l= minim.loadFile("l.mp3");
       c= minim.loadFile("c.mp3");
        d1= minim.loadFile("d1.mp3");
        myPort = new Serial(this, "com4", 9600);

}
```

```
void draw()
{ background(0, 0, 0);while (myPort.available() > 0) {
    input =myPort.readChar();
    println(input);
    if(input == 'a')
  { d.play();
    d.rewind();   }

  if(input == 's')
  {   r.play();
    r.rewind(); }

if(input == 'd')
  { m.play();
    m.rewind(); }

  if(input == 'f')
  {   f.play();
    f.rewind();    }

  if(input == 'g')
  { s.play();
    s.rewind(); }

  if(input == 'h')
  { l.play();
    l.rewind(); }

  if(input == 'j')
  {   c.play();
    c.rewind(); }

  if(input == 'k')
  {d1.play();
    d1.rewind(); }  //eceive data from arduino
  }
}
```

Fig. 4. Audio Input of Processing (Drawn by the author)

```
if (irSensorOutput2 == HIGH) {
  // If someone is detected at the door, the infrared sensor outputs a high level,
Transmit the signal to processing and execute the print program
        Serial.println("B");
        digitalWrite(led, HIGH);
        Serial.println("Hello");
        delay(100);
        Serial.println("This is a Thermal printer interface");
        Serial.println("with Arduino UNO.");
        delay(100);
        Serial.println("Circuitdigest.com");
        Serial.println ("\n\r"); .....
        Serial.println ("---------------------------- \n \r");
        Serial.println ("Thank You.");
        Serial.println ("\n\r"); .....
        digitalWrite(led, LOW);
    }
   delay(100);
}
```

Fig. 5. Print Implementation of Arduino (Drawn by the author)

Fig. 6. Material Preparation, Debugging Device, Model Building (Drawn by the author)

6 Discussion and Conclusion

The parent-child relationship is the most basic family relationship and the core of intergenerational relationships. However, the decreasing family stability leads to growing problems of intergenerational balance. Thus, optimizing communication patterns between family members becomes particularly important to sustain intergenerational relationships better. This paper reflects on Satir's Family Therapy Model and Nel Nodding's Care Theory to explore intergenerational parent-child relationships. Beyond theories, the applications of interactive sensing and programming language to the interactive installation achieve richer interactive forms with more optimal outcomes. With the interactive installation, feelings and connections between parents and children will be further consolidated and more interactive. Therefore, parents and children can better learn to understand each other and achieve consistency in communication.

Today, the combination of interactive installation and new media technology is a booming new trend, promoting the development of interdisciplinarity and the digital creative industry to a large extent. As an effective narrative form of contemporary media art, the interactive installation facilitates resonance between users and creators regarding experiences, thoughts, and emotions. It also provokes people's reflections on social issues.

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