Journal of Ecohumanism
2024
Volume: 3, No: 8, pp. 10803 – 10822
ISSN: 2752-6798 (Print) | ISSN 2752-6801 (Online)
https://ecohumanism.co.uk/joe/ecohumanism
DOI: https://doi.org/10.62754/joe.v3i8.5690

A Study Portable Tea Set Based on the Application of Huizhou Design Elements in China

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Abstract

The continuous advancement of science and technology and the constant evolution of product forms have been driving changes in product design. Therefore, contemporary product design must go beyond functional development, aiming for higher performance and broader market coverage. Portable product design is adapting to the changing market demands. In the case of portable tea sets, the industry is advocating for higher design standards through new conceptual approaches. Since Huizhou culture and tea culture hold significant positions in Chinese culture, this paper applies Huizhou cultural elements to the design of portable tea sets, using them as a medium for cultural dissemination. By using Huizhou's horse-head walls and the "Three Carvings" (wood, brick, and stone carvings) as symbolic elements, their shapes and patterns are extracted for design, and their cultural significance is analyzed. Through semiotics and combination design methods, the structure of traditional tea sets is redesigned to imbue the product with spiritual and cultural value. It is hoped that this design will not only improve the monotonous design environment of the current tea set market but also change people's lifestyles and perspectives, while effectively promoting regional culture.

Keywords: *Regional Culture, Huizhou, Tea Set, Element Symbol, Portable.*

Introduction

Nowadays, with the rapid development of the tea market, both the production and growth rate of Chinese tea have increased significantly. Tea sets have become an indispensable part of people's lives. However, there is an urgent need for in-depth research into the relationship between tea culture and tea set design—how to make tea set designs more relevant to people's lives, and how to combine tea set design with tea culture to create modernized tea sets. The rapid development of society and technology continuously influences product design methods and forms, requiring designers to consider more than just the product's functionality during the design process. Currently, the market offers a limited range of media to convey tea culture, primarily simple tea-drinking vessels. To better promote tea culture, there is a need to supplement this form of media to meet the challenges posed by cultural diversity.

The objective of this research is to modernize traditional tea sets through innovative designs that address both the preservation and modernization of tea culture. Due to historical context and regional distinctions, local culture differs from mainstream culture. Product design based on traditional Huizhou cultural elements must meet user needs while preserving both functionality and cultural significance. Due to historical context and regional distinctions, local culture differs from mainstream culture. Product design based on traditional Huizhou cultural elements must meet user needs while preserving both functionality and cultural significance. The context in which a product is used can evoke emotional experiences in users. By embedding "stories" of Huizhou culture, designers can deepen the connection between users and products, fulfilling emotional needs and enhancing the user experience (Yuanjun Feng, 2018). Additionally, by analyzing relevant domestic and international design principles, this research summarizes the significance of regional culture in design and offers reasonable suggestions for the design of contemporary tea sets. Based on the current state of tea set design, combining regional culture with modern tea set design and implementing new design concepts can foster innovation in the modern tea set industry, effectively protecting and preserving cultural heritage while promoting economic development and cultural exchange.

Based on the collection, comparison, and study of relevant literature, this paper integrates the history of tea

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culture, the aesthetics of tea sets, and the design styles of tea sets to compare different styles and historical origins of tea sets. In response to gaps and shortcomings in the innovative design research in this field, this paper proposes a research topic—the design proposal for a portable tea set based on the application of Huizhou cultural elements in China—and establishes research goals that are "theoretically systematic and methodologically feasible. Finally, using SPSS tools to analyze survey content, combined with the SD statistical analysis method, this study examines the shape, color, material, and relationship between Huizhou elements and tea sets, the historical evolution of tea drinking, case studies of tea set designs, and the temporal characteristics of tea set forms.

Methods

The Evolution of Huizhou Culture and Tea Set Combinations

Huizhou culture is a comprehensive integration of Central Plains culture and a highly distinctive regional culture. It emerged in the late Northern Song Dynasty, and by the Southern Song Dynasty, it was known as the "Zou Lu of the Southeast" and the "Land of Propriety." It flourished during the Ming and Qing dynasties, lasting as a unique regional culture for about 800 years. Since the 1990s, Huizhou studies, along with Tibetan and Dunhuang studies, have become one of the three major regional disciplines in Chinese ethnic research (Qiong Ding, 2011).

At the same time, Huizhou culture is a highly localized regional culture with broad and profound content, characterized by an overall systematic nature. It deeply reveals the mysteries of Eastern society and culture, encompassing the basic elements of the economy, society, daily life, and culture of late feudal China, and is regarded as a typical specimen of China's later feudal society.

Huizhou architecture is a crucial part of Huizhou culture, bearing the weight of thousands of years of history. It reflects the material forms and spiritual concepts of ancient Huizhou's social history, politics, economy, geography, natural conditions, production methods, and way of life. As a material form developed under specific cultural conditions that transcends time and space, Huizhou architecture has three key characteristics: practicality—functional use, environment—natural ecological factors, and symbolism—spiritual and cultural elements (Andong, Zhang, 2011).Additionally, Huizhou architecture has developed a unique architectural philosophy, combining natural beauty, social beauty, and artistic beauty, fully reflecting the harmonious unity of people with others, society, and nature. The harmonious unity between Huizhou architecture and nature creates a basic and direct connection between people and architecture, and between architecture and nature, holding significant historical, cultural, and artistic value.

Overview of the Development of Tea Sets

The term "tea set" appeared as early as the Han Dynasty. According to the Western Han poet Wang Bao in "Tong Yue," there is a reference to "all the tea utensils being used to brew tea," which is the earliest historical record mentioning a "tea set" in China. The evolution of society is not only a change in politics, economics, and culture, but also in people's lifestyles. Tea culture, as a product of both material and spiritual civilization, has always been closely linked to humanity, and its development has been influenced by the spiritual values of the time. Tea sets, however, are a modern invention. Therefore, in this study, we need to investigate how human lifestyles have influenced the design of tea sets. This paper conducts research on tea drinking methods and the material characteristics of tea sets across three distinct periods: early, middle, and modern times.

Early Tea Sets

In the early years following the founding of the People's Republic of China, due to low economic development and modest incomes, tea sets during this period focused primarily on practicality and functionality, rather than on ornate appearance or excessive decoration. Most of these sets were made using traditional techniques. Although the designs were simple, they still employed traditional craftsmanship such as hand-making and clay firing. The shapes of the various components were relatively uniform, with clean

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and smooth lines, avoiding overly complex forms. Teapots were typically large in size, making it easier to store more tea for outdoor use. Materials commonly used included purple clay or white porcelain, known for their superior quality and longer durability.

