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## Design Of Cultural and Creative Products Based on Multi-Sensory Channel Recognition and Interaction Behavior

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### Abstract

*This study explores and expand the design methods of traditional cultural and creative products by combining people's multi-channel perception and interactive behavior. It focuses on developing products that engage multiple senses, such as sight, sound, touch, and smell, to create immersive experiences. It explores how cultural products—ranging from traditional crafts, wearables, and interactive installations—can evoke emotional and cognitive responses through innovative sensory design. The study emphasizes user interaction, examining both physical engagement and digital interfaces, to enhance the connection between individuals and cultural heritage. To explain the form of human perception, simulate and collect and select reasonable sensing operation mode, and realize innovation in the design of cultural and creative products through human perception and behavior. Through the human sensory recognition mechanism, combining the interaction between people and products in the design of cultural and creative products can bring users a better sense of experience, so as to optimize the design of cultural and creative products. The research of this paper mainly focuses on sensory recognition and interactive behavior, both from the input and output of human, which can expand the method of cultural and creative product design.*

**Keywords:** *multi-sensory channel, interaction, cultural and creative product design*

### 1.Introduction

Natural interaction is a more natural, intuitive, human-computer interaction method that is closer to human behavior, and it enables people to interact with machines in a more natural and diversified way <sup>[1]</sup>. People communicate with products through posture, movement and behavior, and the effective and timely feedback of products can also promote people's good emotions, resulting in a good sense of experience, and achieve harmony between products and people and the use of scenes. Cultural and creative products are items or experiences that combine traditional cultural elements with modern creativity. They draw inspiration from a society's heritage, including art, customs, or symbols, and are transformed into contemporary forms like crafts, fashion, digital content, or multimedia experiences. These products aim to preserve cultural identity while engaging modern audiences through innovation.

Meanwhile, natural interaction refers to user interactions that feel intuitive and seamless, mimicking real-world behaviors. This includes gestures, voice commands, or touch, allowing users to engage with technology in a way that feels instinctive, with minimal effort or learning required. The goal is to create an experience that feels organic and mirrors natural human behaviors. In this process, it is necessary to fully mobilize people's multi-sensory channels and combine people's interaction ways to design applied cultural and creative products to obtain new ways in the design of such products.

Despite the growing interest in cultural and creative products as a means of preserving and promoting cultural heritage, current designs often fail to fully engage users on a multi-sensory level. Existing products tend to focus primarily on visual aesthetics, neglecting the potential of other sensory channels—such as sound, touch, and smell—to create more immersive and meaningful user experiences. Furthermore, interaction behaviors with these products remain limited, lacking the natural, intuitive engagement that can foster deeper emotional and cognitive connections with cultural content. This research seeks to address these gaps by exploring how multi-sensory channel recognition and natural interaction can be integrated into the design of cultural and creative products to enhance user engagement and cultural appreciation.

## **2. Multi-sensory channels and applications**

We are familiar with the five senses, including "sight, hearing, smell, taste and touch", which are interrelated and influence each other<sup>[2]</sup>. In the process of experience, the stimulation of one sense often triggers another or multiple senses, and thus forms a sensory system<sup>[3]</sup>.

### **2.1. Vision and application**

Light acts on the visual organ to excite its receptor cells, and the information is processed by the visual nervous system to produce vision. The basic elements of visual design include form, colour, material, light & shadows, time & space. The design of these elements will have different design requirements for different products, different users and different use situations, but the "goal" is to display information quickly and accurately to product users, that is, to improve the legibility and legibility of the displayed information<sup>[4]</sup>.

At least more than 80% of the external information obtained through vision is the most important sense of human and animal. Therefore, in the design of cultural and creative products, it is very important to pay attention to the design of visual images. In general, color, form, and material in visual design are the most easily concerned, so pay special attention to the use of these elements.

## **2.2. Hearing and application**

Through the transmission of sound waves, the ear can pick up sound. Human hearing not only has the characteristics of fast response, can perceive the direction, the pattern of the perception of information is wide, not limited by lighting and object obstacles, but also has the characteristics of forcing people to pay attention. Due to the existence of audio, intensity, tone, timbre and other characteristics of sound, people have auditory adaptation to sound and use sound to communicate information between products and people.

The auditory display design of cultural and creative products can be carried out from the perspective of display nature and sound category <sup>[5]</sup>. In the design, from the perspective of display nature, the suggestive display and feedback display can be set up in the product; From the perspective of the sound category, you can choose audio display or voice display at the time of design.

