

# *Research on the Design of Tea Culture Exhibition Stand Based on Multimodal Concept in Interactive Device Art*

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**Abstract:** In recent years, with the increasing emphasis on personal health among young people and China's continuous efforts to enhance its external exchanges, more and more people are beginning to accept and understand Chinese tea culture. According to data provided by the General Administration of Customs of China, in 2021, the tea export volume reached 369,400 tons, with an export value of 2.299 billion US dollars. China has always been a major exporter of tea in the world, but mostly in the form of raw tea materials. This article aims to combine the concept of multimodal theory with emerging interactive technologies to integrate interactive art installations with virtual reality technology for design and practice, allowing people to experience and understand the traditional Chinese tea-making process.

## 1. Introduction

This paper explores the design of interactive art installations that combine virtual reality technology with Chinese tea culture. Through the multimodal concept, a project named "Experience Chinese Tea" is designed to provide people with a multi-sensory interactive experience through visual, auditory, and tactile interactions, deepening their understanding of Chinese tea culture. The article introduces the development history of virtual reality technology and the current status and characteristics of Chinese tea culture. In the design process, porcelain tea utensils from the Ming and Qing dynasties are selected as the theme, and the overall experiential process is designed based on the Gongfu tea brewing method, including tea picking, tea washing, and tea waiting. This interactive art installation combines technology with culture, providing users with an immersive experience and promoting the integration and development of technology and culture.

## 2. The current state of virtual reality technology and Chinese tea culture

### 2.1. Virtual reality technology

The concept of virtual reality technology was proposed by writer Stanley G. Weinbaum in the 1930s in his novel "Pygmalion's Spectacles". In the story, there is a pair of virtual reality glasses

that, when worn, allow users to see, hear, and smell the things experienced by the characters inside, as if living in a virtual world. In the mid-1950s, American photographer Morton Heilig invented the first VR device: the Sensorama, considered the earliest version of VR equipment. (as shown in Figure 1a) It was large and bulky, with a fixed screen, 3D stereophonic sound, 3D display, vibrating seat, fan (to simulate wind), and an odor generator. American computer scientist Ivan Sutherland invented a prototype of VR glasses that is closest to the modern concept of VR devices. This VR glasses prototype, (as shown in Figure 1b) was bulky and required to be suspended from a mechanical arm above the user's head. It utilized ultrasound and mechanical axes to achieve rudimentary posture detection. When the user's head posture changed, the computer would calculate new graphics in real-time and display them to the user.

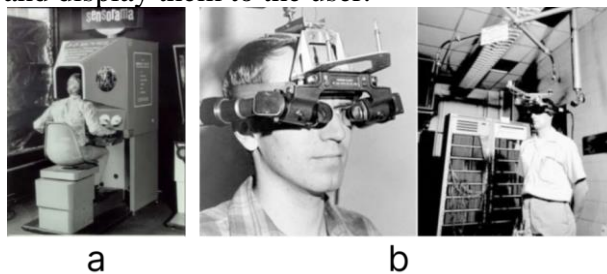


Figure 1: The history of virtual reality (VR) devices

In the 1990s, virtual reality (VR) headsets experienced their first wave of popularity. Major gaming companies saw them as an opportunity to revolutionize the gaming industry and rushed to launch their own VR headset products (as shown in Figure 2a). In 2015, HTC Vive was officially released at MWC2015 (as shown in Figure 2b), and the following year, Sony announced PSVR. Subsequently, a large number of manufacturers began to develop their own VR devices, marking the beginning of a new era for VR. Virtual reality technology began to flourish.



Figure 2: The history of virtual reality (VR) devices

## 2.2. The current status of Chinese tea culture

Tea, as the quintessence of China, encompasses every step from planting and harvesting to processing and enjoying, infusing each process with the tranquility and dedication of tea practitioners. Originating as a medicinal herb and evolving into a popular beverage, the formation and development of tea culture in China blend humanistic and natural factors, ultimately giving rise to the splendid and unique Chinese tea culture. China, as the birthplace of tea, has had a profound global influence, significantly impacting world civilization. Tea, originating in China, has traversed oceans to reach other countries, altering the tastes of people worldwide and enriching the cultural diversity of the world. [1]In recent years, the Chinese tea industry has actively integrated into and served the construction of a new economic landscape. Through continuous innovation, it has maintained stable development. While traditional products and formats continue to thrive, new tracks such as new tea beverages, packaged teas, herbal teas, and blended flavored teas have emerged, driving prosperity in both online and offline consumption. Multiple economic indicators,

including total tea production, total output value, domestic sales volume and value, export volume, and export value, have achieved historic breakthroughs. Specifically regarding tea imports and exports, as a major tea-producing country, China's tea trade has always maintained a situation where exports exceed imports. Since 2015, China's tea exports have shown a continuous growth trend. The overall export volume of tea in China has been on the rise, reaching 3.64742 million tons in 2018, an increase of 2.7% year-on-year. The export value of tea in China in 2018 was 177.786 million yuan, an increase of 10.4% year-on-year. [2]According to statistics, in 2021, the total tea export volume nationwide was 369,400 tons, an increase of 5.9% year-on-year, with exports amounting to \$2.299 billion, up 12.8% year-on-year.