Mid-Period Tea Sets

After the reform and opening-up, productivity was liberated, and people's incomes increased, leading to more modernized ideas and consumption patterns. During this period, tea set designs became more diverse, emphasizing individuality and a sense of fashion, with a stronger focus on appearance and decoration. Compared to the 1970s and 1980s, tea sets from this period frequently employed modern processes and techniques, such as machine manufacturing and laser engraving, while also innovating on traditional craftsmanship. The shapes of tea sets became more novel, with smoother lines and more diverse forms. Designs were no longer restricted to traditional tea set forms, focusing more on innovation. In terms of materials, aside from purple clay and white porcelain, tea set materials expanded to include glass, metal, bamboo, and wood, resulting in more diverse material options. Furthermore, tea sets were no longer just simple combinations of tea utensils; they placed greater emphasis on aesthetics and multifunctionality, with additions like tea storage jars and fairness cups.

Modern Tea Sets

Modern tea sets typically feature minimalist designs, focusing on visual appeal and practicality. This design style aligns with modern people's pursuit of quality living, while also making daily cleaning and storage more convenient. The materials used in modern tea sets are diverse, including not only traditional materials like purple clay and porcelain, but also modern materials such as glass and stainless steel. These materials are not only aesthetically pleasing but also easy to clean and maintain. The designs also place greater emphasis on functionality and fun, often including accessories like tea storage jars, tea filters, and tea scoops, making them easier for users to operate and maintain. Some modern tea sets incorporate advanced technology, such as smart temperature control, insulation, and bottom heating functions, enhancing comfort and convenience during use. Modern tea sets not only meet the needs for tea storage and drinking but also emphasize cultural integration. For example, they incorporate traditional Chinese cultural elements like Chinese characters and landscape paintings into the design, reflecting the deep heritage and continuity of tea culture.

Combination and Use of Portable Tea Sets and Consumer Survey Analysis

In product design, combination design usually refers to the design of new products and components. In such cases, not all parts and components are redesigned. Instead, inheritable structural and functional units, such as depreciated standard or universal parts, are selected based on functional requirements. Even when components are redesigned, standard structural elements are used whenever possible to enable the iterative combination of original and new technologies, thereby enhancing the iterative impact of standardization. In a new design system, the combination principle is applied to product design, allowing it to adapt to market competition and economically produce a variety of products. It represents a new type of design system (Yue Li, 2015).

The principle of the combination method is essentially a system principle and manifests in three forms:

In systems thinking, the combination method refers to the process of combining two or more systems according to specific principles to form a new system. In this new system, each component is coherently and organically integrated under a shared overall objective and interacts with each other in some way.

The new system must possess new characteristics or results, and the overall function of the system must exceed the sum of the individual functions of its components.

Since systems have different properties and states, creators using the combination method must analyze and evaluate the system from various directions and perspectives during the creative process.

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Methods of combination innovation include similar and dissimilar combinations based on different elements. Based on content, combinations can be categorized into principle combinations, additive combinations, material combinations, and structural combinations. Based on techniques, combinations can be classified as technical combinations and informational combinations.

From a portability perspective, which aims to reduce weight and optimize volume ratios, the combination forms can be divided into the following two types: Structure refers to the overall composition or arrangement of components. A combination typically refers to several parts or elements contained within a whole. Structural combination in a product refers to assembling various parts into one unified product. Since the primary requirement for portability is the size of the product, the best way to alter the structure without changing the materials or design is to modify the structure. This allows the current product to achieve suitable dimensions without changing the original size. Different structural combinations come together to form a complete product.

Function refers to the specific features and applications of a product, which fulfill a particular role. Simply put, it is the utility the product provides to consumers. Functional reorganization refers to making the product's components more functional, maximizing their value, and allowing them to save space and enhance portability while being part of the product.

Functional combination typically involves combining two products with different functions. However, since many different products share the same functional principles, combining such products is more meaningful. Additionally, because of their similar functions, the product's cost won't increase significantly. Another advantage of functional combination is meeting the needs of users in different scenarios. Some products lack specific usage contexts, and altering the usage scenario allows the product to adapt to various contexts (Yanan Li, 2020).

In today's fast-paced life, being able to slow down and enjoy a cup of tea has gradually become a rare luxury. The Quick Cup in portable tea sets represents a significant advancement in portable tea set design. The Quick Cup effectively combines the fast pace of life with the enjoyment of a slower, more leisurely tea experience. The Quick Cup first appeared at the 2010 World Expo, and its name is derived from the English word "quick. Its purpose is to simplify the complex process of brewing tea and tea preparation, finding a balance between a fast-paced life and the slow enjoyment of tea. It is easy to use, eliminating the complicated steps, providing a fast-paced yet structured tea-brewing process, allowing tea to be enjoyed quickly. For the Quick Cup, the lid and body are integrated, simplifying the brewing process while separating the tea from the water. The basic essence of tea brewing is retained, and its ergonomic handle and sleek design helped it quickly gain popularity, becoming a new trend in tea brewing.

As shown in Figure 1, the "Wind of May" Quick Cup, designed by Mita Creative, features a one-pot, one-cup design. When fully expanded, it includes a teapot and two cups, with the small cup fitting neatly onto the teapot without disrupting the overall design. This form perfectly combines aesthetics with functionality.

Figure 1. "Wind of May" Quick Cup

When designing portable combination tea sets, it is important to note that each time the product is assembled, it must undergo a simple disassembly process. Therefore, the design should be simple and intuitive, allowing consumers to save time and effort during use. To reduce design effort and labor, mass

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production should adhere more closely to standardized and modular design requirements. Additionally, the active use of environmentally friendly materials should be encouraged, enabling continuous innovation in product types and further expansion of functionality.

The classification standards for modern portable tea sets are generally consistent with those for traditional tea sets. Based on materials, portable tea sets can be divided into various types such as ceramic, glass, purple clay, metal, and more. Different materials have distinct characteristics and uses. For example, purple clay tea sets are favored by many tea enthusiasts for their good breathability and strong insulation properties, while glass tea sets can display the color and form of the tea, making them suitable for appreciating high-quality tea leaves.

Table 1. Analysis By Material Classification and Type

Material	Illustration	Characteristics
Ceramic		Ceramic is a natural and eco-friendly material, free of harmful substances, making it a healthy option. Due to its versatile production process, ceramic tea sets come in a variety of shapes. The surface is smooth and flat, making it easy to clean and resistant to bacterial growth.
Purple Clay		Purple clay has a fine texture and high density, making it durable and less prone to breakage. It retains the tea's heat well, enhancing the tea's aroma. Purple clay tea sets also have good adsorption abilities, filtering impurities from the tea and enhancing its clarity, while absorbing the tea's fragrance, making the tea more flavorful.
Glass		The main characteristic of glass is its transparency, allowing for a clear view of tea leaves unfurling and the changing color of the water. Glass tea sets do not absorb the color or flavor of the tea, making them easier to clean. Unlike other materials, glass does not affect the taste of the tea, ensuring the preservation of its original flavor. However, glass is a fragile material, requiring careful handling, and it has poor heat retention.
Metal		Metal is a strong and durable material, resistant to breakage and wear, with a long lifespan. It is convenient for outdoor use due to its unbreakable nature. Metal tea sets are moisture-proof and odor-resistant, making them suitable for various environments.

