

Application of Symbolic Language and Pattern Innovation of Chaoshan Peach Cake Mold in Paper Packaging Design

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To explore the symbolic language of the Chaoshan peach cake mold and its innovative applications in modern design, the material form and cultural connotations of the mold patterns were analyzed from a semiotic perspective. Through a symbolic language of the primary pattern elements, the essence of the traditional culture they embody was revealed. Building on this analysis, the generative rules of shape grammar were applied to creatively reinterpret and recombine these traditional pattern elements, resulting in a set of innovative designs that retain the essence of traditional culture while incorporating modern design aesthetics. Furthermore, these innovative patterns were implemented in paper packaging design, and their effectiveness was validated through product evaluation. Through an in-depth exploration and innovative application of the symbolic language of the Chaoshan peach cake mold, a successful fusion of traditional cultural symbols and contemporary design concepts was achieved. This approach provides a new pathway for the inheritance and innovation of Chaoshan peach cake mold culture and offers insights into the modern transformation of other traditional cultures.

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INTRODUCTION

The Chaoshan region is situated on the southeastern coast of Guangdong Province China, at the intersection of Fujian and Guangdong. Its unique geographical location and natural environment have fostered a rich and vibrant local folk culture. The peach cake mold, an important symbol of this folk culture, not only reflects the region's distinctive natural environment and belief systems but also encapsulates the wisdom and aesthetic values of the Chaoshan people.

As one of the most representative traditional snacks in the region, the peach cake mold plays a significant role in the daily life of the Chaoshan people and serves as an essential offering during festivals and rituals (Zhao 2022). The peach cake mold is not only a practical tool for making red peach cake but also an important symbol and physical embodiment of the cultural characteristics of Chaoshan. It reflects the long history and rich cultural heritage of the Chaoshan area while showcasing the local people's wisdom and aesthetic sensibilities (Ou *et al.* 2020).

Traditionally, each peach cake mold is crafted from wood and intricately carved with auspicious characters and floral patterns using a hand-operated knife. This process represents a unique traditional craft within the wood carving art of Chaoshan (Yao 2019). However, modernization poses significant challenges to both the traditional peach cake mold and the cultural significance it embodies. The widespread use of plastic molds has contributed to the decline of traditional wooden peach cake molds, resulting in a loss of this cultural artifact. Unfortunately, the younger generation's awareness and appreciation of traditional peach cake molds are diminishing. To address this situation, efforts are being made to analyze the Symbolic Language of peach cake mold patterns and innovate new designs. This exploration aims to integrate traditional cultural elements with modern packaging design concepts, thereby revitalizing the cultural heritage and promoting the development of peach cake molds.

In this context, the application of semiotic theory and design principles is particularly important. Semiotics in design not only conveys information but also influences the audience's emotional response. By establishing new semiotic ontologies and affective evaluations, designers can ensure that the emotions conveyed by visual works are consistent with their symbolic meanings (Chowdhury and Varala 2023). The semiotic analysis framework in multimodal works helps to reveal the complex relationships between visual and textual elements, which is crucial for the coordinated transmission of cultural connotations and brand information through patterns, text, and other elements in packaging design (Serafini and Reid 2024). In interface design, applying semiotics is essential for creating and evaluating intuitive symbols that bridge communication between designers or systems and users, directly impacting user experience through their intuitiveness and comprehensibility (Islam *et al.* 2020). Similarly, in the packaging design of peach cake molds, symbols should be intuitive and culturally relevant, enabling consumers to quickly understand the product's characteristics and value.

Moreover, traditional artistic symbols can enhance cultural exchange and artistic innovation in packaging design. Incorporating traditional artistic symbols such as Chinese calligraphy into packaging design can elevate the product's cultural value and meet consumers' needs for cultural experiences (Zhang and Ghazali 2023). Hu (2020) illustrates that translating traditional Chinese symbols into contemporary visual communication design not only aids in preserving cultural identity but also enriches the visual appeal of packaging design. Research shows that integrating traditional ink art elements into modern packaging design can enhance the cultural connotation of products (Xu 2023). Applying regional cultural features to product packaging design helps to improve the uniqueness of traditional food packaging and consumer satisfaction, highlighting local characteristics and strengthening consumers' recognition of the product (Ba *et al.* 2024). Chen and Sharudin (2024) emphasize that integrating traditional symbols with modern product design can achieve innovative design while maintaining cultural heritage, providing valuable strategies for cultural inheritance and innovation. Emotional design in cultural and creative products influences consumers' preferences and purchase intentions. Understanding the cognitive differences between design professionals and consumers aids in creating more attractive packaging designs that meet consumers' emotional needs (Yu *et al.* 2022).

Exploring the application of symbolic language and pattern innovation in the paper packaging design of peach cake molds involves merging Chaoshan's unique cultural elements with modern design concepts. This integration not only helps to protect and inherit culture but also satisfies modern consumers' aesthetic and emotional needs, achieving a win-win situation for both cultural value and market value.

