

# Intelligent Sculpture Design for Children in Public Space

Bei Liu<sup>1, \*a</sup> [0000-0002-7908-9751], Jirawat Vongphantuset<sup>2, b</sup> [0000-0000-0000-0000]

<sup>a</sup>liubei0019@gmail.com, <sup>b</sup>jirawatv@yahoo.com

\*Corresponding author: liubei0019@gmail.com

<sup>1</sup>Faculty of Decorative Arts, Silpakorn University, Bangkok 10200, Thailand

<sup>2</sup>Faculty of Decorative Arts, Silpakorn University, Bangkok 10200, Thailand

**Abstract.** The interactive design of sculpture will become a future trend. Sculpture uses intelligent sensing technology to detect the surrounding environment as well as the body language of the audience, forming autonomous feedback and dynamic intelligent recognition, transforming sculpture from a static visual language to a dynamic graphic language. This study takes sculptures in children's public activity spaces as the experimental object, investigates the feasibility and application of sculpture design based on intelligent sensing systems, and uses surveys and data analysis to conduct experiments on the design of interactive sculpture.

**Keywords:** Sculpture design, intelligent recognition, behavioral interaction, children's public space.

## 1 Introduction

The fusion of art and technology is getting closer and closer at a time when network big data and artificial intelligence are constantly evolving. Nowadays, public sculptures, in addition to combining technology to play technical beauty, are giving the works themselves more intelligent possibilities.

In the context of increasingly diverse ways of displaying artworks, combining sculpture art creation with new media has become a new trend, and using computer systems to control the intelligent interaction between sculpture and people, making it interactive, technological, and artistic has become the collision and integration of art and technology. The growth of a sensuous culture necessitates the evolution of public sculptural design toward experience and participation. The public's demand for sculpture art has not only stayed at an aesthetic level, but has evolved to include sculpture works that provide emotional support and behavioral experience.

In China's urban public spaces, there is a dearth of interactive public sculptures designed specifically for children, despite the large number of children. This has prompted researchers to develop intelligent sculptures for children.

## **2 Intelligent interactive sculpture**

### **2.1 The concept of intelligent interactive sculpture**

The Internet of Things + artificial intelligence + adaptive services are the major components of the intelligent economy's present development phase. The development method of intelligent sculpture, as a branch of intelligent economy, must adapt to the development mode of intelligent economy. "In the future, based on technology, more sculptures will be embedded in technological systems that will make them dynamic, intelligent and modular."<sup>[1]</sup>As a result, intelligent sensing systems can support the sculpture's full interaction with the environment and the audience.

Due to the interdisciplinary crossover mode, sculpture is becoming more and more diverse in today's development, and sculpture art is detached from the traditional shelf art and appears in various forms of expression. Based on the original sculpture modeling, intelligent interactive sculpture adds sound and light elements, as well as color recognition, sound recognition, photoelectric recognition, temperature recognition and other intelligent factors, allowing the sculpture to make "predetermined feedback" under the control of the computer induction system, according to human body language, sound, environmental temperature and other factors. Intelligent interactive sculpture is a comprehensive art integrating science and technology, art and culture, which enters the public space as a special medium due to its unique interactivity, participation and playfulness.

### **2.2 The feasibility of intelligent interactive sculpture**

The built-in computer system in intelligent interactive sculptures is used to control the intelligent interaction between the sculpture and the people participating in the activity. Combining art and technology has resulted in the interactive sculpture. Through computer cloud data acquisition and sensing devices, the computer control system receives human movements, operations, messages, or environmental changes from the outside world, converts them into digital signals, and sends them to the controller. The controller interprets the signals received and then sends them to the output device, which displays the appropriate interactive sensory recognition, completing an interactive cycle and achieving the communication effect between sculpture and human.

### **2.3 Intelligent interactive : "Movement"**

The sculpture's "movement" is controlled by a motor inside the sculpture. When the sensing device is influenced by external factors such as ambient temperature, air humidity, human body language, and so on, the information is transferred to the computer system, which then issues instructions to the mechanical device to drive the sculpture to interact with people.

