

# Design and Research of Intelligent Art Products for Children

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**Abstract.** Artificial intelligence and interactive technology have benefited all aspects of life. Science technology has rapidly entered the field of children's education. Transformation of children art education industry is closely linked with modern science technology. According with the law of children's growth and combined with science technology, it is more urgent to innovate intelligent children art products and education modes. This paper explores the relationship between children intelligent art products and children art education, learning and personality cultivation from the perspective of children's color cognitive psychology. Taking preschool children aged from 3 to 7 as the user group, through theoretical research, user research, interactive experience design and other methods to discuss the necessity of preschool children's intelligent art product design and more possibilities in the future. We can find problems of traditional children art education through the research so that we can deeply explored the opportunities. The opportunities can be expanded and combined with the modern science technology which will help the art education industry developing the quality of children better.

**Keywords:** color recognition, children art, intelligent products, interaction design.

## 1. Introduction

Lowenfeld puts forward that creativity is the potential of each child. In the setting of educational curriculums, children need to match different courses according to the stages of creation, physiology, wisdom, perception, society, beauty and so on. [1] The need for children to adapt to the Internet age environment is becoming more and more urgent. Children and their parents in the experience economy are more inclined to have intelligent products with interactive experience.

### 1.1 Status of Smart Product Development.

With the emergence and flourishing of science and technology, intelligence as a new development trend has become a key factor in changing the future of manufacturing and lifestyle, and is now widely used in various fields of social life. The product innovation proposed in German Industry 4.0 mainly refers to intelligent products defined by intelligent characteristics. [2] At present, smart products are mostly used in military technology, industrial manufacturing, health care, home and education. These products are well known such as cars, smart robots, smart home systems, smart security systems and smart wearable systems product.

### 1.2 Development Status of Intelligent Art Products for Children.

The development of children art products has changed with the changes in children art education concepts and methods, and the integration of science and technology. The forms of education and tools are also becoming much more abundant. Virtualized and intelligent products are more effective in cultivating children art and achieving teaching goals. According to the data of China Industrial Information Research Network, children consumer market is 'a huge cake', and the website Yangguang has issued 'a new growth point for children consumption in cultural consumption market'. In children consumer market, smart products have become a new hot issues. Enthusiasm of brand enterprises and creators for children smart products makes children smart products more influential and competitive. There are countless children smart products in the market, such as children intelligent early education products, children smart watches, children smart toys, children smart school supplies, smart medical equipment. However, the interactive experience with children art-related smart products is now aimed at the design and development of older children, such as art APP interactive service platform, smart hand-painted board, compared with smart interactive art products

for preschool children. It is relatively simple. Taking children picture books as an example, although it can basically achieve the purpose of children independent learning, the interactive experience of children and products still have the drawback of fixed thinking.

## **2. Color Cognitive System Theory**

### **2.1 Overview of Color Cognitive System Theory.**

The Swiss psychologist Piaget divided the development of children psychological cognition into four stages: perceptual movement stage, pre-operational stage, specific operation stage and formal operation stage. He believes that the cognitive process of preschool children is the process of individuals grasping external objects through assimilation or adaptation in a certain cognitive structure. They acquire knowledge through the world of perception. This stage is usually called the sensory layer. This feeling can affect its behavioral activities, and children have a strong initiative to imitate. This stage is called the behavioral layer. In the process of imitating learning, children will also reflect on their previous behaviors through new knowledge. To make yourself progress, this stage is called the reflection layer. [3]

Through the first and most direct perception of the world, research have found that preschool children have a strong curiosity, a great jump in thinking. Children performance of emotions and feelings is also simple and direct. Color has a non-negligible effect at this stage. It can stimulate children imagination, regulate children emotions, strengthen temperature perception of color psychology and cultivate children ability to understand color.

Color education is an important part of visual education in art education. It is an effective way to cultivate children figurative thinking and divergent thinking. It has the functions of emotional expression, cultivation of aesthetic ability, cognitive ability, thinking ability and innovation ability. [4]

In addition, color provides a stronger artistic understanding ability in children artistic creation and art appreciation. Color brings children more direct and specific artistic appeal and explosiveness. Through color education and training, children image thinking can be exercised. Ability to develop their hands-on practical creativity.

An important influence of color on children visual education is to cultivate children communication ability, judgment ability, build self-confidence and enhance the potential role of observation and memory. In the color education, the children ability training is targeted and the training can induce children to discover beauty, appreciate beauty and express passion and interest in beauty

### **2.2 Application of Color Cognition Theory in Children Art Products.**

Color expression is an effective way for children to express their thoughts and emotions. Children's feelings about color should be prior to their logical expression ability. It is very important to use color to actively guide children associative thinking and establish a good psychological orientation. However, the differences in children gender and age are different from the perception and understanding of color. Cold and warm colors usually give children different psychological feelings. Warm color-based products will give children a sense of expansion and advancement. Cool-based products will give children a sense of contraction and retreat. Children aged from 3 to 6 years old have gradually formed their own personality thinking, and began to have a gender distinction in the perception of color.[5] High-definition and high-purity colors are more sensitive to children visual stimulation and color psychology.