Based on usage, portable tea sets can be classified into types such as household, commercial, and outdoor. For example, some simple and affordable portable tea sets are suitable for daily household use, while others with more complex designs and exquisite craftsmanship are suitable for commercial use or as high-end gift items. Outdoor tea sets prioritize convenience and storage. They are generally smaller in size, lightweight, and easy to carry, making them ideal for tea-drinking needs during outdoor activities, travel, or camping.

Portable tea sets can also be classified according to their different regional cultural backgrounds. For example, Chinese portable tea sets are typically based on traditional culture, featuring refined shapes and intricate carvings. Japanese portable tea sets, on the other hand, emphasize simplicity, natural aesthetic, and purity, reflecting the essence of Japanese tea ceremony culture. Korean portable tea sets incorporate elements of nature, simplicity, and minimalism from Korean traditional.

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Table 2. Analysis By Classification and Type of Use

Function type	Illustration	Description
Household Type		Household portable tea sets generally have simple designs, are affordable, and feature smaller teapots suitable for one or two people.
Commercial Type		Commercial portable tea sets have more elegant and refined designs, with larger capacity, making them suitable for use in business settings to serve multiple guests. They also come with various accessories, such as tea trays, tea spoons, and fairness cups, making them ideal for tea ceremonies and service in business environments.
Outdoor Type		Outdoor portable tea sets are smaller in size, lightweight, and typically feature a compact structure with detachable components that are easy to assemble and disassemble. They are designed for easy portability, with enhanced durability and resistance to impact, making them well-suited for outdoor use.

Based on the previous research, in order to understand the extent to which regional cultural elements in portable tea sets resonate with consumers, a series of surveys was conducted to collect consumer opinions. A total of 150 questionnaires were distributed through online survey sharing. By analyzing user persona models, three levels of user needs were identified. Subsequently, based on these needs, design principles and elements for portable tea sets were summarized and analyzed, providing clear theoretical guidance for the following design proposals.

The following conclusions were drawn from the analysis of the survey responses:

The survey showed that among tea-loving respondents of different age groups, 53% frequently travel short or long distances, with 60% of these travelers aged 25-45. This group mainly travels for study, vacation, or work, with 65% being students studying abroad or professionals on business trips. Most users travel 4-6 times a year, indicating a high demand for portable products in this group.

The survey also indicated that among frequent travelers aged 25-45, the highest level of education was typically a bachelor's or master's degree. Since many respondents were students, their monthly disposable income ranged from 1,000 to 15,000 yuan. The subsequent user persona models were built targeting this demographic.

The main reasons users were unwilling to carry tea sets were difficulties with portability and inconvenient operation of current products on the market.

Therefore, the target group was defined as individuals aged 25-45. This group is generally well-educated, with a certain level of economic stability and purchasing power. They enjoy traveling and lead independent lives. However, current portable tea sets on the market do not meet their needs, leading to a low usage rate during travel.

Table 3. Analysis of Regional Cultural Background Classification Type

Regional classification	Illustration	Description
China		Chinese portable tea sets have distinctive designs, often drawing inspiration from traditional Chinese cultural elements such as flowers, birds, landscapes, and figures. They represent the aesthetics and values of traditional Chinese culture.

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Korea		Korean portable tea sets are typically made from white porcelain. The porcelain has a clear, soft sheen, exuding an elegant beauty that reflects traditional Korean aesthetic concepts. The texture is fine, with a smooth and glossy surface that feels pleasant to the touch. The craftsmanship is meticulous, embodying a rich cultural heritage, and showcasing the unique charm and historical value of Korean art.
Japan		Japanese portable tea sets, in addition to their traditional natural colors, often feature modern designs influenced by traditional Japanese ukiyo-e art. Natural elements such as flowers and plants are often incorporated into the designs, reflecting the traditional Japanese aesthetic and respect for nature.

Consumer Survey Analysis

User Persona Model Research Method

Due to the diversity in user backgrounds, such as nationality, cultural background, economic status, and education level, their interests, preferences, and lifestyle tastes also vary significantly. Therefore, to address this diversity, we first need to build a user persona model to accurately identify the commonalities and specific needs of the target user group. This model will reflect key information such as users' consumption preferences, behavioral habits, life attitudes, and aesthetic values. By thoroughly analyzing the user persona model, we can accurately identify user needs based on the "Three-Level Needs Theory." (Michael R. Solomon, 2009).

To obtain more specific data, we will conduct a survey using the online CHINA-VALS questionnaire. CHINA-VALS were launched in 2002 by the China New Generation Market Monitoring Organization, aimed at adapting to the diversified consumer lifestyles in the Chinese market. The model categorizes Chinese consumers based on social stratification and lifestyle dimensions. The stratification includes occupation, education level, and income, while the lifestyle dimension covers consumers' way of life and behavior patterns. In this model, the "Social Followers" group is the largest population. As shown in the figure below:

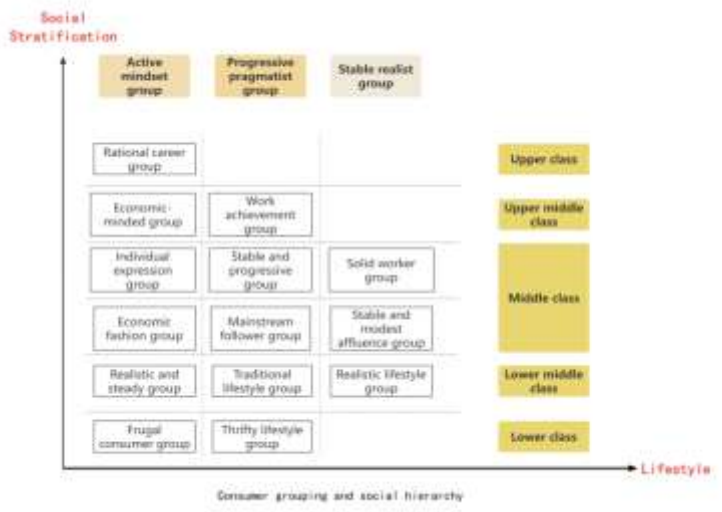

Figure 2. Consumer Grouping and Social Hierarchy

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Questionnaire Design

Based on the previously identified target group of 27-44-year-olds, this survey focuses on analyzing the personality traits of this target group, summarizing their consumption preferences, behavioral characteristics, and life attitudes.

Questionnaire Data Analysis

The CHINA-VALS survey included 40 lifestyle test statements, and respondents were asked to choose the level of consistency between the statements and their lifestyles, rated as: very inconsistent, somewhat inconsistent, neutral, somewhat consistent, and very consistent.

