IDEALOGY
JOURNAL

Exploring Tea-Ware Design Strategies: A Sensibility Theory and SEM Analysis

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ABSTRACT

This paper employs structural equation modelling (SEM) to quantitatively analyse users as the research subjects in the current design of Chinese tea ware, which faces issues such as severe appearance homogenization and a lack of cultural connotation. Based on this, we integrate sensibility theory into tea ware design to arouse deep emotional resonance between users and the unique cultural attributes of tea ware. This integration aims to realize a new tea-drinking experience. Several issues related to the characteristics of tea ware contribute to establishing a hierarchical framework for tea wares. Taking the inheritance of tea-drinking culture, the reshaping of the tea-drinking experience, and the satisfaction of users' emotional needs as the starting point, quantitative methods have been employed to emphasize objective measurements and the statistical analysis of data collected through polls, questionnaires, or computational techniques (e.g., analysing pre-existing statistical data). The results highlight the influence of users' sensibility and emotional identity on design feedback and strategies throughout the process from selecting tea wares to tea drinking. The study further suggests that "to optimize the outcomes, cultural identity should be integrated with users' emotional identity, and factors influencing the design strategy should be deeply examined within the context of tea culture." However, limitations exist due to the reliance on quantitative methods.
*Keywords: Design Strategy; Sensibility Theory; Structural Equation Modelling (SEM); Tea Ware*

1 INTRODUCTION

Cultural identity is integrated with users' emotional identity to optimize the results. Within the context of tea culture, factors influencing the design strategy are analysed in depth (Wu, 2013; Yue et al., 2024). China's traditional tea-drinking culture once enjoyed an excellent global reputation for its tea wares. However, with changes in the social, economic, and cultural environment, the modern tea ware market now faces multiple challenges (Wang, 2023). Although traditional tea ware has historical advantages and brand effects, it still confronts the issue of product homogenisation. According to the market research data in Figure 1, among respondents aged 18–60 years old: 20.75% reported daily tea drinking; 3–5 times per week accounted for 23.58%; occasional and rare consumption accounted for 41.5%; and those who rarely drink accounted for 7.55%. Most daily tea drinkers are middle-aged or older adults, while the younger generation and occasional/rare drinkers make up the highest proportion. This indicates that traditional tea-drinking culture is exerting diminishing influence on younger groups and is being increasingly replaced by fast-food milk tea and coffee.
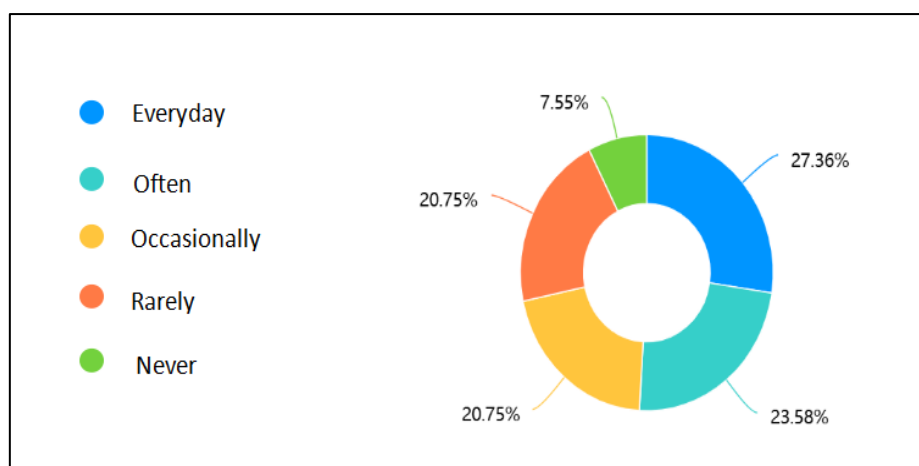
Figure 1 Frequency of users drinking tea

Changes in tea drinking habits have correspondingly impacted the market for tea ware. Awakening people's demand for tea drinking stems from two factors: tea culture being an excellent traditional Chinese culture and tea drinking benefiting human health (Du & Ayob, 2024). With the progress of material civilization, meeting the needs of diverse groups in the tea and tea ware market can better guide users to accept and love tea, making tea drinking a popular trend. Therefore, design plays an important role in reflecting users' perceptions related to tea ware (Abidin, 2008a). In this context, form creation or form-giving is essential (Abidin, 2008b).