## **3. Design of Children Intelligent Art Products based on Color Cognition System**

In order to develop children potential in early stage of art education of children and cultivate their artistic accomplishment, their parents can observe and understand their children more accurately

through products. Based on the research of color cognition theory, children color-development is basically completed after 18 months. Children who are 3-7 years old have little difference in color recognition with adults, and they are in a sensitive period of color cognition, so in this period they have strong sensitivity to color. Therefore, if we target the users of the product at 3-7 years old, we can closer to the design goal.

Preschool children are in a golden age of intellectual development. They are sensitive to outside world excitement. Facial senses develop rapidly, especially in visual and touching. The development of children ‘sensory integration’ focuses on randomness, spontaneity, self-nature and follow-up. [6] Children visual attention, object shape, color preference and other behaviors are mainly observed and recorded in the design process. Children’s thinking is mainly concrete thinking and they intend to imitate others. They also have strong hands-on ability so they have more requirements on the tactility of products. Children’s emotional fluctuates greatly. It is also a way for them to express their feeling of the environment and ideas directly. During this period, children body structure and limb ability are gradually developing and they are able to make accurate actions independently such as grasping and pinching. They prefer activities, such as running, jumping and climbing.

Based on color cognition theory, according to the development characteristics of children ‘sensory integration’ and simulating the application scene of products, product storyboards are drawn to find out the advantages and disadvantages of existing similar products. We analyzed and sort out users' needs and interaction behaviors, and extract the key words of product design to focus on problem points.

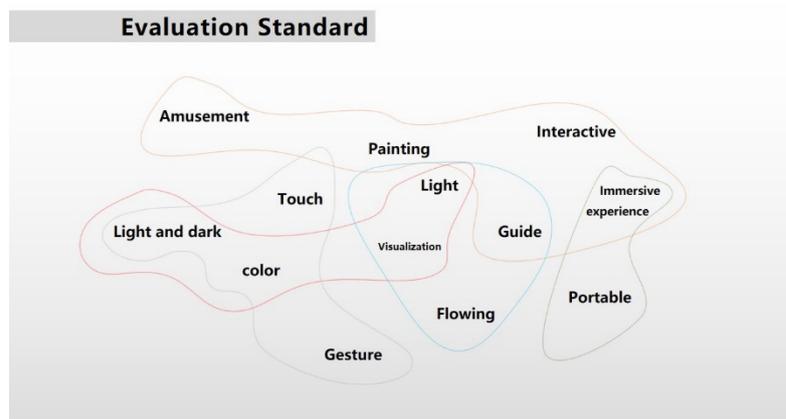


Fig. 1 Evaluation Standard

Therefore, through the non-linear cyclic process of divergence, convergence, re-divergence and re-convergence of design thinking we can determine the usage scene of the products and we can satisfy users with the function and innovative interactive mode. Setting the product as an interactive application scene that conforms to color cognition, daily and family color exercises which can not only integrate the learning and practice of color cognition into life naturally, but also make it more convenient for parents to further understand children and promote family relations.

#### 4. Design of Interactive System for Children

Children art education has experienced a transition from fixed mode teaching to development mode teaching. Interest and games are important factors that affect children interactive behavior. Children curiosity and thirst for knowledge about intelligent products are generally strong. The generated interactive behavior is more inclined to instinctive exploration. Intelligent products with simple functions can satisfy children certain psychological needs. However, simple interactive experience cannot achieve the expected effect of children multiple intelligence development.

Traditional children art products are important to the learning of children art skills, and the applied tools are limited, such as paper, brushes and pigments. Software courses are taught mainly by talking, while children basically practice and perform with plane painting. With the learning of western

teaching ideas, teaching of children fine arts has changed into an ecological and guiding teaching mode. The goal of aesthetic education has changed from hands-on to hand-brain development, which is highlighted by some courses arrangements such as painting creation, hand-making and model building. The content of children aesthetic education has gradually expanded. The methods of expression have become more diversified, and more artistic works with three-dimensional structure have been presented. The teaching mode which is promoted by science and technology soon appeared experiential teaching, which stimulates the consumption of children art education to a greater extent. All kinds of intelligent science and technology products go forward to children education market one after another. In the interactive experience of intelligent products, children enthusiasm for art education is heated up again, and product's expressions became fast and virtualized, adding more pleasure to learning. The development trend of art education industry proves that science, technology and data have changed our way of life once again.