RESEARCH BASIS AND METHODOLOGY

Innovative Research Framework Ideas for Peach Cake Molds

After exploring the styles and patterns of Chaoshan peach cake mold prints, their characteristics were examined in depth. Through preliminary screening, original patterns with cultural significance were identified, as well as its symbolic language, followed by an examination of its material form and cultural connotation. Representative primitive patterns were extracted from these designs. By applying the principles of shape grammar, these primitive pattern elements were creatively reorganized to derive basic patterns. Through regeneration and deduction, a new peach cake mold pattern was created. This new design not only embodies rich historical and cultural values but also reflects distinctive characteristics of contemporary times. Additionally, it serves as a reference for the modernization and transformation of other traditional crafts (Fig. 1).

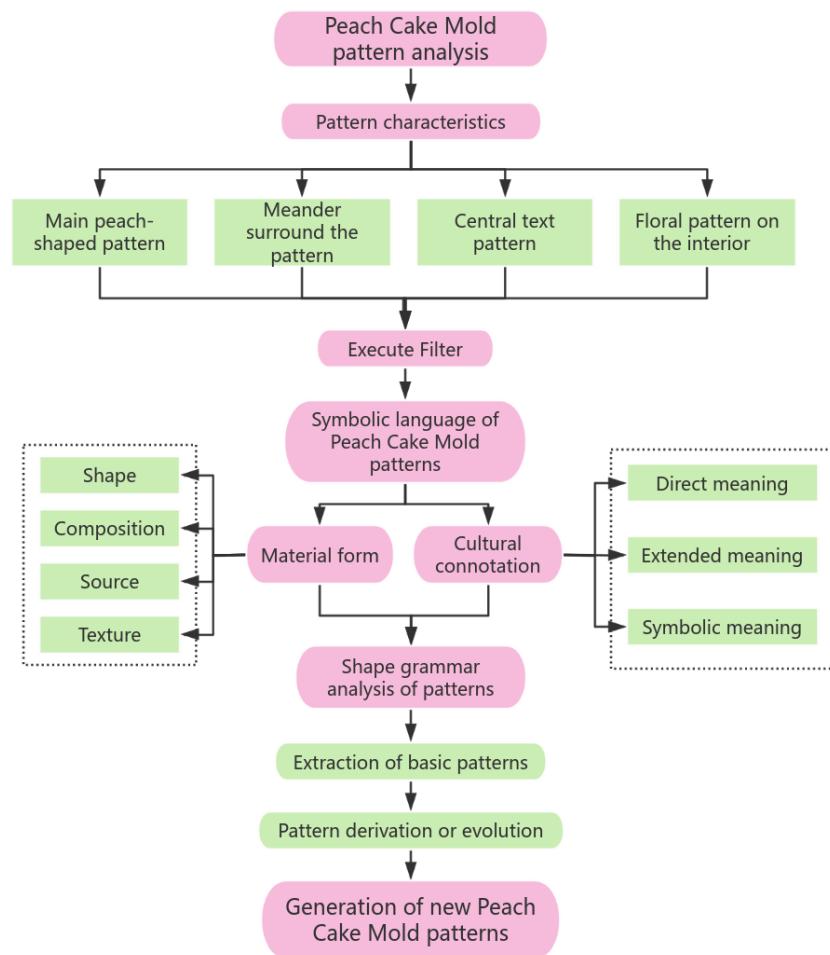


Fig. 1. Innovative research ideas for peach cake mold patterns

Peach Cake Mold Style

The production of peach cake molds involves the use of specialized molds. As a traditional handicraft that highlights the cultural characteristics of the Chaoshan region, the peach cake mold combines ancient woodblock printing techniques with folk woodcarving methods, resulting in a distinctive artistic style (Du and Wang 2015). Analyzing and

categorizing numerous Chaoshan Cake Molds reveals four main styles:

1. Single-sided Cake Molds with Handles: This is the most traditional style, utilizing a rectangular block of wood with handles as a base. A peach-shaped pattern is deeply carved into the wood as the central design.
2. Double-compartment Cake Molds without Handles: These molds feature two juxtaposed designs engraved on the same face of a rectangular block of wood. The upper and lower molds can showcase a variety of peach shapes in different sizes.
3. Double-sided Cake Molds with Handles: This style is adorned with a deep-relief peach-shaped seal on the front and a light-relief circular seal on the back, making it a clever dual-purpose vessel.
4. Multi-compartment Cake Molds without Handles: These molds are smaller in size and consist of a combination of three or more designs (Fig. 2).



Fig. 2. Peach cake mold style

Peach Cake Mold Pattern Analysis

The Chaoshan peach cake mold features a peach-shaped outline as its primary design, incorporating elements such as encircling patterns, text motifs, and internal floral designs to create a visually appealing and symbolically rich pattern system (Wang 2023). Each component of the pattern holds specific significance, both visually and in terms of cultural connotation (Fig. 3).