### **2.4 Intelligent interactive: "Light"**

"Using modern science and technology supported by optics, fiber optics can be used to create an artistic atmosphere with spatial depth and layers in any space. "<sup>[2]</sup>Light has a powerful ability to sculpt space, which makes it a new option for many architectural approaches. By constructing mathematical models, light can be transformed into "architecture" and computer-controlled changes in light can make the sculpture more flexible in the way it interacts.

### 3 Research Purpose

There are two primary aims of this study:

1. to use computer system technology to guide the feasibility of sculpture and audience interaction
2. To analyze the application of intelligent sensing systems in the design of children's public space sculptures

### 4 Case study: interaction between photoelectricity and audience in sculpture

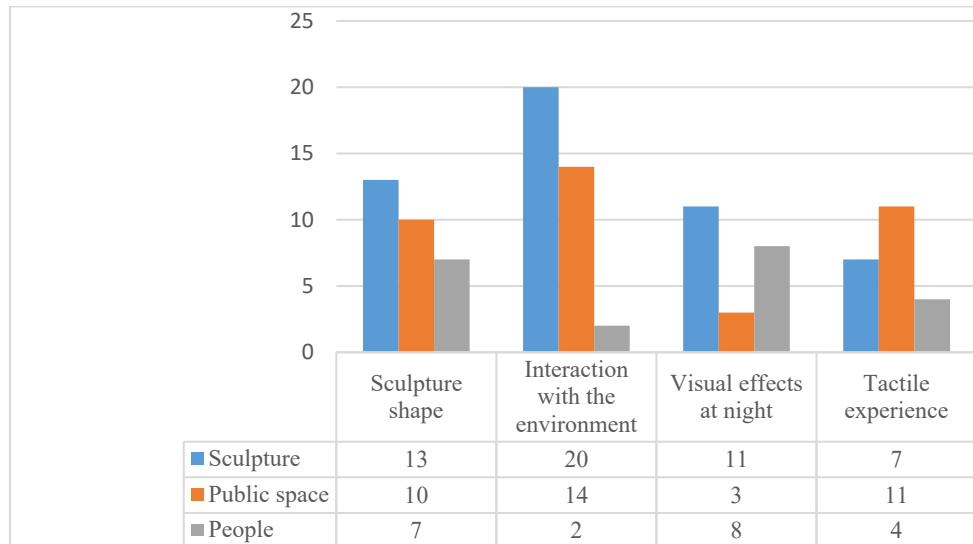


**Fig. 1.** Interactive installations“Bulb Cloud”, making by Caitlind r.c. Brown, Image from <https://incandescentcloud.com/2014/09/20/two-years-of-cloud/>

As shown in Figure 1, in "Bulb Cloud" by artist Caitlind r.c. Brown, the viewer can turn on 1,000 functional light bulbs by pulling the metal chains attached to them, resulting in a huge sparking and flickering effect. The uncertainty and unpredictability of the sculpture's photo-voltaic interaction with the viewer give the viewer a different sense of experience. “Smart Internet sculpture is constantly changing the interaction between sculpture and people and space.”<sup>[3]</sup>As a result, intelligent sculpture must consider the placement of technical information on the intelligent sculpture system so that the intelligent sculpture system can engage with people and trigger the audience's thinking.

Through fieldwork and case studies, the researcher effectively evaluated and tested the application of computer systems, induction programs, and vibration devices in the sculpture, and the collected design elements were subjected to 400 public questionnaires and 15 expert questionnaires for statistical and data analysis. The survey data were utilized to determine the main elements, which were then investigated using rough set theory (RST), choice experiments, and assessment laboratories, as shown in Table1.

**Table 1.** Feedback data, Author drawing



## 5 The relationship between intelligent sculpture and people and environment

### 5.1 The impact of intelligent technology on the way sculpture interacts with the audience

The relationship between the artwork and the observer in classical sculpture is one-sided and one-way, referred to as a "passive interaction." In contrast, intelligent interactive sculpture's "interaction" is first sensed, then calculated, and then outputted, and its interaction is initiated by people's behavior toward the sculpture. As a result, intelligent sculpture affords the spectator more control in terms of interaction. Intelligent sculpture draws the aesthetic object's participation, and the transformation of the work's form and color is decided by the participant, making contact with the piece a highly gratifying experience.