Market tea ware designs are categorized into several types, including traditional wares with pattern changes, modern wares with traditional decorations, traditional wares with texture elements, modern wares with texture elements, and wares with glaze colour variations (Chen, 2023). Regarding tea wares in various forms, exploring users' comprehensive sensory quality experiences requires integrating the theory of sensibility to examine how different shapes, textures, colours, and patterns shape user experience (Zhongyue et al., 2024). This paper analyses and derives guiding design strategies by quantifying user perceptions. Enhancing the competitiveness of tea wares in domestic and international markets through differentiated design and brand positioning is a current challenge requiring resolution. Maintaining the essence of traditional craftsmanship while innovating designs to modernize them is a critical issue facing the tea ware market, aiming to attract young consumers and the international market (Yue et al., 2024).

This study addresses current issues in tea ware design by integrating sensibility theory and exploring design strategies at three levels: cultural imagery translation of sensibility products, innovation of tea-drinking modes through sensibility transmission, and emotional resonance between hosts and guests during sensibility experiences (Abidin, 2022). Quantitative research explores the experiences brought by different materials, glaze colours, and textures to users. Sensibility theory is applied to organize and analyse tea design strategies, serving as a foundation for integrating texture theory with cultural elements. This integration aims to awaken deep emotional resonance between users and the unique cultural attributes of tea, ultimately achieving a new tea-drinking experience that combines tea with cultural heritage (He, 2022).

2 LITERATURE REVIEW

2.1 Sensibility Theory in Product Design

Sensibility theory, originating in philosophy, emphasizes the connection between conscious experience and sensory perception (Yang et al., 2022). Product design focuses on creating emotional resonance through material selection, form cultural elements (Khalaj & Pedgley, 2019). This study demonstrated how sensibility theory guides the transformation of cultural features into modern product

design. Pan further emphasized the role of visual elements as cultural carriers in traditional product design, providing new perspectives for applying sensibility theory in tea ware design (Pan et al., 2024).

2.2 Emotional Identification and Design Strategy

Research shows that emotional identification significantly influences design strategies through cultural resonance. Zhang found that cultural identity drives innovation in creative industry product design (Zhang & Li, 2022). Alaniz and Biazzo revealed how cultural elements shape design decisions through emotional connections (Alaniz & Biazzo, 2019). In tea ware design, Chen demonstrated how emotional needs influence product development using the KANO model (Chen, 2023). Xie empirically proved the mediating role of product aesthetics in cultural design, particularly in the relationship between emotional identification and design strategy in traditional craft design (Xie et al., 2024).

2.3 Visual Elements as Design Mediators

Visual elements serve as crucial mediators between emotional identification and design strategy. Product metaphors translate cultural meanings through visual features. Xie showed how sensory elements mediate between cultural identity and design outcomes in the tea ware context (Xie et al., 2024). These studies further found that visual elements bridge cultural values with contemporary design approaches. Comi demonstrated that user experience significantly moderates cultural product perception, particularly in tea culture products (Comi et al., 2019).

2.4 User Experience in Cultural Product Design

User experience, with usage frequency as a key dimension, moderates design perception and cultural interpretation. Zhou revealed how user engagement with tea culture influences design appreciation. Wang demonstrated that user experience shapes both functional requirements and cultural interpretation in outdoor tea ware design. Wu established that user interaction frequency affects sensitivity to traditional design elements. Wang and Zhang confirmed that frequency of use directly influences cultural product appreciation, providing strong support for the moderating role of user experience in design (Wang & Zhou, 2023).