The essence of the peach cake mold design is its main peach-shaped pattern, featuring a simplified and abstract outline with slightly tilted lines, creating a full and dynamic form. This design not only provides a unique visual experience but also establishes a profound connection between its distinct visual appearance and its cultural significance within traditional Chinese culture.

Surrounding the main peach patterns are intricate patterns that play a crucial role in the overall composition of the mold. These patterns include meander, botanical, triangular, cloud, thunder, and diagonal (leaf vein) patterns. The meander pattern is inspired by traditional designs, while botanical patterns, such as local rui grass and pomegranate flowers, add depth and richness to the composition. The use of geometric patterns may be connected to the totemic traditions of the Chaoshan region. Together, these elements enhance the visual appeal of the peach cake mold and showcase refined and diverse craftsmanship.

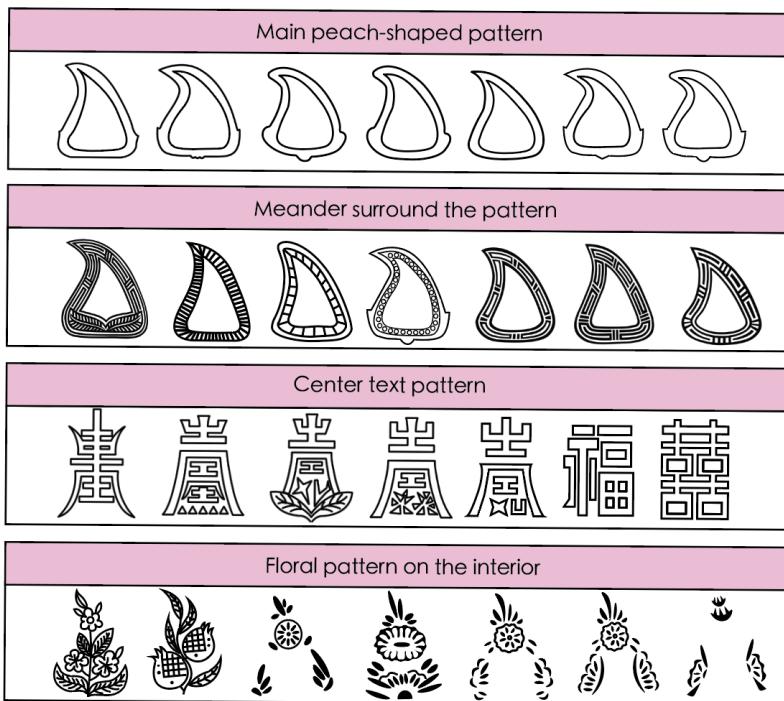


Fig. 3. Common patterns for peach cake molds

At the center of the peach cake mold, text patterns are typically inscribed in ancient seal script, with “寿” (longevity) being the most common character. Some designs also incorporate other auspicious characters such as “福” (fortune) or “囍” (double happiness), adding decorative and unique qualities to the mold, where the textual elements harmonize with the overall motif.

In the interior design of the peach cake mold, auspicious floral motifs are thoughtfully arranged, regardless of whether text is included. Floral patterns like peach blossoms, plum blossoms, pomegranate blossoms, and peach leaves are carefully selected and positioned, further enriching the mold's aesthetic and creating a refined and layered visual effect.

An Analysis of Peach Cake Mold from a Symbolic Language Perspective

Semiotics encompasses a wide range of study, focusing on the nature, characteristics, and meanings of symbols, as well as the relationship between symbols and human beings (Viol *et al.* 2023). In design, it is employed to examine the connections between symbols and culture, enabling designers to effectively communicate the core values of a brand or culture (Gu *et al.* 2020). These concepts were introduced by the Swiss linguist Ferdinand de Saussure, who laid the theoretical foundation for semiotics (Mo 2023). Saussure emphasized that the meaning of symbols arises from the differences and relationships between them, rather than from the inherent properties of the symbols themselves. The meaning of a symbol is contingent upon its position within the entire sign system and its relationship with other symbols. Consequently, the study of symbol meaning necessitates situating them within specific linguistic and cultural contexts, exploring the associations between signifiers and signifieds, as well as the differences and combinatorial

relationships among symbols (Yang 2023). In the peach cake mold, the “signifier” denotes the material form of the pattern, while the “signified” embodies the cultural connotations associated with these symbols. Formulas (1) to (5) illustrate the mapping relationship between material form and cultural connotation. This mapping makes it possible to clearly understand how the cultural significance of each pattern is expressed and communicated through its material form.

Analyzing the peach cake mold pattern can focus on both its material form and cultural connotation. Let T represent the visual symbol system of the peach cake mold pattern, and its material form set is illustrated in Eq. 1,

$$Sr(T) = \{sr_1, sr_2, \dots, sr_n\} \quad (1)$$

where $sr_i \in Sr(T)$ indicates a specific material form of the peach cake mold pattern, encompassing elements such as shape, composition, source, and texture.