### 5.2 The relationship between intelligent interactive sculpture and public space

In the book *Aesthetics*, Hegel refers to the relationship between sculpture and public space. "When creating a work, the artist needs to prioritize the external space in which the sculpture is situated, rather than thinking first about his or her own creative vision."<sup>[4]</sup> A successful public sculpture must be constructed for a specific location in a given context, while remaining in harmony with its surroundings. "The judicious use of the characteristics of public space can be the finishing touch to the creation of an interactive public sculpture, but it can also serve to accentuate the theme of the sculpture."<sup>[5]</sup> The public area in which the artwork is located not only provides habitat for it, but also a psychological and physical haven for the public. Intelligent interactive public sculpture can also make public space more lyrical and humanistic.

## 6 Research on the application of intelligent interactive technology in sculpture design experiments

The researchers put the intelligent sculptures to the test in public settings for kids, then assess the knowledge and data gathered as fundamental knowledge, as shown in Table 2. By developing an intelligent data analysis model of the intelligent sculpture, it is integrated with text semantic analysis and experimentation on the natural environment around urban children's public space, children's behavior, and computer-aided systems to provide dynamic intelligent recognition and feedback. Data analysis also comprises providing data support for the sculpture's installation in the surroundings. This research is built on an intelligent system that uses data to deliver feedback.

**Table 2.** Intelligent sculpture data model feedback, Author drawing

Intelligent sculpture interactivity	Environment	Proportion (%)	Intelligent sculpture feedback ratio
	Material	45	
	Shape	36	
	Light	40	
	Computer control system sensory	43	
	Color	55	
	Sensory device acuity	45	
	Motor rotation speed	30	
	Sound and voice control system	35	
	Interactivity	50	

In the design of the smart sculpture, the researcher uses the colorful bouncing ball hanging on the tree as a design element. The mechanics and computers of the smart interactive sculpture are hidden inside the stainless steel tree, and the surface of the stainless steel tree shape will have a distorted mirror effect, which has a strong appeal and playful effect on children. The reflection of the stainless steel surface to the surrounding environment also makes the sculpture better integrated into the public environment.

The major interactive component of this study's intelligent interactive sculpture is a sagging rubber ball. The rubber ball can bounce and wobble lightly under the action of human external force due to the material's properties. The inside intelligent interactive device can cause it to move up and down or vibrate lightly. Rubber's toughness and elasticity open even more possibilities for the sculpture's interactivity. The rubber's softness assures the safety of children while still maintaining the sculpture's shape. As demonstrated in Figure 2, the sculpture employs powerful sensors to provide movement and photoelectricity by sensing and recording the various movement states of children as well as environmental sounds, allowing audience children to engage in a variety of sensory experiences.



**Fig. 2.** Intelligent interactive sculpture for children, Author drawing

As A sensing device within the rubber ball will detect the child's touching behavior and transmit it to the computer system, which will process the signal and send it to the motion device inside the stainless steel branch, which will generate vibrations in the sculpted ball component. The extent to which the rubber ball is covered by the child's body impacts the outcome of the output device. The sounds of the children are encoded in the computer system, read by the sound receiver, transformed to digital codes, and then shown in a variety of lighting changes via a built-in application.

It has been demonstrated through practice that intelligent sculpture models can be generated reasonably in the interactive experience of intelligent sculpture and the same environmental space using appropriate data analysis techniques and tools while ensuring the credibility of certain source data.

## **7 Conclusion**

While considering technical aspects, intelligent interactive sculptures for children's public spaces should consider psychological characteristics and behavioral habits of children's groups. Intelligent technology should reflect the emotional effect of interaction while increasing participation and creativity in the sculpture itself. The advancement of intelligent technology and the rise of experience allow for the development of public sculpture in the direction of diversity.

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