### 3. The embodiment of multimodal concept in virtual reality devices

"Modality" is a biological concept proposed by German physiologist Hermann von Helmholtz, which refers to the channels through which organisms receive information via sensory organs and experience. For example, humans have visual, auditory, tactile, gustatory, and olfactory modalities. According to studies, the proportions of external information perceived by humans through visual, auditory, tactile, olfactory, and gustatory modalities are approximately 83%, 11%, 3.5%, 1.5%, and 1%, respectively[3]. Multimodal refers to the integration of multiple senses, while multimodal interaction refers to the communication between humans and computers through multiple channels such as sound, body language, information carriers (text, images, audio, video), and environment, simulating the interaction modes between individuals.

In expressing the concept of multimodality, virtual reality (VR) devices have also made significant developments and achievements. A home improvement retail chain, Lowe's, based in the United States, announced the launch of a DIY VR home decoration laboratory aimed at assisting people in learning the correct steps and methods of home decoration. The VR home decoration design software, Holoroom How To, utilizes immersive teaching methods to guide users step by step through various types of residential renovations. Once users put on HTC Vive or Oculus Rift headsets, they are immediately transported into a realistic home decoration environment. The controllers with tactile feedback functionality enable users to immerse themselves as much as possible. For example, when using a high-powered drill to make holes in the walls, users will experience distinct vibrations (as shown in Figure 3).



Figure 3: Lowe's DIY VR Home Decoration Laboratory

Given the developing and inevitable shift from print-based textual learning environments to digital, information-based, and distributed communities, VR is one of the less understood dimensions of media-based learning environments and multimodal textual production. VR technologies offer different affordances for embodied writing and multimodal communication, distinguished from previous forms of virtual technology with the advent of HMDs that have become prominent since 2013 (Jensen & Konradsen, 2018). These affordances account for multimodal and sensorial ways of interacting with sophisticated, three-dimensional virtual environments and objects, orchestrating vision, sound, haptics (touch to interact with the environment), and head and body

movements, in fully immersive environments[4].

## 4. Experiencing Chinese Tea

### 4.1. Design description

"Experience Chinese Tea" is designed with the theme of "Observing Tea Making Culture, Sensing the Charm of Tea Ceremony" to enable the public to understand the interactive cultural installation of tea culture. This work uses software such as Blender and SolidWorks to create 3D models (as shown in Figure 4a, b). The virtual tea culture platform is created in Unreal Engine, where the 3D models are placed, and interactive functionalities are added through blueprint editing (as shown in Figure 4c). In addition, Oculus Quest 2 is used as the output device (as shown in Figure 4d), and an HDR background is created to showcase the virtual reality tea culture platform. By combining visual, auditory, and tactile senses, and utilizing a multimodal design approach, this installation provides users with a multisensory interactive experience, offering them an opportunity to participate in social activities and understand Chinese tea culture.

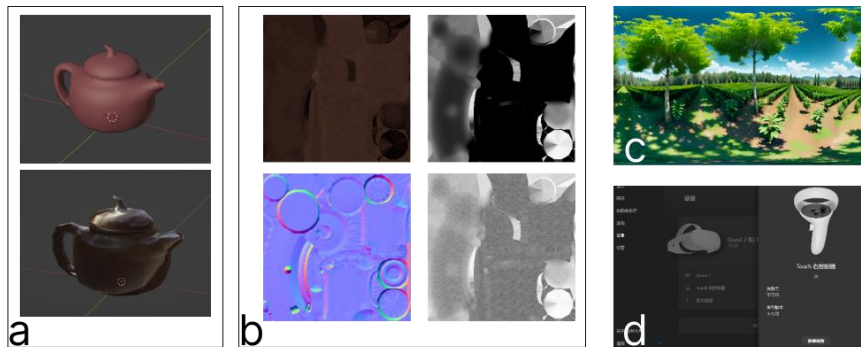


Figure 4: The production process of "Experience Chinese Tea"