The set of cultural connotations is represented in Eq. 2,

$$Sd(T) = \{sd_1, sd_2, \dots, sd_n\} \quad (2)$$

where $sd_j \in Sd(T)$ indicates a specific cultural connotation of the peach cake mold pattern, including its direct meaning, derivation, symbolism, and more.

The relationship between physical form and cultural connotation is illustrated in Eq. 3,

$$R(T) \subseteq Sr(T) \times Sd(T) \quad (3)$$

where $(sr_i, sd_j) \in R(T)$ indicates that there is some association between sr_i and sd_j .

The mapping function that defines the physical form to the cultural connotation is shown in Eq. 4,

$$f: Sr(T) \rightarrow P(Sd(T)) \quad (4)$$

where $P(Sd(T))$ denotes the power set of $Sd(T)$ for any $sr_i \in Sr(T)$

$$f(sr_i) = \{sd_j \in Sd(T) | (sr_i, sd_j) \in R(T)\}$$

The mapping function that defines the cultural connotation to the physical form is shown in Eq. 5,

$$g: Sd(T) \rightarrow P(Sr(T)) \quad (5)$$

where $P(Sr(T))$ denotes the power set of $Sr(T)$, for any $sd_j \in Sd(T)$,

$$g(sd_j) = \{sr_i \in Sr(T) | (sr_i, sd_j) \in R(T)\};$$

The definitions of functions f and g reveal the complex relationship between material forms and cultural connotations in T : for any $sr_i \in Sr(T)$, $|f(sr_i)| > 1$ denotes that sr_i is polysemous; for any $sd_j \in Sd(T)$, $|g(sd_j)| > 1$ denotes the existence of multiple cultural connotations mapped to sd_j , reflecting tautology. In addition, the mapping relation $R(T)$ may vary with cultural context C and time t and can be expressed as $R(T, C, t)$.

Through the aforementioned theories and formulas, the structure and properties of peach cake mold patterns, as a visual symbol system, can be described with greater precision. This analysis reveals the polysemy, synonymy, and dynamic relationships between the signifier and the signified. It establishes a theoretical foundation for a comprehensive discussion of the unique significance of peach cake mold patterns within the context of Chaoshan culture.

Screening Analysis of Peach Cake Mold Print Symbols

The peach cake mold patterns derive their significance from associations deeply rooted in Chaoshan culture. Influenced by the region's unique geography, historical background, and rich folklore traditions, the symbolic language of these molds require interpretation within this specific cultural context. It is essential to explore the relationship between the signifier and the signified to uncover their deeper cultural connotations (Hu 2024).

In conducting research on cultural symbolic language, the most representative patterns were selected from commonly used peach cake mold designs through surveys and expert interviews. These pattern elements are not only widely utilized in Chaoshan peach cake molds but are also considered iconic symbols that best represent the cultural essence of the region. Through in-depth analysis and interpretation of the cultural semantic structures of these core patterns, a more comprehensive understanding of the rich cultural connotations embodied in the Chaoshan peach cake mold can be attained.

Table 1. Morphological Analysis of Peach Cake Mold Substances

Pattern Element	Shape	Composition	Source	Texture
	Abstract peach-shaped outline, slightly tilted, full form	Serves as the main pattern, primary outline	Auspicious plants and flowers from nature	Smooth, round
	Meander curve surrounding the main element, geometric and simple	Surrounds the main pattern, creating a sense of enclosure	Traditional meander pattern	Smooth, distinct, flowing lines
	Ancient seal script "寿" (longevity), calligraphic style, neat and dignified	Typically placed in the center, serving as the focal point	Ancient Chinese script	Clear and bold strokes
	Pomegranate flower shape, detailed, rich, and lively	Used as an embellishment, placed around the text or as the main theme	Auspicious plants and flowers from nature	Dense and intricate

As a distinctive symbolic system, peach cake mold patterns are represented by various designs carved into the mold. These patterns form the material expression of peach cake mold designs through diverse methods of shapes, compositions, sources, and textures. The design of each pattern encapsulates the wisdom and aesthetic sensibilities of the ancestors of Chaoshan, reflecting their profound understanding and appreciation of the natural environment and social life, as shown in Table 1.

By analyzing the various aspects of cultural connotations, the meaning of peach cake mold motifs can be comprehensively understood, along with their manifestations and roles at different levels, including direct, extended, and symbolic meanings. Direct meaning refers to the concepts or objects explicitly represented by the pattern; extended meaning pertains to the extended interpretations that arise from the pattern within a specific cultural context; and symbolic meaning encompasses the abstract concepts and values associated with the pattern. This multi-dimensional analysis fosters a deeper appreciation

of the peach cake mold pattern as a unique cultural symbol, reveals the aesthetic interests and values it embodies, and explores its inheritance and evolution within Chaoshan folk culture, as shown in Table 2.