Using the SPSS tool for analysis, factors with eigenvalues greater than 1 were selected. After performing maximum variance orthogonal rotation, 14 main factors were extracted. Following statistical tests based on factor and cluster analyses of valid data, combined with demographic and consumer behavior variables, the results were compared with the features of 14 population groups (Yujie Zhong, 2013). Six personality groups were identified and named: Expressive Individualists, Economic Fashionistas, Steady Progressives, Social Followers, Solid Workers, and Stable Middle-Class.

Design Principles of Portable Tea Sets Based on Emotional Needs in User Persona Models

By analyzing the emotional needs in user persona models, we can derive three-level design principles for portable tea sets: the instinctive level focusing on aesthetics and novelty; the behavioral level emphasizing ease of use and functionality; and the reflective level highlighting experience and sustainability. These principles provide more specific guidance for converting emotional needs into design parameters.

The target consumer group in this study is aged 27-44, typically well-educated and forward-thinking, inclined to pursue individualized and free lifestyles, and therefore highly value the aesthetics and innovation of products. The appeal of a product primarily lies in its shape, color scheme, material selection, surface texture, and decorative details.

The product conveys emotions to users through its design, meeting their aesthetic needs. According to Sino Market Research, "appearance design" is a key factor influencing consumer purchasing decisions. The product's shape is formed through various combinations of points, lines, planes, and volumes, with different combinations creating unique visual and psychological effects. For tea sets, these differences are reflected in angles, lines, curves, and detailed handling of internal and external structures, creating rich dynamic visual effects. For young consumers seeking fashion, portability, and simplicity, tea set designs should feature simplified lines, reduce complex curves, and create a smoother and more natural form.

The combination of color and form, or "form and color in harmony," is crucial to the overall visual impact of a product. Color expresses a product's characteristics and emotions through elements such as hue, brightness, and saturation, and the right color choices and combinations can effectively attract consumers. Young consumers are generally more sensitive to color and have a broader range of color preferences. Therefore, when designing, it's essential to consider current seasonal color trends, such as the 2024 spring color trends forecasted by Pantone, which includes 15 trendy colors—10 primary colors and 5 classic neutral tones. Portable tea sets should be designed with colors that create a warm, relaxed, and stylish atmosphere, which can be achieved through the following four color-matching methods:1. Monochromatic combinations, using varying shades of the same color to create depth;2. Contrasting color combinations, using bold contrasts to showcase youthful energy;3. Adjacent color combinations, using harmonized colors for a relaxed and balanced visual experience;4. Leveraging the natural colors of the materials themselves to highlight their inherent beauty.

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Figure 3. 2024 Spring Color Trends Forecasted by Pantone

The starting point of design is the form of the product, and the design of the form largely depends on the characteristics of the selected materials. Materials determine the visual and tactile features of a product, as well as the symbolic meanings they convey. Consumers experience the texture of a product through both visual and tactile dimensions. Visual texture arises from the visual properties of the material's surface combined with previous touch experiences, while tactile texture comes from the sensation of direct contact with the product. Whether visual or tactile, the texture is strongly influenced by the surface of the material. For example, fabric gives a feeling of softness and warmth, metal feels smooth and cold, and bamboo and wood provide a natural and rugged touch. Different materials evoke different emotional responses. Appropriately combining one or more materials can not only enrich the sensory experience of the consumer but also bring pleasure and satisfaction on a psychological level, thereby triggering emotional resonance. Given that the target user group tends to pursue refined and comfortable experiences, material selection in tea set design should fully reflect these needs.

The primary goal of product design is to provide a pleasant user experience, including ensuring the product's safety, functionality, and ease of use. Safety is at the core of product design, ensuring that users are not harmed during operation. A well-designed product not only has an appealing appearance but also combines practical functionality, a reasonable structure, and ergonomically correct proportions.

Functionality is a fundamental requirement of a product. To achieve this, designers must ensure the reasonableness of the product's size, structure, and proportions, as well as the ease of operation. For example, the placement of a teapot's handle and its proportion to the teapot body directly affect the ergonomics and comfort during use.

Considering the physiological characteristics of the user group, tea set designs should ensure comfort and compatibility at all contact points. The product design should be meticulous, ensuring users feel relaxed and comfortable during use. With the rapid development of technology, younger consumers tend to choose products that are simple and efficient to operate. Therefore, when designing tea sets, the process should be simplified to meet basic functions while improving efficiency, reducing labor, and minimizing potential operational obstacles to alleviate negative emotions. Additionally, since portable tea sets are often used outdoors, the design should be more compact and lightweight for easier portability. In conclusion, the design should fully reflect a human-centered approach to the user group, ensuring the product is not only functional but also easy to use and carry. This will elicit positive emotional feedback from users, which is a key aspect of behavioral-level design principles.

In the context of rapid economic development, the pace of life and work has accelerated, and material

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needs have been fully met. However, this often only satisfies survival needs, not the quality of life. Modern individuals long to slow down and experience moments of tranquility. As a result, when choosing household items like tea sets, they prioritize quality and products that evoke emotional resonance. In recent years, the trend of a refined lifestyle has become popular. From trendy restaurants to the spread of fashionable items, these trends reflect the user group's pursuit of a sophisticated life. This includes detailed tablecloths, carefully arranged tableware, and high-quality decorations, all of which are expressions of their desire to enhance the quality of life.

When designing tea sets, emphasis should be placed on the ritual and profound experience of tea drinking, making it a form of spiritual relaxation and an enjoyment of the good life, rather than merely quenching thirst. As the living standards of the user group rise, they are increasingly focused on healthy and eco-friendly lifestyles. The design of durable tea sets should consider multifunctionality and simplified structures to maximize resource utilization. Furthermore, incorporating sustainability concepts into product design can deepen the emotional connection with consumers, reduce the need for frequent replacements and purchases, and enhance the value and lifespan of the product. Through this approach, designers can convey the concept of green consumption to users, promoting a healthy, low-carbon lifestyle.

Table 4. Sensory Glossary for Screening

1	Fashionable — Primitive	6	Smooth —— Sharp	11	Smooth — Rough	16	Rational — Emotional
2	Simple — Complex	7	Warm — Indifferent	12	Unique — Ordinary	17	Subtle — Showy
3	Light — Heavy	8	Streamlined — Rigid	13	Harmonious — Abrupt	18	Practical — Decorative
4	Exquisite — Crude	9	Elegant — Vulgar	14	Technological — Handmade	19	Figurative — Abstract
5	Natural — Artificial	10	Comfortable — Uncomfortable	15	Dynamic — Static	20	Luxurious — Simple

Experimental Research Methods and Sample Selection

The Semantic Differential Method (SD method) was introduced by American scholar Osgood and his team as a psychological measurement method. This method primarily studies attributes such as appearance and color and maps them onto a Likert scale based on user perceptions for quantitative analysis. It is a core technique in the study of affective imagery (OsgoodCE, 1957).