During the initial design phase, we conducted research on the history of tea ware, as Chinese porcelain tea ware exhibited different characteristics during different periods of history. In the Tang Dynasty, tea ware was primarily multifunctional, with relatively large sizes and grand designs influenced by Western gold and silverware, suitable for the high tables and chairs of that era (as shown in Figure 5a). In the Song Dynasty, tea ware gradually became more specialized, with the soup bottle and tea bowl becoming the main vessels, and their shapes started to diversify (as shown in Figure 5b). In the Yuan Dynasty, porcelain tea ware was influenced by the Mongolian culture, exhibiting a heavy and robust style, with blue and white porcelain becoming popular in Jingdezhen due to the Mongolian preference (as shown in Figure 5c). In the Ming Dynasty, tea ware came in various specifications and intricate designs, reflecting the prosperity of the economy and the maturity of porcelain-making technology (as shown in Figure 5d). In the Qing Dynasty, changes were made based on the Ming Dynasty, with teapots becoming mainstream, covered bowls gaining popularity, and new developments in painting techniques such as famille-rose and enamel colors. The porcelain tea ware from these periods not only reflects the changes in society but also showcases the remarkable development of Chinese ceramic craftsmanship (as shown in Figure 5e).[5]



Figure 5: The historical development of Chinese porcelain tea

## 4.2. Overall process

We chose the porcelain tea ware from the mature and prosperous periods of Chinese tea culture during the Ming and Qing dynasties, particularly focusing on the method of "yueyin", which became prevalent in the late Ming and early Qing dynasties (as shown in Figure 6). "yueyin" replaced the previous method of grinding tea into powder and whisking it, known as "Tangzhu Songdian", marking a significant shift in tea-drinking customs. Historical records praise "yueyin" as the "origin of the ancient tradition of drinking tea." [6]



Figure 6: "The Preparation of Tea" by Wang Wen (Ming Dynasty) (Partial) (Collection of the National Palace Museum, Taipei)

The process of "yueyin" begins by taking an appropriate amount of dried tea leaves. Next, the tea is washed: high-quality spring water is used to rinse the tea utensils, followed by rinsing the tea leaves with hot water (not boiling). The tea leaves are then repeatedly rinsed and agitated in a strainer using a bamboo rod to remove dust, yellow leaves, and old stems. After washing, the cleaned tea leaves are placed in a tea vessel, and boiling water is swiftly poured over them. Finally, the tea is allowed to steep until it reaches the desired strength. Based on the "yueyin" method, we designed an overall experiential process, divided into three steps: taking the tea, washing the tea, and waiting for the tea (as shown in Figure 7).

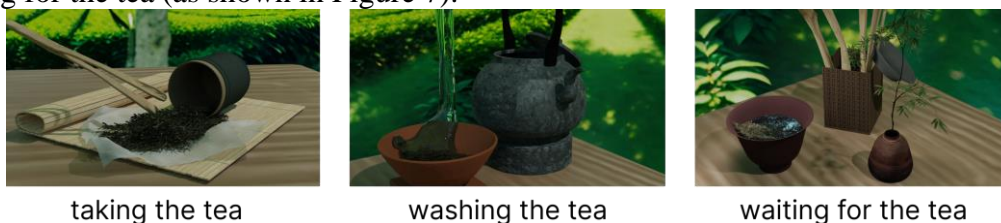


Figure 7: The process of "yueyin" method

In the first step of "taking the tea" participants wearing VR headsets can use the controllers to operate a virtual clamp, picking up tea leaves and placing them into a teacup. (as shown in Figure 8)



Figure 8: Taking the tea

In the second step of "washing the tea" participants manipulate the controllers to lift the virtual teapot and use its hot water to rinse the tea leaves in the teacup. They then use the controllers to remove any yellow leaves or old stems from the tea leaves, repeating these steps until all impurities are removed. Afterwards, participants place the cleaned tea leaves into the teacup and use the boiling water from the teapot to steep the tea leaves. (As shown in Figure 9)



Figure 9: Washing the tea

In the third step, "waiting for the tea" participants visually discern the stage of the tea based on its appearance. If the bubbles in the tea are only the size of shrimp eyes, crab eyes, fish eyes, or small pearls, the tea is still in the initial boiling stage. Only when the bubbles in the tea are boiling vigorously and the steam has dissipated completely is the tea considered fully matured. (as shown in Figure 10)



Figure 10: Waiting for the tea

## 5. Conclusions

This paper explores the design research of a tea culture exhibition booth based on the concept of multimodal interaction in interactive art installations. It investigates and summarizes the current status of virtual reality technology and Chinese tea culture, elucidating the manifestation of multimodal concepts in virtual reality installations. Through the design practice of "Experiencing Chinese Tea," it demonstrates how to apply multimodal design methods, combined with virtual reality technology, to provide users with a multisensory interactive experience involving visual, auditory, and tactile sensations, allowing them to understand Chinese tea culture.

The flourishing development of virtual reality technology is attributed to the continuous advancement of modern technology, enabling cultural experiences to come to life and facilitating better understanding of traditionally static knowledge. Interaction is no longer limited to simple communication with users but has evolved into a comprehensive multimodal interaction method, offering users an opportunity for immersive experiences. Technology forms the foundation of interactive art, and, conversely, interactive art also serves as an external manifestation of technology. The pursuit of deeper interaction has also driven technological advancements to a certain extent.[7]

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