2.5 Research Gap

While existing research examines individual aspects of tea ware design, few studies have investigated the integrated relationships among emotional identification, visual elements, and design strategy. Additionally, the moderating effect of user experience on these relationships remains understudied (Siyi & Ayob, 2024). The current research addresses these gaps by proposing a comprehensive theoretical framework that examines direct, mediating, and moderating effects in tea ware design, thereby advancing both theoretical understanding and practical applications in cultural product design.

3 RESEARCH METHODOLOGY

3.1 Theoretical framework

As a sophisticated statistical methodology, SEM evaluates the relationships among observable indicators and their underlying latent constructs. Its proven effectiveness in analysing satisfaction dynamics and subsequent purchase intentions has received substantial empirical validation. In terms of product and service satisfaction, this study constructs its research model based on sensory quality theory, as illustrated in Figure 2. Visual sensibility, emotional identity, and the summarization of design points collectively influence the design strategy of tea ware. The product's shape, material, colour, texture, and pattern constitute the five dimensions of visual sensibility; cultural symbols, cultural

narratives, spiritual resonance, and cultural identity form the components of emotional identification. Users' subconscious emotional identification and their visual sensibility toward tea ware jointly inform the design reflection process, there by shaping the corresponding design strategy.
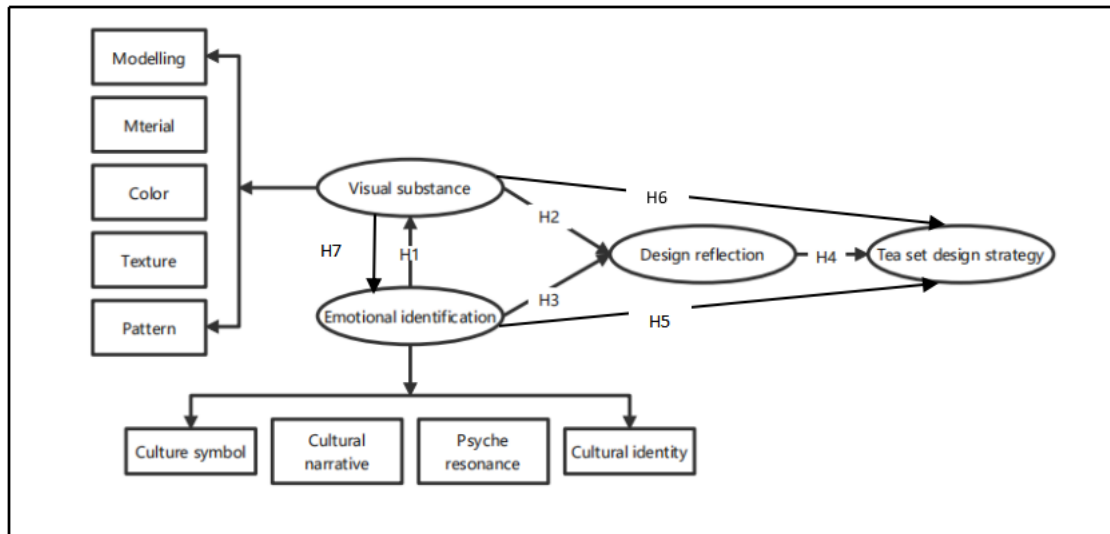
Figure 2 Research model of this study.
（Variable definitions=Visual Substance; EI=Emotional Identification=Design Reflection; DS=Tea Set Design Strategy）

3.2 Hypothetical

Based on our comprehensive literature review, we developed the following research hypotheses, as illustrated in Figure 2:

H1: Emotional identification (EI) demonstrates a positive influence on Visual substance (VS).
H2: Visual substance (VS) contributes to enhanced Design reflection (DR).
H3: Emotional identification (EI) exhibits a direct impact on Design strategy (DS).
H4: Design reflection (DR) shapes the development of Design strategy (DS).
H5: Emotional identification (EI) correlates positively with Design strategy (DS).
H6: Visual substance (VS) drives improvements in Design strategy (DS).
H7: Visual substance (VS) functions as a mediator in the relationship between Emotional identification (EI) and Design strategy (DS).