Table 2. Analysis of the Cultural Connotations of Peach Cake Molds

Pattern Element	Direct Meaning	Extended Meaning	Symbolic Meaning
	Directly related to the peach tree and peach fruit	Health, longevity and renewal	Vitality, eternity, prosperity and protection
	Meander curve surrounding is common in traditional Chinese decoration, which means continuous	Family continuation and reunion	Infinity and cycle, the endless nature and the inheritance of life
	The literal meaning of “寿” (longevity)	Meaning of blessing and celebration	Pursuing the ideal of health, longevity and the dignity of life
	Directly associated with pomegranate flowers and fruit	Pomegranates with many seeds represent many children and a prosperous family.	Blessings for the reproduction of life and prosperity of the family

Peach Cake Mold Print Symbol Mapping Relationships

The mapping relationship shows the close association between different visual elements and symbolic language in peach cake mold patterns, and by skillfully combining the material form with cultural connotation, traditional patterns convey rich cultural information and aesthetic value (Liu 2024). Within the theoretical framework of semiotics, a systematic analysis of the cultural symbols represented in the peach cake mold patterns can reveal the profound cultural connotations and wisdom contained therein. For example, the combination of pomegranate flower and the pattern of the refrain reflects the mapping relationship from $sr_i \in Sr(T)$ to $sd_j \in Sd(T)$, where sr_i includes the shape, composition and texture of the pomegranate flower and the pattern, and sd_j includes the cultural connotations such as having many children and good fortune, having a prosperous family, and having endless life, etc. Through the mapping relationship $R(T)$, the leap from material form to symbolic language is realized. The pomegranate flower symbolizes fruitfulness and good fortune, while the pattern symbolizes the endlessness of life. The combination of the two expresses the continuity and endlessness of life in the cycle.

The comprehensive mapping of the peach shape with the meander pattern, the character for “寿” (longevity), and the pomegranate flower reflects the situation of $|g(sd_j)| > 1$, i.e., different signifiers (peach shape, longevity, pomegranate flower, and meander pattern) are mapped to the associated signifiers (longevity, many children, many blessings, family prosperity, and unending life), which shows the complementarity and integration of the culture's semantics. The peach shape symbolizes longevity, while the character for “寿” (longevity) directly expresses longevity, and the combination of the two emphasizes health and longevity as the core pursuit of life; and the pomegranate flower symbolizes many children and good fortune, which echoes the character for “寿” (longevity) and the peach shape, and together expresses the good wishes for the prosperity of the family,

and longevity. The meander pattern encircles the entire design, symbolizing eternal life and complementing the various elements. It further enriches the cultural expression of the symbolic system.

The use scenarios of peach cake mold and people's cultural perceptions change over time, resulting in a dynamically evolving cultural context C . In different contexts, people's interpretation and experience of the material form of peach cake mold patterns also change. This reflects the fact that the mapping relationship changes with the cultural context, which can be expressed as $R(T, C, t)$. For example, the auspicious symbolism of peach cake mold pattern is more prominent in the festival and ritual contexts, while its cultural identity as a regional specialty food is more prominent in the modern daily contexts. Through this dynamic context mapping, the peach cake mold patterns continues to enhance its cultural significance across various cultural contexts, effectively bridging the gap between tradition and modernity.

RESULTS AND DISCUSSION

Application of Shape Grammar in Peach Cake Mold Printing

Through the analysis of the symbols found in Peach Cake Mold patterns, the relationship between their material form and cultural connotation is thoroughly deconstructed. This process reveals the rich symbolic language embedded within the peach cake mold. Various elements convey distinct meanings and values, which are further innovated through shape grammar, preserving the cultural essence while infusing modern creativity. By combining shape grammar with the cultural-semantic structure of peach cake mold patterns, designers can develop a new visual language that enables the exploration of innovative variations and combinations of patterns, all while maintaining cultural continuity. This approach results in pattern designs that harmoniously blend traditional and contemporary elements.

Shape grammar is a rule-based design method that generates complex and intricate patterns with fractal characteristics by recursively applying a set of predefined geometric transformation rules to an initial shape (Su *et al.* 2023). By combining shape grammar with the cultural semantic structure of peach cake mold patterns, designers can develop a new visual language that enables the exploration of innovative variants and combinations of patterns while preserving cultural continuity. This approach results in pattern designs that are both traditional and contemporary (Wang and Ma 2023).

After deconstructing the peach cake mold pattern in terms of symbolic language, a quaternion is first defined to apply the shape grammar, as shown in Eq. 6,

$$SG = (S, L, R, I) \quad (6)$$

where S is the abstraction of the elements of Middle Sr (T) (e.g., peach, meander pattern, “寿” (longevity) character, pomegranate, *etc.*) into a set of basic shapes; $L = \{l_1, l_2, \dots, l_m\}$ is a finite set of non-terminal symbols, (e.g., A, B, C, *etc.*); R is the definition of a set of shape transformation rules based on the mapping relations in $R(T)$ that enable the generation of new variations of shapes while preserving the cultural semantics, $R = \{r_1, r_2, \dots, r_k\}$ is a finite set of transformation rules (e.g., A \rightarrow Circle, B \rightarrow square, A \rightarrow A + B, *etc.*), and I is an initial shape (e.g. A).