## **2.3. Smell and taste and application**

The sense of smell can trigger all the complete memories of people, it is by the olfactory nervous system and the nasal trigeminal nervous system, two sensory systems are involved. Taste is a sensation produced by stimulation of the chemical sensing system of the taste organs. All the tastes we normally taste is the result of a mixture of four tastes: sweet, sour, bitter and salty. Smell and taste integrate and interact. The sense of smell is a prerequisite for the realization of pheromone communication. Smell is a remote sense, meaning that it is the sense of feeling a chemical stimulus over a long distance; Taste, by contrast, is a sense of proximity that requires tasting substances to stimulate taste receptors in the mouth and be produced by the nervous system.

Human's memory of the sense of smell is very deep, but there are many factors affecting the sense of smell, it is difficult to apply many designs. In the design of cultural and creative products, the role of smell and taste can still be used to design, such as implanting taste in the design, so that users can recall a certain scene or item through smell or taste perception in the process of use and enhance the sense of experience.

## **2.4. Touch and application**

The sense of touch is caused by the interaction of weak mechanical stimuli with the touch receptors in the superficial layer of the skin. The pressure sense is a strong mechanical stimulation of the deep tissue of the skin and deformation caused by the feeling, touch and pressure sense is often called touch sense. The tactile sensation can handle the mechanical properties of the size, shape, hardness, smoothness and surface texture of the object.

In cultural and creative design, the sense of interest can be enhanced by increasing the sense of touch in the use of items.

## **2.5. Multi-channel integration and application**

Multi-channel human-computer interaction can break through the limitations of traditional GUI technology and input information by acquiring a variety of senses and body behaviors of users [6-8].

The multi-channel here refers to the comprehensive use of human sensory organs to communicate a variety of information. Sight and hearing constitute the main sources of aesthetic pleasure, while taste and smell cause physical pleasure. Taste and smell are difficult to communicate with sight and language, vision is easier to communicate with shape and color, hearing is conveyed with sound, and touch is limited by distance. In the process of information exchange, it is often necessary to comprehensively apply various sensory channels to form sensory cognition and carry out corresponding display and operation design on this basis.

## **3.The basic way of interaction in the design of cultural and creative products**

Multi-sensory integration in design presents several complexities. Sensory overload occurs when users receive too much input at once, leading to confusion or discomfort, while cognitive load makes it difficult for users to process multiple inputs simultaneously, reducing the design's effectiveness. Subjectivity also plays a role, as individuals perceive sensory experiences differently due to personal or cultural factors. Temporal coordination is critical to ensure sensory inputs are synchronized; mismatched timing can disrupt the experience. Additionally, technological limitations, such as the need for advanced, often costly tools, add further challenges. Despite its potential for creating immersive experiences, balancing these factors is crucial for successful multi-sensory design. The interaction between people and products can be divided into two stages: input and output [9]. People often combine different forms of input and output according to a certain law, resulting in numerous forms of interaction. The following describes several common forms of interaction:

### **3.1. Motion**

People are used to using the action of the hand to control objects, there are many manual manipulators in life, the common action modes include pressing, rotating, flipping, sliding and so on [10]. With the progress of science and technology, the use of tactile operation has become a new way of control.

The action design of cultural and creative products can consider people's familiar finger control forms, such as the product with a hand wheel or buttons and other familiar control devices, it can be faster to narrow the distance between people and products, so that people can quickly understand the use of products and control methods.

### **3.2. Voice**

As we all know, the sound signal is a continuous analog signal, which must be converted into a digital signal through information technology, and then processed by sampling. In fact, the speech recognition process is to find an optimal path through Viterbi algorithm in the state network of the model. Since the 1970s, the emergence of statistical linguistics has made speech interaction based on speech recognition, speech synthesis, natural language understanding and other technologies a relatively new form of interaction<sup>[11]</sup>.

In the design of cultural and creative products, the design of voice interaction can make the product no longer a simple way of use, and the implantation of other ways of use, such as voice, can enhance the intuitiveness and interest in use.

### **3.3. Gesture**

A gesture is a movement of the body, it contains some information, just as a wave goodbye is a gesture, tapping the keyboard is only an expression of the keyboard being pressed rather than a gesture. At the same time, the meaning of the gesture should be understandable to the target user, and this understanding is not based on language culture, but on established technical rules<sup>[12]</sup>. For example, we know how to use the mouse (behavioral learning) not because it's something we've imported from our culture, but because it's a cross-cultural convention based on a particular graphical user interface. Similarly, we know how to click on a tablet to a certain extent because we learned how to click with a mouse before. Technical conventions are transferable to each other because language and gestures can be transferable between different languages and cultures.

In the field of interaction design, there is a big difference between gestures and manipulation in natural touch-based interfaces. Gestures in the design of cultural and creative products refers more to a way of control, to convey simple instructions. Combined with such simple instructions in the design, it forms good interaction with users and enhances the user experience.