3.3 Questionnaire

Based on the data analysis results from Table 1, this study collected 226 valid questionnaires. Gender distribution indicates 53.50% male and 46.50% female respondents, maintaining a relatively balanced proportion. Age distribution is primarily concentrated in the 18–25 age group (35.80%), followed by the 26–30 age group (17.30%) and the 31–40 age group (19.90%). Education level is predominantly undergraduate degree holders (59.70%), followed by junior college degree holders (16.40%) and postgraduate or higher degrees (12.40%). Regarding drinking frequency, 3–5 times per week is the most frequent (36.30%), followed by 1–2 times per week (24.30%) and daily consumption (20.80%). Regarding style preferences, the simple modern style is the most popular (43.40%), followed by the traditional classical style (32.30%) and the creative abstract style (16.80%).

Table 1 Descriptive Statistics of Survey Respondents(N=226)

Sample	Category	Number	Percentage
Gender	Male	121	53.50%
	Female	105	46.50%
Age	Below 18 Years	8	3.50%
	18-25 Years	81	35.80%
	26-30 Years	39	17.30%
	31-40 Years	45	19.90%
	41-50 Years	20	8.80%
	51-60 Years	20	8.80%
	Above 60 Years	13	5.80%
Education	below Junior high school	4	1.80%
	Senior high school	22	9.70%
	Junior college	37	16.40%
	Undergraduate	135	59.70%
	Postgraduate and above	28	12.40%
Drinking frequency	Every day	47	20.80%
	Often (3-5 times a week)	82	36.30%
	Occasionally (1-2 times a week)	55	24.30%
	Rarely (1-2 times a month)	28	12.40%
	Almost never	14	6.20%
Favourite style	Simple modern style	98	43.40%
	Traditional classical style	73	32.30%
	Creative abstract style	38	16.80%
	Natural pastoral style	17	7.50%

3.4 Reliability Validity Analysis

Based on Table 2, the reliability analysis demonstrates strong internal consistency across all dimensions. The Cronbach's α values for DR (0.936), EI (0.899), VS (0.926), and DS (0.913) are all significantly above the 0.6 threshold. The Corrected Item-to-Total Correlations (CITC) for all items are above the 0.5 threshold, ranging from 0.757 to 0.855, indicating strong item-scale relationships. The Cronbach's α if Item Deleted values for all items are lower than the overall Cronbach's α of their respective dimensions, confirming that removing any item would reduce scale reliability. Therefore, all items should be retained without deletion, as they positively contribute to the scale's reliability.

Table 2 Reliability Analysis

Dimension	Items	Corrected Item-to-Total Correlation	Cronbach's α if Item Deleted	Cronbach's α
DR	DR1	0.805	0.925	0.936
	DR2	0.804	0.925	
	DR3	0.812	0.924	
	DR4	0.81	0.924	
	DR5	0.803	0.925	
	DR6	0.826	0.922	
EI	EI1	0.769	0.872	0.899
	EI2	0.757	0.876	
	EI3	0.783	0.866	
	EI4	0.789	0.864	
VS	VS1	0.822	0.907	0.926
	VS2	0.808	0.909	
	VS3	0.809	0.909	
	VS4	0.763	0.918	
	VS5	0.831	0.905	
DS	DS1	0.779	0.895	0.913
	DS2	0.855	0.868	
	DS3	0.797	0.889	
	DS4	0.777	0.896	

3.5 Exploratory Factor Analysis

The statistical analysis was performed using SPSS version 24.0. The results showed KMO values ranging from 0.847 to 0.93, well above the 0.5 threshold. Additionally, Bartlett's test of sphericity yielded p-values < 0.05 (approaching zero), indicating statistical significance. These robust statistical indicators demonstrate strong sampling adequacy and variable correlations, establishing a reliable foundation for subsequent factor analysis. Principal component analysis (PCA) was used to extract factors. The findings, presented in Table 3, show that the data yielded four distinct factors with eigenvalues > 1. The total explained variance exceeded 50%, indicating strong explanatory power of the extracted factors. Furthermore, the communalities of all items were > 0.5, and factor loadings exceeded 0.6, aligning with established research guidelines. In summary, this study concludes that the findings exhibit good unidimensionality.