When conducting a study using the Semantic Differential Method, researchers first need to determine a series of opposing imagery words closely related to the research objective, such as "modern-traditional" and "light-heavy." Next, a 5-point, 7-point, or 9-point psychological scale is set to indicate varying intensities of perception, ranging from "very" to "neutral. "Participants rate each research sample according to their subjective perceptions. For example, with a 5-point scale, the values are set as -2, -1, 0, 1, and 2, where 0 represents the midpoint of the evaluation, and higher or lower values indicate stronger alignment with the extreme terms on the scale. Finally, the collected data is analyzed using statistical methods, and an SD curve is generated to reveal how different design elements perform in terms of emotional cognition.

To ensure the representativeness and accuracy of the survey, a questionnaire using a 5-point semantic differential method was designed, with a scoring range from -2 to 2. According to the analysis of the dendrogram, with the horizontal axis set at 15, we can divide the 20 affective words into three groups. The results of this analysis indicate that when describing an ideal portable tea set, users are most likely to use adjectives such as "simple," "light," "rounded," "harmonious," "elegant," "natural," "exquisite," "comfortable," "smooth," and "practical." The collection of portable tea set product samples was mainly done through major online shopping platforms and design websites. After conducting the survey, a total of

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DOI: https://doi.org/10.62754/joe.v3i8.5690

12 representative sample images were obtained.

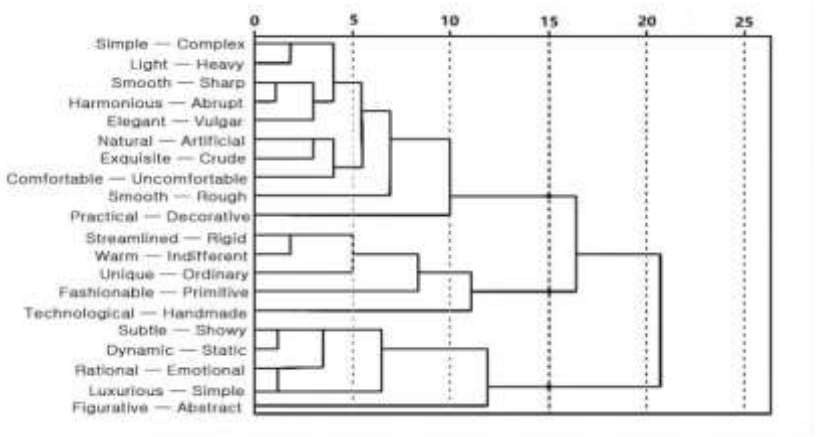

Figure 4. Dendrogram

Table 5. Product Sample Images

(1) 	(2) 	(3) 	(4) 
(5) 	(6) 	(7) 	(8) 
(9) 	(10) 	(11) 	(12) 

Portable tea sets in the market are mainly divided into three types: concentric cups, flowing cups, and easy-brew teapot sets. The choice of usage form for these products will determine their appearance design, so it is essential to clarify their specific usage before finalizing the design. Portable tea set design must consider the emotional needs related to the usage, such as portability, ease of operation, efficiency, ease of cleaning, and comfort in handling. These needs correspond to the overall size of the tea set, the complexity of its structure, the ease of tea brewing, the convenience of assembling and disassembling parts, and the comfort of the handle.

To determine the best choice among these three forms, this study applied the Analytic Hierarchy Process (AHP). AHP is a hierarchical decision-making method proposed by Professor Saaty in the early 1970s in the United States (Xue Deng et al., 2012). This method combines quantitative and qualitative analysis, using the decision maker's experiential judgment of the importance of each decision goal, while assigning relative weights to decision criteria, thereby ranking different options in terms of their merits.

First, a hierarchical structure model needs to be established. The goal level, Z, represents the selection of the usage form of portable tea sets. The criteria level, A, represents five factors: overall volume, structural complexity, ease of tea brewing process, ease of assembly/disassembly, and comfort of the handle. The alternative level, B, represents the concentric cup, flowing cup, and easy-brew teapot set, as shown in the

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figure below:

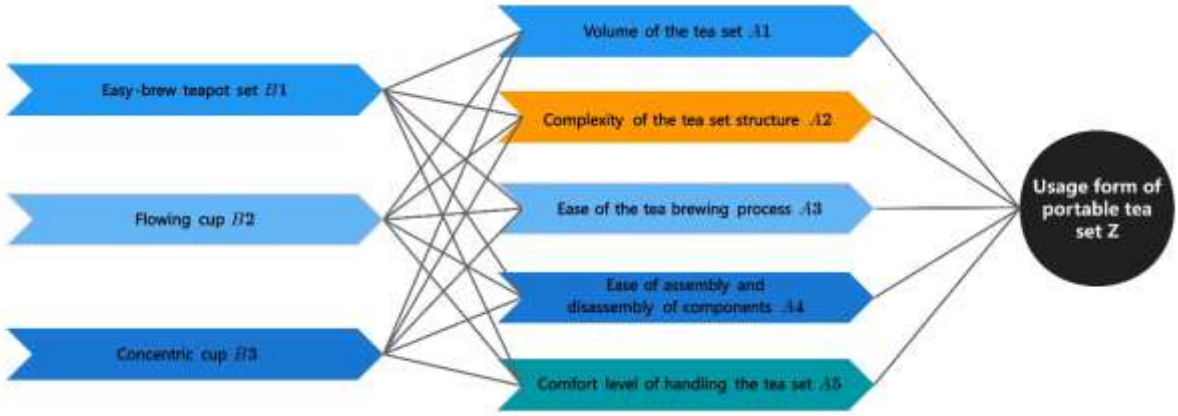

Figure 5. Hierarchical Structure Model for the Usage Forms of Portable Tea Sets

Then, a pairwise comparison matrix is constructed. The criteria level consists of 5 factors, and a 1-9 scale method is used to derive the elements of the judgment matrix, where each element is compared pairwise.

Table 6. Meaning of the Scale Method

Importance Scale	Meaning of Scale
1	Indicates element i is equally important as element j
3	Indicates element i is slightly more important than element j
5	Indicates element i is obviously more important than element j
7	Indicates element i is strongly more important than element j
9	Indicates element i is extremely more important than element j
2,4,6,8	Indicates intermediate values of the above judgments

The results of the pairwise comparison between criteria and goal levels were obtained through a questionnaire survey. After summarizing the data and calculating the average values, the results are shown in the table below:

Table 7. Results of Pairwise Comparison Between Criteria and Goal Level

Z	A1	A2	A3	A4	A5
A1	1	01-Feb	4	2	2
A2	2	1	8	5	5
A3	01-Apr	01-Aug	1	01-Feb	01-Apr
A4	01-Feb	01-May	2	1	1
A5	01-Feb	01-May	4	1	1