The shape grammar SG generates a sequence of shapes $\{s_1, s_2, \dots, s_n\}$ by recursively

applying the transformation rules R to the initial shapes I , where $s_0 = I$ and for each i , $s_i = r(s_{i-1})$ for some $r \in R$.

The transformation rules include additions, deletions, scaling, mirroring, rotations, translations, substitutions, miscuts, and Bézier curves (Fig. 4). By repeatedly applying these transformation rules in various sequences and with different parameters, highly colorful, symmetrical, and orderly fractal patterns can be recursively generated from simple initial shapes (Zhang *et al.* 2023). During the generation process, elements featuring patterns from the Chaoshan peach cake mold are continuously incorporated, enhancing the designs with distinctive Chaoshan characteristics and cultural connotations.

Using shape grammar for parametric generative design, designers can rapidly create and preview a wide array of Chaoshan peach cake mold pattern schemes on computers. By adjusting the order of transformation rules and geometric parameters, they can explore various possibilities within the design space, ultimately selecting the most innovative and aesthetically pleasing patterns. This cutting-edge approach not only preserves the cultural heritage of Chaoshan peach cake mold but also infuses it with new design concepts and aesthetic expressions, revitalizing its significance and appeal.

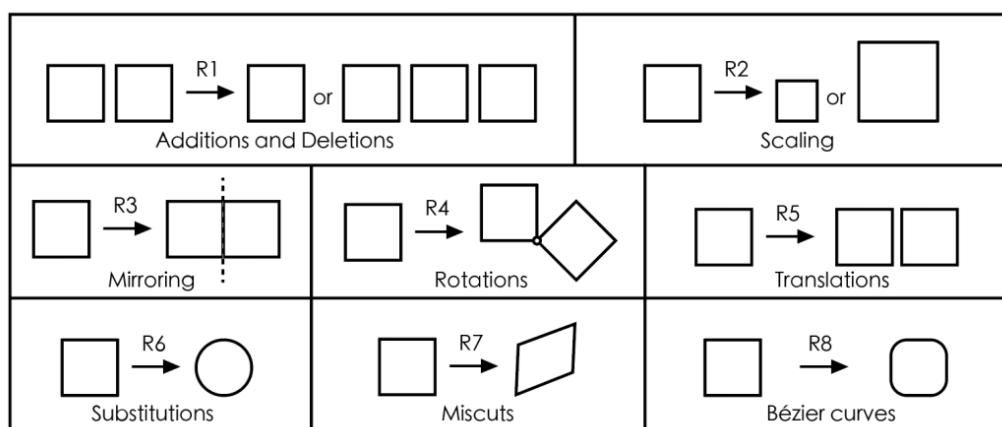


Fig. 4. Shape grammar derivation rules

Initial Pattern Shape Extraction for Peach Cake Mold Printing

The tattoo image files were initially imported into Adobe Illustrator for design and analysis. Using the pen and bending tools in Illustrator, the author manually drew the main peach-shaped pattern, the meander surrounding the pattern, the central “寿” (longevity) motif, and the inner pomegranate floral design. The manually drawn shapes were then meticulously adjusted and optimized to eliminate unnecessary anchor points and paths, enhancing both the accuracy and visual simplicity of the designs. The most representative and essential components were extracted from the optimized design to serve as the foundational shapes for the shape grammar derivation, which will inform subsequent design renditions (Fig. 5).