#### 4.1 Application of Sensor Technology Construction and Display of Effect Diagram.

Color recognition sensors are widely used in children intelligent toys. Color recognition sensors are needed to realize the functions of color collection, recognition, transmission and display in the process of interaction with products. The application and effect diagram of sensor construction of this product are shown in Fig.2 to Fig.4.

#### 4.2 Design of Product Appearance and Color Application.

The appearance of the product comes from the folk art of face changing in Sichuan opera. Children are familiar and curious about human facial senses. The color of facial makeup in Sichuan opera is profound and various. The use of color changes to divide the human facial structure can increase children understanding and thinking about the structure. The product refers to the skill of face changing to realize the changing interactive behavior. Children can change the pattern of facial makeup through a twisting device mechanism, and the graphic module of facial makeup interacts with children through a color recognition sensor.

The appearance color of the product is chosen to be high-brightness and low-purity color expression. It is more consistent with the image concept in Sichuan drama. On the other hand, children usually refer this low-brightness and low-purity color as gray, which indicates the lack of children cognitive ability to this kind of color. Taking this as appearance color can compensate children visual and highlight the effect of facial makeup color change.

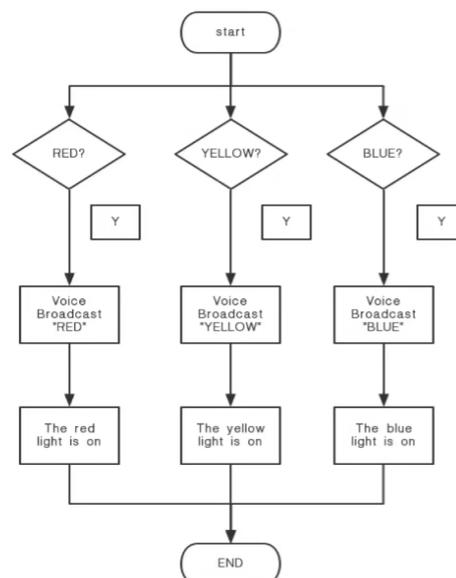


Fig. 2 color sensor work flow diagram and corresponding program

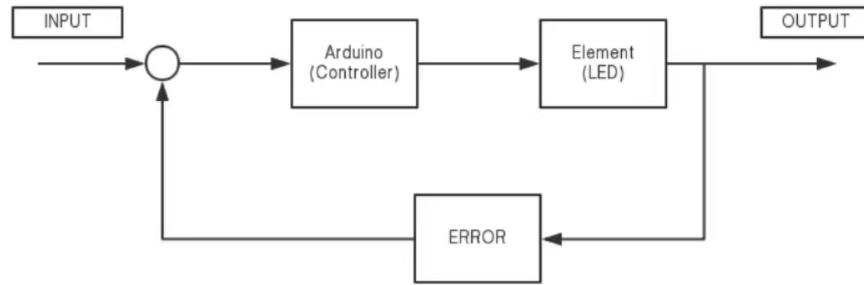


Fig. 3 hardware connection diagram design idea



Fig. 4 product effect diagram

#### 4.3 Design of Product Functional Structure and Material Finish.

Design of structure and function is the key elements of product. The product should meet the design requirements of local color recognition and light emission. Therefore, the components with special requirements are divided into modular structures to ensure the functional requirements and also meet the convenience of product use and maintenance. As the functional components are independent modular components, more consideration should be taken in the overall appearance and internal structure of the product, such as shape, size, material, weight, fixing method and installation method. The rotating mechanism is a traditional physical structure device system, which satisfy its functional requirements through meshing and friction between gears.

The plastic materials of children products are generally nontoxic, tasteless and colorfast. PLA, ABS and PP can be selected as materials. 3D printing technology is applied to print, assemble, bond and polish the parts.

### 5. Summary

In the context of high-tech such as artificial intelligence, Internet of Things, big data, and cloud services, lifestyle changing provides more opportunities. Through the theoretical study based on color cognition psychology, the research and design of intelligent products for children has found that the children growth environment and technology are moving forward in the future, and the potential of technology is used to develop children's potential. The design practice activities carried out the preliminary exploration of children intelligent art products. Through the design process, we discovered the trends and shortcomings in existent children art education products. So we can design the children-oriented experiential intelligent interactive art products. It is dual expression of technology and art. However, there are still some problems in the practice process. For example, we can find the balance between science technology and artistic concept. We can also find the balance between the lack of description of the user and the limitations of the scene deduction. So we can

improve in the future research and design of intelligent products. The arrival of the intelligent era should emphasize the initiative mind of people-oriented.

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