From the table above, the pairwise comparison matrix is obtained：

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$$A=\begin{bmatrix} 1 & \frac{1}{2} & 4 & 2 & 2 \\ 2 & 1 & 8 & 5 & 5 \\ \frac{1}{4} & \frac{1}{8} & 1 & \frac{1}{2} & \frac{1}{4} \\ \frac{1}{2} & \frac{1}{5} & 2 & 1 & 1 \\ \frac{1}{2} & \frac{1}{5} & 4 & 1 & 1 \end{bmatrix} \quad B_1=\begin{bmatrix} 1 & 2 & 5 \\ \frac{1}{2} & 1 & 2 \\ \frac{1}{5} & \frac{1}{2} & 1 \end{bmatrix} \quad B_2=\begin{bmatrix} 1 & \frac{1}{2} & \frac{1}{8} \\ 2 & 1 & \frac{1}{4} \\ 8 & 4 & 1 \end{bmatrix}$$

$$B_3=\begin{bmatrix} 1 & \frac{1}{2} & 3 \\ 2 & 1 & 4 \\ \frac{1}{3} & \frac{1}{4} & 1 \end{bmatrix} \quad B_4=\begin{bmatrix} 1 & 2 & 5 \\ \frac{1}{2} & 1 & 3 \\ \frac{1}{5} & \frac{1}{3} & 1 \end{bmatrix} \quad B_5=\begin{bmatrix} 1 & 2 & \frac{1}{4} \\ \frac{1}{2} & 1 & \frac{1}{4} \\ 4 & 4 & 1 \end{bmatrix}$$

Then, the weight vector for hierarchical single ordering and consistency check is calculated. The largest eigenvalue of the pairwise comparison matrix A is λ=5.079, and the corresponding normalized eigenvector is ω={0.393, 0.183, 0.183, 0.264, 0.264}. Therefore, $CI=\frac{5.079-5}{5-1}=0.01675, RI=1.609$, and since $CR=\frac{CI}{RI}=0.01675$<0.1it indicates that matrix A passes the consistency check.

For pairwise comparison matrices B1, B2, B3, B4, and B5, the weight vectors for hierarchical total ordering are calculated and consistency tests are performed. The results are shown in the table below:

Table 8. Data of the Overall Ranking Weight Vector

K	1	2	3	4	5
ωK1	-0.89	1.203	0.488	0.871	0.295
ωK2	-0.89	-1.116	-0.244	0.871	-0.147
ωK3	-0.89	2.866	-0.244	0.871	-0.147
λk	3.005	3	3.018	3.003	3.053
*CI*K	0.002	0	0.009	0.001	0.265
*RI*K	0.472	0.521	0.325	0.343	0.312

Substituting the above results into the formula below, it is evident that B1, B2, B3, B4, and B5 pass the consistency test.

$$\begin{bmatrix} 0.393 \\ 0.183 \\ 0.183 \\ 0.264 \\ 0.264 \end{bmatrix} \times \begin{bmatrix} -0.890 & 1.203 & 0.488 & 0.871 & 0.295 \end{bmatrix} = -0.146$$

Finally, calculate the total ranking weight and perform a consistency check. The weight of B1 for the overall goal is similarly, the weights of B2 and B3 for the overall goal are: -0.407 and 0.321, respectively. The decision level's weight vector for the overall goal is: {-0.164, -0.407, 0.321}. Since $CR=\vec{\omega}\times\vec{CI}<0.1$, the total ranking passes the consistency test. {-0.164, -0.407, 0.321} serves as the basis for the final decision, with the weight ranking of the options as B3 > B1 > B2. The above calculations were completed using Python in Spyder, as shown in the figure.

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Experimental data shows that the concentric cup outperforms both the easy-brew teapot set and the flowing cup in terms of performance. To enhance user experience, the design combines features of the concentric cup and easy-brew teapot set, adopting the separate design of the concentric cup and incorporating the compact structure of the easy-brew teapot set. This integration of both advantages better adapts to diverse consumer usage scenarios.

The experiment used a 5-point Semantic Differential Method to study the form of portable tea sets, collecting user perceptions of the tea set forms through a questionnaire survey and analyzing the results to draw conclusions.

Using the 12 tea set samples previously selected and 10 groups of affective words, an imagery space was constructed and a survey questionnaire was designed. Participants from the target user group (aged 27-44), representing different age ranges and professions, were asked to rate the form of the sample images based on subjective judgment. Scores were given on a scale of -2, -1, 0, 1, and 2. After collecting the questionnaires, the average score for each pair of adjectives for each tea set sample was calculated. The data was then compiled into a table, and based on the table data, an SD curve chart of the product forms was drawn.

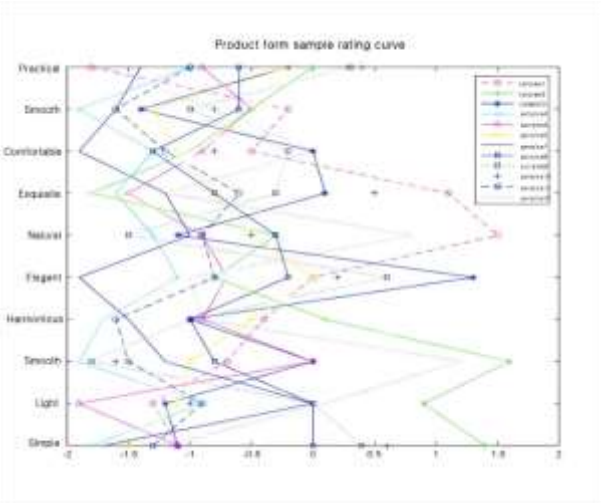

Figure 6. SD Curve of Portable Tea Set Form Samples

A negative score indicates that the description aligns more with the affective words on the left, while a positive score suggests it is closer to the description on the right. The absolute value reflects the intensity of emotional imagery. Based on the chart analysis, samples 4, 7, and 11 primarily trend toward the negative region, leaning to the left; whereas samples 2, 1, 3, and 10 tend toward the right. Since the left side represents the users' emotional needs, sample 4 exhibits the product form most aligned with the users' emotional imagery. However, considering that specific product imagery from certain samples also meets user needs, the design should integrate the advantages of each sample, such as combining the simplicity and smoothness of sample 4 with the refinement of sample 2.

In this study, we applied the Semantic Differential Method (SD method), conducting experiments based on participants' subjective perceptions of different colors and scoring the selected affective words. The collected data was then used to construct SD curve charts, analyzing how color as a design element performs in terms of emotional perception.

Additionally, by analyzing the main colors of popular portable tea sets on e-commerce platforms, eight highly representative colors were selected: porcelain white, pottery black, celadon green, earthy yellow, rubber pink, sky blue, coral red, and peacock green.

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Figure 7. Representative Color Samples of Portable Tea Sets

From the ten groups of previously identified affective words, we filtered and excluded words that were not suitable for describing color, ultimately determining eight applicable groups of affective words. These words correspond to a 5-point rating scale in the semantic differential table, with scores of -2, -1, 0, 1, and 2. The experiment involved participants aged 27 to 44. Each participant observed the color samples one by one and rated each color based on personal subjective feelings using the affective words, completing the questionnaire. After collecting the questionnaires, the data was statistically analyzed, the average values were calculated, and the data was organized into a table, which was then used to draw SD curve charts for the colors.