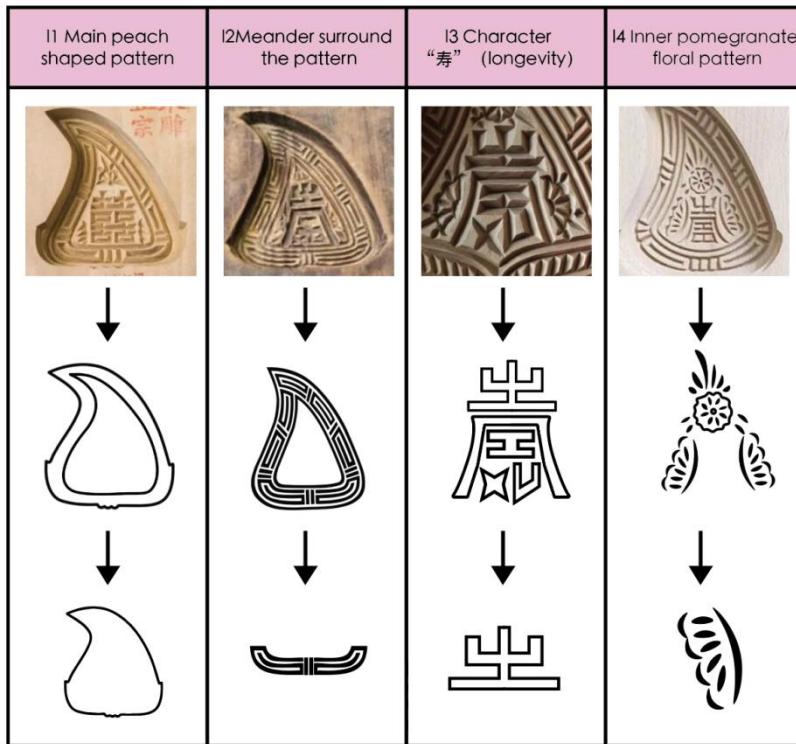


Fig. 5. Initial pattern shape extraction for peach cake mold printing

Derivation of Peach Cake Mold Patterns

The initial shapes, which include the main peach pattern, the meander pattern with a surround, the central text pattern featuring the character “寿” (longevity), and the pomegranate flower interior embellished with floral designs, serve as a foundation for generating a set of complex and aesthetically pleasing innovative patterns through Shape Grammar transformation rules. In Deduction 1, a flower-like symmetrical pattern is developed by applying transformation rules such as rotations (R4), mirroring (R3), rotations (R4), and additions and deletions (R1) based on the main peach-shaped pattern. In Deduction 2, a symmetrical woven texture pattern gradually evolves from the Meander pattern with a peach-shaped surround by utilizing mirroring (R3), rotations (R4), and additions and deletions (R1) transformations.

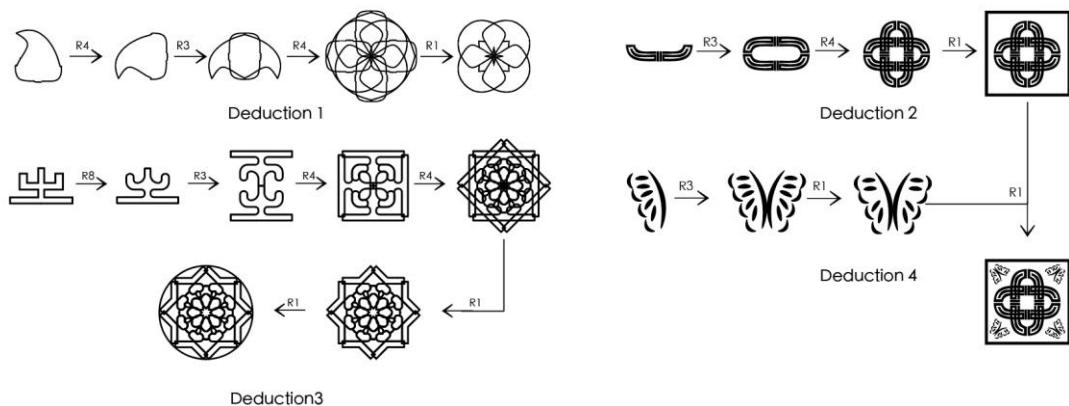


Fig. 6. Peach cake mold pattern deduction process

During Deduction 3, a geometric floral texture pattern is created using Bézier curves (R8), mirroring (R3), rotations (R4), and additions and deletions (R1) transformations, all based on the central text pattern of the character “寿” (longevity). In Deduction 4, a butterfly-shaped pattern is gradually formed through mirroring (R3) and additions and deletions (R1) transformations, starting from the flower and grass pattern embellished within the pomegranate flower. The new patterns obtained from Deduction 2 and 4 are merged using additions and deletions (R1) to create a completely new design. This innovative pattern not only preserves the relationship between the pomegranate flower and the Meander pattern mapping but also integrates elements of modern design, showcasing a unique aesthetic charm (Fig. 6).

Peach Cake Mold Color Extraction

When selecting colors, the representative hues of the peach cake mold and red peach cakes were chosen to establish the primary color scheme of the design, fostering a soft and warm atmosphere. These selected colors are applied to the patterns of the peach cake mold, revitalizing traditional designs and enhancing their visual depth and complexity. This design approach not only creates a striking visual pattern but also conveys cultural messages and values, serving as a bridge that connects the past with the future, thereby preserving cultural heritage and symbolic significance. This design reflects both a respect for and an inheritance of traditional culture, while also showcasing the potential for innovation and modern expression (Fig. 7).



Fig. 7. Color matching design of Peach Cake Mold pattern

Design Practice and Evaluation of New Patterns of Peach Cake Mold

Design practice

In the innovative design of peach cake molds, analysis of the symbolic language of elements includes the peach shape, the “寿” (longevity) character, meander patterns, and pomegranate flowers. These elements carry profound cultural connotations, symbolizing

good fortune, longevity, and prosperity. This cultural essence is expressed through the combination of physical forms and spiritual symbols. In actual design practice, these classic elements were systematically analyzed and refined. By employing design methods like shape grammar, gradually transformed cultural elements into modern design symbols, achieving an innovative interpretation of traditional culture.