### **3.4. Face expression**

Facial expression recognition is a relatively complex process, which can be divided into static image recognition and dynamic image recognition<sup>[13]</sup>. Facial feature extraction is the most important and critical part of facial expression recognition system. Facial expression recognition (FER) is a non-judgment of human emotions the most direct method, through the "face detection, image processing, feature extraction - expression classification - results" this process, to capture people such as happiness, anger, surprise and other expressions<sup>[14-15]</sup>.

In the design of cultural and creative products, if the product has the function of interactive expression, it can make people and products communicate more directly and effectively solve the dialogue between products and people.

### **3.5. Eye movement**

Eye-movement interaction is based on the principle of corneal reflection and takes the high-brightness reflection point formed on the cornea of the user's eye by the light emitted by the near-infrared light source as the reference point. When the eyeball is turned to gaze at different positions of the target, because the eyeball is like the sphere, the light spot does not move, the pupil shifts relative to the light spot, and the position relationship between the pupil center and the light spot can be used to determine the direction of the line of sight.

In the design of cultural and creative products, the use of eye movement interaction technology not only maintains the active input function of the traditional input channel in the client side, but also provides real-time intelligent feedback based on the user's eye movement information to increase the user's sense of immersion and improve the manipulation performance and experience, to achieve multi-channel interaction.

### **4. Design principles for incorporating these interaction modes into cultural products.**

Incorporating multi-sensory interaction modes into cultural products requires a thoughtful approach to ensure a meaningful and immersive user experience. These are some practical design principles to be considered.

Firstly, is to prioritize sensory harmony by ensuring that all sensory elements (sight, sound, etc.) work cohesively to enhance the overall experience rather than compete for attention. For example, match visual aesthetics with subtle tactile and auditory feedback, like pairing intricate designs with soft textures and calming sounds.

Then, designers can start with the core cultural story by identifying the key cultural message or heritage to be conveyed, then choose sensory elements that best align with and reinforce that narrative. For example, if the product is based on a traditional festival, it incorporates sounds, colors, and textures that evoke that specific cultural experience.

To avoid overwhelming users, it is advised to introduce new sensory inputs gradually. Start with the primary sense (usually sight) and layer other senses like touch or sound to build a rich, cohesive experience.

Keep the overall design simple while integrating sensory elements thoughtfully to Balance Simplicity with Richness. For instance, tactile elements like embossed patterns or natural textures can complement a product's visual design without adding cognitive overload.

Aside from that, designers should have user-centered customization which offer adjustable sensory features that allow users to control the intensity of input, such as customizable sound volume or the ability to switch between textures. This allows users to tailor their experience based on personal preferences or sensory sensitivities.

Technology was used thoughtfully by leveraging advanced technologies (e.g., haptic feedback, augmented reality) to add depth to the experience, but ensure they are easily accessible and don't detract from the cultural authenticity of the product.

Finally, to test for accessibility and inclusivity by ensuring the design is inclusive by testing it with individuals who have different sensory abilities (e.g., vision or hearing impairments). This helps in refining the sensory balance and making the cultural product more accessible.

By applying these principles, designers can create culturally rich products that engage multiple senses, enhancing user interaction and emotional connection without overwhelming or alienating users.

## **5. Innovation of cultural and creative products**

The innovative development of product design is connected through the media of regional and local culture, which is closely combined with people's senses, so that ancient traditional culture can be reborn.

Cultural and creative industries originated in the United Kingdom. From the perspective of industry, different countries focus on different aspects. For example, China focuses on "culture", the United States focuses on "copyright", and the United Kingdom focuses on "creativity"<sup>[19]</sup>. In the design of cultural and creative products, it is still possible to start with the combination of human experience, because the experience and feeling of details are the easiest for consumers to feel. This is exactly the Angle that is lacking in the current design, because the users of cultural and creative design are almost human. Since it serves people, it is necessary to be people-oriented, not only from the perspective of aesthetics and cultural implantation, but also need to pay attention to the physiological mechanism and psychological feedback generated in the interaction process of people and products. With the help of people's multi-sensory channels and intelligent sensing methods, people can capture different information, to promote good experience in the process of use, and then increase people's cultural experience and form effective design.

From the physical environment to the situation, and then to the artistic conception, the product develops from the surface to the inside, from the outside to the inside. This process is always combined with human perception, and even plays an important role in solving the problem in the way of cultural and creative product design.

## **5.1. Sensory experience innovation in cultural and creative product design**

This stage is the physical stage. Traditional cultural and creative product design focuses on the intuitive feelings brought by materials, forms and colors, and often ignores the comprehensive feelings brought by auditory, tactile, and taste stimuli. Therefore, in cultural and creative design, it is necessary to pay attention to multi-sensory experience. Cross-sensory cultural and creative design forms sensory systems by mobilizing different users' sensory organs and triggering diversified emotional experiences. Make the design result more popular.