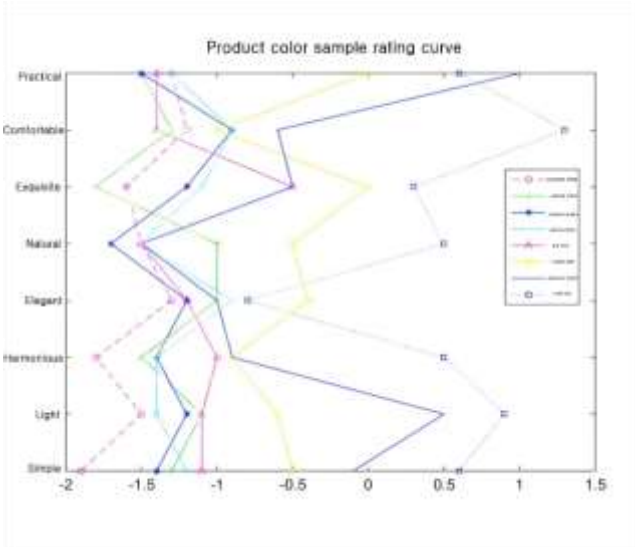

Figure 8. SD Curve of Color Samples for Portable Tea Sets

In the SD curve chart for colors, the further the curve is to the left, the more the color aligns with users' emotional needs, as the affective words on the left side are directly connected to these emotional requirements. Analysis of the SD curve chart shows that the curves for colors such as porcelain white, pottery black, celadon green, earthy yellow, and sky blue are all in the negative value region, while the other three colors are near the positive region or around the midpoint. Particularly, the curves for porcelain white and pottery black are furthest to the left, indicating that these two colors best meet users' emotional expectations for portable tea sets. Based on this analysis, it is recommended that porcelain white or pottery black be prioritized as the primary color for portable tea sets during the design process.

The study on materials was conducted using the SD method to design a survey. We selected the target user group as the participants and asked them to rate various materials based on their subjective feelings. The rating used a 5-point scale from -2 to 2, where -2 represents "strongly disagree," 2 represents "strongly agree," and 0 is neutral. The data was then summarized and compiled into a table to create SD curve charts, analyzing the subjective perceptions and effects of each material in design.

To ensure the broad representativeness of material selection, we analyzed consumer preferences for the materials of portable tea sets on online shopping platforms. The statistical results showed that porcelain, pottery, purple clay, glass, wood, bamboo, and metal are the seven primary materials used. The set of affective words used in the survey questionnaire was the same as the ten groups previously identified, which were used to evaluate the various material samples.

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After the survey was completed, we collected and analyzed all the questionnaire data and converted it into SD curve charts to visually display the emotional texture of each material. These curve charts helped us gain deeper insight into how users emotionally evaluate various materials, providing guidance for selecting appropriate materials when designing portable tea sets.

Figure 9. Seven Common Material Samples for Portable Tea Sets

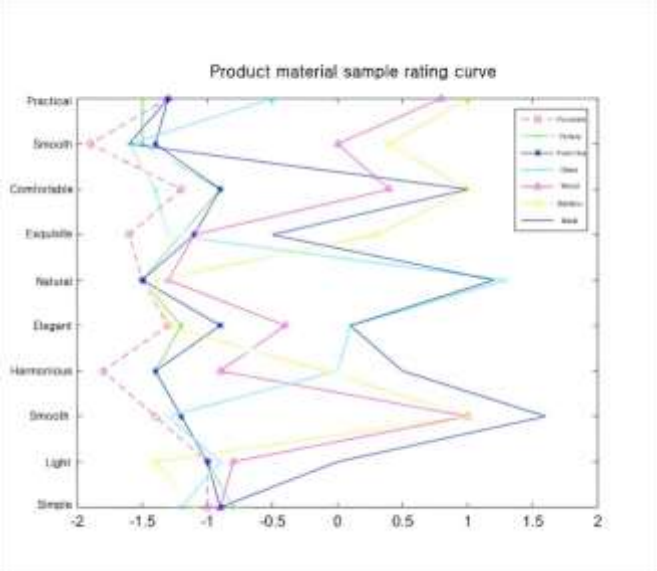

Figure 10. SD Curve of Material Samples for Portable Tea Sets

The analysis of the SD curve chart reveals how different materials meet users' emotional needs. Porcelain, pottery, and purple clay curves are in the negative value region on the left, indicating they align more closely with users' emotional expectations. In contrast, metal and bamboo curves are closer to the positive region on the right, while glass and wood curves are near the neutral region. The further the curve is in the negative value region on the left, the more the material's emotional texture aligns with users' needs. Therefore, porcelain, pottery, and purple clay materials match users' emotional needs better than metal, bamboo, glass, and wood. Particularly, porcelain shows the largest absolute value among all materials, indicating it best meets users' emotional needs. Thus, it is recommended to prioritize porcelain or pottery as the primary material in the design of portable tea sets.

This paper applies the three-level theory of user emotionalization, combined with forward-looking quantitative methods such as the Semantic Differential Method and the Analytic Hierarchy Process, to provide theoretical and methodological support for portable tea set design. First, the three-level emotionalization theory was combined with a questionnaire survey to conduct in-depth user research and construct an accurate user persona model. The CHINA-VALS questionnaire was used to explore the target user group (aged 27-44) in terms of consumption preferences, behavioral habits, lifestyle attitudes, and aesthetic perceptions.

Based on the user persona model, users' emotional needs were analyzed from three dimensions: the instinctive, behavioral, and reflective levels. These needs were translated into three design principles for portable tea sets: aesthetics, functionality, and sustainability. Based on these principles, emotional measurements of design elements were conducted, transforming affective imagery words into specific design parameters.

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The experimental part used the Semantic Differential Method and Analytic Hierarchy Process to analyze the form, structure, color, and material texture of portable tea sets. The data helped determine a design based on the concentric cup, supplemented by the structural features of the easy-brew teapot set, with a round and low-profile form, primarily in black and white, and using new ceramic as the main material. The application of this methodology not only enhanced the emotional texture of the product design but also improved the product's market adaptability and user satisfaction.

Application of Huizhou Cultural Elements in Portable Tea Set Design

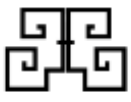
From the cultural perspective of tea sets, unique cultural elements are sought within the Huizhou regional cultural system. Based on the selected region, cultural differentiation elements are extracted, first by understanding the background knowledge of cultural elements such as regional characteristics, tea culture, historical context, folk customs, unique craftsmanship, and forms of expression. Representative elements are extracted, and symbolic graphics, keywords, and cultural imagery are drawn, combining them with the design elements of the tea set's form. For example, in the decoration patterns, form characteristics, craftsmanship, and color of the tea set, cultural elements can be found within the framework of regional cultural differences. The regional cultural system is aligned with the tea set culture system to identify corresponding cultural elements and apply them in restructured designs.