Table 3 Exploratory Factor Analysis

Dimension	Items	KMO	Bartlett Sphere Test	Factor Loading	Commonality	Eigenvalue	Total variation explained％
VS	VS1	0.902	0	0.889	0.791	3.862	77.24%
	VS2			0.880	0.774		
	VS3			0.881	0.776		
	VS4			0.847	0.717		
	VS5			0.896	0.803		
EI	EI1	0.847	0	0.873	0.761	3.069	76.74%
	EI2			0.864	0.747		
	EI3			0.882	0.778		
	EI4			0.885	0.783		
DR	DR1	0.93	0	0.866	0.75	4.549	75.82%
	DR2			0.866	0.751		
	DR3			0.872	0.761		
	DR4			0.871	0.759		
	DR5			0.866	0.749		
	DR6			0.883	0.779		
DS	DS1	0.85	0	0.876	0.767	3.174	79.34%
	DS2			0.924	0.853		
	DS3			0.888	0.788		
	DS4			0.875	0.765		

3.6 Confirmatory Factor

Based on the confirmatory factor analysis results in Table 4, the standardized factor loadings for all items range from 0.797 to 0.91, exceeding the 0.7 threshold, indicating good convergent validity. All p-values are less than 0.001, indicating statistical significance. The Average Variance Extracted (AVE) values for all dimensions (DR=0.71, EI=0.69, VS=0.716, DS=0.728) either exceed or approach 0.7 (above the commonly accepted 0.5 threshold), demonstrating strong convergent validity. The Composite Reliability (CR) values for all dimensions (DR=0.936, EI=0.899, VS=0.926, DS=0.914) are well above 0.7, indicating excellent construct reliability of the measurement model. These results confirm the measurement model's convergent validity and composite reliability.

Table 4 Confirmatory Factor

Dimension	Items	Unstandardized Factor Loading	Standardized Factor Loading	S.E.	p-Value	AVE	CR
DR	DR1	1	0.835	-	-		
	DR2	1.072	0.836	0.069	0		
	DR3	1.07	0.845	0.068	0	0.71	0.936
	DR4	1.061	0.845	0.068	0		
	DR5	1.044	0.834	0.068	0		
	DR6	1.03	0.86	0.064	0		
EI	EI1	1	0.825	-	-		
	EI2	0.977	0.808	0.071	0	0.69	0.899
	EI3	0.997	0.842	0.068	0		
	EI4	1.039	0.848	0.07	0		
VS	VS1	1	0.86	-	-		
	VS2	1.029	0.849	0.062	0		
	VS3	1.024	0.848	0.062	0	0.716	0.926
	VS4	0.925	0.797	0.062	0		
	VS5	1.064	0.875	0.061	0		
DS	DS1	1	0.832	-	-		
	DS2	1.114	0.91	0.065	0	0.728	0.914
	DS3	0.996	0.845	0.065	0		
	DS4	0.949	0.822	0.064	0		

3.7 Differential Validity

The correlation matrix reveals significant relationships ($p < 0.01$) between all variables. All correlations are positive and moderate, ranging from 0.334 (between Emotional Identification and Design Strategy) to 0.512 (between Visual Sensibility and Design Strategy). The diagonal elements (representing latent variable reliability, with values 0.846, 0.831, 0.843, and 0.853) significantly exceed the cross-correlations between latent variables, indicating good discriminant validity.

Table 5 Square Roots of the AVES Versus Correlations.