The multi-sensory "situation-evaluation-emotion-emotion" model can stimulate the cerebral cortex to produce evaluation, and then design feedback through evaluation, so it is necessary to pay attention to the user's suitability for the stimulus brought by the physical environment [20]. Appropriate stimuli can bring users a sense of pleasure, on the contrary, it will also make users feel anxious, irritability and other negative emotions.

However, in the process of sensory recognition, vision is still the one that receives the most information. However, in this design carrier is cultural and creative products, if you want to design a cultural and creative product that can meet people's needs and is convenient to operate and use, you should fully consider a variety of perceived realities, as well as issues such as cognition, use, experience and interaction in the use process.

## **5.2. Interactive innovation of cultural and creative product design**

There is a need to establish effective links between people, objects and the environment. This level is related to the physical environment and situation, and users need to have an understanding and judgment of the product, and then know how to operate. If in the process of use, the item can interact with the user on the action and behavior, it will produce the experience of use. By establishing the organic relationship of "designer-product-user", users can be guided to perceive the form of the product and enhance their experience of using the product through interactive ways such as behavior and action. At the same time, cultural characteristics can be enhanced.

According to Fitz's Law, the time for a user to select a target is mainly determined by the size of the target and the distance from the target. The target area will affect the difficulty of the user to select the target. If the target area is large, the user can choose the target more easily; on the contrary, the small and far target area will affect the user's attention span. And requires users to make a series of fine adjustments from a long distance, which will consume user time, distract attention span, and the user experience will be bad. Therefore, the design interaction of cultural and creative products must be strong, to visually enhance users' cognition of product relevance, and reduce users' time and energy in choosing products.

As people are increasingly pursuing their own internal needs, the interaction design of cultural and creative products can be set according to everyone's preferences to form a personalized design pattern. At the same time, developed science and technology give new



vitality to cultural and creative products. In the process of using products, users can immerse their body and mind and be satisfied with the result of the interaction with the connotation provided by cultural and creative products in an interactive way and realize the digital interactive experience of cultural connotation with the help of information technology means and equipment, which will be more conducive to the continuation and inheritance of cultural values.

### **5.3. Cultural innovation of cultural and creative product design**

Chinese aesthetic culture is also a kind of cultural experience. At this stage, a stream of consciousness interaction is established between users and cultural and creative products, and the interaction between users' spiritual thinking and artistic aesthetic and creative thinking. Designers need to familiarize themselves with their audience and find a cultural presentation that fits their cognitive level.

Cultural and creative products urgently need to grasp the pulse of The Times with The Times and introduce "change" elements in a timely manner, to make cultural and creative products inherit and deduct rich traditional cultural elements based on practicality and have a clearer sense of The Times.

The cultural connotation of cultural and creative products is rich, including character symbols, local characteristics of historical buildings (structures), folk articles, stationery, life and production tools, historical allusions, humanistic legends, etc. In terms of innovative methods, cultural elements can be reinterpreted and reconstructed, flexible in forms, methods, materials, etc., and different forms of cultural elements can also be learned from each other.

Here are some real-world examples of cultural and creative products that successfully integrate multi-sensory experiences and innovative interaction design, the Van Gogh Immersive Experiences. It uses projection mapping to create stunning visual displays of Van Gogh's artworks. Accompanied by a carefully curated soundtrack and sometimes even scent elements, these experiences transport visitors into the artist's world, allowing them to feel deeply connected to art.

Another famous one is the Olfactory Art by Scent Bar which offers olfactory art experiences that blend scent with visual art installations. Visitors can explore how different fragrances relate to the artworks, enhancing their understanding and emotional connection through smell, which can evoke memories and feelings tied to the cultural context of the pieces.

## 6. Conclusions

The human body is the basis for understanding the world, and the interaction between direct sensation and movement is helpful for product design. To some extent, the direction of design should be shifted from traditional modeling to human information input and output mode, which is more in line with human cognition and understanding ability and provides a new perspective for the design methods of cultural and creative products.

Future research on multi-sensory cultural product design could explore how emerging technologies like augmented reality (AR) and artificial intelligence (AI) personalize sensory experiences in cultural preservation and education. It could also examine applications in smart environments, such as integrating multi-sensory products into museums or smart homes, and investigating their therapeutic uses in healthcare settings. Additionally, research could focus on cross-cultural comparisons of sensory preferences and the development of sustainable, eco-friendly materials for multi-sensory products, expanding their potential for global audiences and sustainable practices.

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