Huizhou architecture is one of the important schools of traditional Chinese architecture, with white walls and black tiles, giving an impression of simplicity and elegance. For example, a typical element of Huizhou architecture is the horse-head wall. It has a strong sense of flatness, with few windows on the outer walls, and the white walls form continuous blocks, which makes it easier to create geometric shapes of points, lines, and planes, enhancing the architectural volume and integrity.

The architectural decorations in Huizhou buildings are not only for aesthetic purposes but also serve as an important medium for Huizhou people to express their life expectations and social education. Additionally, the charm of Huizhou architecture is reflected in its details, perfectly exemplified by the Huizhou "Three Carvings.(Xinyuan Cai, 2022)"

The "Three Carvings of Huizhou" refers to three traditional Chinese folk carving techniques in Huizhou style—brick carving, stone carving, and wood carving—primarily used for decorating residences, ancestral halls, temples, and gardens. Their content is rich and varied, focusing on ethical expression and public education. The carving techniques are diverse, including line carving, shallow relief, high relief, full relief, and hollow carving. The content and technique of the carvings vary depending on the part of the building. The wood carvings are not decorated with paint but instead use the color and natural texture of high-quality wood, making the details more vivid and contributing to the exquisite nature of Huizhou's "Three Carvings. The beauty of the "Three Carvings" of Huizhou lies in their embodiment of the harmonious and opposing unity of material, form, and color, following aesthetic principles.

Table 9. Extraction of Huizhou Cultural Elements

Element name	illustration	element extraction
horse-head wall		
wood carving		

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brick carving		
stone carving		

This paper analyzes the evolution of tea set designs over different periods and the various styles available on the market today. By combining consumer survey results and examining elements such as function, material, color, and regional cultural symbols, the design direction for this study was determined.

Table 10. Design Recommendation

Design elements	Content
Function	It can meet the daily needs of tea drinking, is easy to carry, and convenient for storage and assembly.
Material	The material is a new type of ceramic, resistant to high temperatures and difficult to break.
Color	The colors are white and black.
Egional cultural symbol	The main structure adopts the design of the Huizhou horse-head wall, with detailed elements inspired by Huizhou's "Three Carvings."

This study abstracts unique architectural forms from the Huizhou region and the cultural elements of Huizhou's "Three Carvings" and applies them to tea set designs. Using semiotics to convey meaning along with deconstruction and reconstruction design methods, the portable tea set serves as a vehicle for promoting and disseminating the distinctive regional culture of Huizhou.

The entire design draws from the most iconic element of Huizhou architecture—the horse-head wall—geometrically representing it in the tea set. The handle is designed based on the typical characteristics of roof eaves, combined with an ergonomic grip. The teapot body is designed using diagonal lines of a square shape. The eaves perfectly fit over the teapot mouth, while Huizhou-style wood carvings at the corners serve as a wooden anti-scald structure, making it easier to pour tea. The overall edges feature textures of brick and stone carvings, adding detailed depth. The base incorporates horizontal lines inspired by roof tiles, providing an anti-slip function. The lid's handle mimics the dynamic, slightly upturned shape of the eaves and the texture of roof tiles. The accompanying tea strainer is designed specifically to filter tea leaves. The modular small tea cups are presented in a nested form, with the upturned eaves dynamically represented, making the interaction of drinking tea more intuitive. The sides feature anti-scald structures inspired by various forms of Huizhou's "Three Carvings," using a hollowed-out design that allows light to pass through the tea. The bottom includes a designed logo that leaves small watermark logos on the table when the cup is lifted, adding an emotional design touch. When the small cups and teapot are arranged together, they create a staggered architectural aesthetic. The design skillfully applies the structural beauty and forms of architecture to the tea set, allowing users to experience Huizhou's unique cultural heritage during their tea-drinking moments, offering a fresh user experience.

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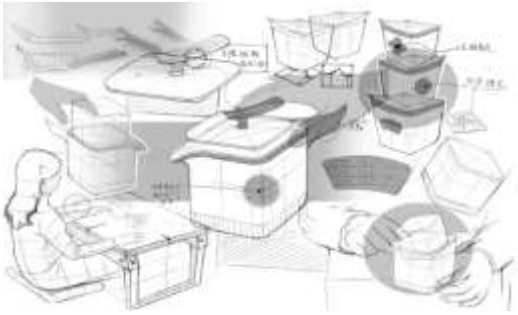

Figure 11. Design Sketch

Table 11. Description of Design Elements

Name	Design elements		
	RHINO model	Rendering	Description
Teapot			The handle is detachable, inspired by the horse-head wall element. The lid design draws from the roof eaves of Huizhou architecture.
Tea strainer—1			The protruding anti-scald structure is inspired by Huizhou stone carvings.
Cup—2			The protruding anti-scald structure is inspired by Huizhou brick carvings.
Cup—3			The protruding anti-scald structure is inspired by Huizhou wood carvings.
Material		The new ceramic material is made from high-purity synthetic inorganic compounds, processed to create a material with a fine crystalline structure. It offers unique advantages in performance, such as high temperature resistance, heat insulation, high hardness, and wear resistance.	
Color	White		C0 M0 Y0 K0
	Black		C0 M0 Y0 K100

Figure 12. Product Rendering

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Conclusion

As an essential item for tea drinking, tea sets, like tea itself, are an important part of Chinese tea culture. They are no longer just simple vessels but cultural carriers that play a crucial role in cultural inheritance. Tea sets, during their use, must not only satisfy the functional needs of tea drinking but also reflect the cultural attributes and artistic significance they embody.

This paper uses Huizhou cultural elements as design factors and approaches the analysis of current portable tea set designs through the lens of portable design methods. It is both a formal breakthrough in traditional tea-drinking methods and a small contribution to the preservation of tea culture and the promotion of regional culture. By redesigning traditional tea sets, new possibilities are provided for their usage environments.

In addition, an analysis of the different tea set types currently available on the market was conducted. Using combination design methods and principles, Huizhou regional cultural features are presented in tea set designs through elements such as form, pattern, and color. By integrating products with regional cultural elements into daily life, this conveys Huizhou's unique cultural features to the outside world, enhancing promotion. The incorporation of Huizhou cultural elements into tea sets allows for the communication of Huizhou's cultural features while enabling people to better understand, discuss, and promote Huizhou during the tea-drinking experience. It is hoped that this can also provide a new theoretical foundation for the design of products that combine other regional cultures.

Acknowledgement: This work was financially supported by the Hanseo University Research Support Project in 2024.

Institutional Review Board Statement: The study was conducted according to the guidelines of the Declaration of Helsinki, and approved by Hanseo University Institutional Review Board. (IRB-24-07-29)

Conflicts of Interest: The authors declare no conflicts of interest.

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