	VS	EI	DR	DS
VS	0.846			
EI	.475**	0.831		
DR	.504**	.508**	0.843	
DS	.512**	.531**	.507**	0.853

** Correlation is significant at the 0.01 level (2-tailed).

3.8 Model Fit Degree

All model fit indices either met or significantly exceeded the commonly recommended thresholds, indicating excellent model fit. Notably, the CFI (0.99) and RMSEA (0.032) statistically demonstrate exceptional fit between the model and the data. This model is therefore appropriate for further analysis.

Table 6 Model Fit Degree

Common indices	c^2/df	RMSEA	GFI	AGFI	NFI	CFI	SRMR
Judgment criteria	<5	<0.08	>0.9	>0.9	>0.9	>0.9	<0.08
CFA Value	1.225	0.032	0.926	0.904	0.949	0.99	0.023

4 FINDINGS

This study revealed several key findings through the analysis of data from 226 valid respondents: First, regarding sample demographics, the gender distribution was relatively balanced (53.50% male, 46.50% female), with age primarily concentrated in the 18–25 years (35.80%) and 31–40 years (19.90%) age groups. Educational background was predominantly at the undergraduate level (59.70%), indicating the sample's representativeness. In terms of tea consumption frequency, users who consumed tea 3–5 times per week accounted for the highest proportion (36.30%), followed by daily consumers (20.80%), suggesting high engagement with tea culture among the respondents.

The measurement model analysis showed excellent reliability and validity, with Cronbach's α values exceeding 0.89 for all constructs, factor loadings ranging from 0.797 to 0.91, and AVE and CR values that met the required thresholds. The structural equation model exhibited excellent fit indices (χ^2/df = 1.225, RMSEA = 0.032, CFI = 0.99, GFI = 0.926), confirming the model's robustness. Regarding variable relationships, the study supported all hypotheses: Emotional Identification (EI) had significant positive effects on Visual Substance (VS), which subsequently positively influenced both Design Reflection (DR) and Design Strategy (DS), while Visual Substance acted as a significant mediator between Emotional Identification and Design Strategy.

Correlation analysis showed significant positive correlations among all variables ($p < 0.01$), with correlation coefficients ranging from moderate (0.334 for EI-DS) to relatively strong (0.512 for VS-DS). Regarding user preferences, simple modern style (43.40%) and traditional classical style (32.30%) were the most preferred, suggesting the need for tea ware design strategies that balance traditional cultural elements with contemporary aesthetic demands. These findings not only support the effectiveness of the theoretical framework but also offer valuable practical insights for tea ware design and manufacturing, highlighting the importance of preserving cultural connotations while adapting to contemporary consumer preferences, and strengthening design strategies through the integration of visual elements and emotional identification.

5 CONCLUSIONS

This study employed structural equation modelling (SEM) to investigate tea ware design, identifying significant relationships among emotional identification, visual substance, design reflection, and design strategy. These findings contribute theoretically by empirically validating the mediating role of visual substance between emotional identification and design strategy, as supported by robust model fit indices (CFI = 0.99, RMSEA = 0.032). This research extends sensibility theory to product design, offering practical implications for manufacturers and designers. Demographic analysis reveals a large proportion of young consumers (35.80% aged 18–25), with preferences leaning toward simple modern design styles (43.40%), indicating opportunities for innovative designs that balance tradition and modernity. The strong reliability of the measurement model (all Cronbach's α > 0.89) provides a robust foundation for product development.

Despite limitations in sample diversity—predominantly undergraduate respondents (59.70%)—this research demonstrates that successful tea ware design requires the integration of cultural heritage with contemporary design principles. Future research avenues include cross-cultural perspectives, sustainable design practices, the impact of digital technology, and the influence of social media on tea ware preferences (Li et al., 2024). These findings underscore that manufacturers and designers need to maintain a delicate balance between preserving cultural authenticity and meeting contemporary consumer preferences to develop resonant products in the evolving tea ware market.

ACKNOWLEDGEMENT

FUNDING

AUTHOR CONTRIBUTION

All authors played equal contributions towards the production of this paper.

CONFLICT OF INTEREST

The authors declare no potential conflict of interest with respect to the research authorship, and/or publication of this article.

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