Specifically, the design centers on the peach shape, using geometric processing, rotation, and mirroring—rules of shape grammar—to enhance its modern aesthetic while retaining the cultural implication of eternal longevity. The meander pattern encircles the peach shape, symbolizing generational inheritance and infinite cycles. Through mirroring and rotational combinations, it reflects the fusion of tradition and modernity. The “寿” character has been evolved using shape grammar to form novel patterns, conveying blessings of health and longevity. The combination of pomegranate flowers and meander patterns symbolizes prosperity, further enriching the design’s cultural connotations. Through these design steps, traditional symbols are deconstructed, reorganized, and innovated, endowing paper food packaging with deeper cultural meaning and visual appeal.

It is worth mentioning that traditional peach cake packaging primarily uses multi-layer plastic materials, which are neither environmentally friendly nor aesthetically appealing (Fig. 8). These conventional designs, while adhering to basic protective functions, often rely on simple patterns and colors that lack visual impact and depth in conveying cultural symbols, making it difficult to evoke emotional resonance among consumers.



Fig. 8. The current design of the peach cake mold packaging

Additionally, some designs are overly literal, presenting cultural symbols in a way that lacks subtlety and fails to engage viewers on a deeper level, diminishing their allure and complexity. This direct approach, combined with outdated aesthetics, results in packaging that may not appeal to younger generations and struggles to capture their interest. Furthermore, the use of non-biodegradable materials raises environmental concerns, conflicting with the expectations of modern consumers for sustainable products. In response, innovative peach cake mold patterns were applied to paper-based packaging that utilizes renewable raw materials. This eco-friendly design is highly biodegradable, capable of decomposing under suitable conditions, thereby reducing solid waste and minimizing environmental impact. The inner layer of the paper-based packaging includes a PLA biodegradable film, effectively preventing moisture entry and extending the food’s freshness. This combination of functionality and sustainability allows brands to demonstrate their commitment to eco-friendly practices while maintaining high product quality, aligning with contemporary consumer values.

Integrating innovative peach cake mold patterns—combining peach shapes, meander patterns, the “寿” character, and pomegranate flowers—into paper packaging

design not only retains the patterns' overall symbolism and cultural connotations but also provides unique competitive advantages for the brand, promoting sustainable development within the industry. Such design allows traditional culture to merge into modern life in a practical and artistic form, finding the ideal balance between functionality and aesthetics. The innovative peach cake mold patterns not only add fashion elements but also become a symbol of consumers' respect and recognition of traditional culture. The practical application of innovative design can stimulate the public's attention and love for traditional culture, injecting new vitality into it (Fig. 9).



Fig. 9. Innovative design of peach cake mold patterns on paper packaging

Product evaluation

To assess whether the innovative designs of the Chaoshan peach cake mold patterns and paper packaging align with cultural heritage and practical value, 80 participants from various backgrounds were invited to participate in the evaluation (Table 3). This group comprised 30 local Chaoshan residents, 10 experts in peach cake mold design, 30 non-local tourists, and 10 design students. The participants hailed from a range of cultural and professional backgrounds, including designers and cultural scholars with significant expertise and practical experience, enabling them to evaluate the product's design innovation and cultural transmission value from a professional perspective. Ordinary consumers provided insights into market demand and general aesthetic feedback. The incorporation of a diverse audience ensured that the evaluation results were comprehensive and representative.

The assessment was conducted using a professional questionnaire that evaluated the product across five dimensions: overall innovation, cultural content transmission, practicality, aesthetic appeal, and purchase intent, with each dimension rated on a scale of 1 to 5. Clear target standards were established: an average score of ≥ 4.5 in each dimension, a total average score of ≥ 4.6 , and a standard deviation of ≤ 0.5 . Additionally, in-depth interviews were conducted to gather extensive feedback and suggestions from the participants, ensuring a more comprehensive and detailed evaluation of the results.

The results indicated that the innovative Chaoshan peach cake mold packaging performed exceptionally well across three dimensions: overall innovation, cultural content transmission, and aesthetic appeal, with average scores reaching or exceeding 4.5 points, thereby fully meeting the expected goals. Although the scores for practicality (4.38) and purchase intent (4.44) were slightly below the 4.5 target, the differences were minimal. The overall average score was 4.53, close to the 4.6 target, and the standard deviation was 0.16, significantly lower than the 0.5 benchmark, indicating minimal variation in participants' evaluations. The product received widespread recognition (Table 4).

Feedback was gathered through in-depth interviews to gain deeper insights into participant perceptions. Many participants expressed strong appreciation for the innovative packaging design:

Firstly, participants universally acknowledged the enhanced aesthetic appeal of the new packaging. Many observed that the fusion of traditional peach cake mold patterns with modern design elements created a visually striking product that aligns well with contemporary tastes. For example, local Chaoshan residents appreciated how the new design preserves cultural heritage while appealing to younger generations. One resident noted that the packaging "beautifully combines our traditional patterns with modern aesthetics," making it more attractive to a broader audience.

Secondly, the new packaging significantly improved the transmission of cultural content. Participants felt that the inclusion of traditional motifs not only preserved but also celebrated Chaoshan culture. Non-local tourists expressed that the new design made them feel more connected to the local culture, enriching their overall experience. Experts highlighted that this approach effectively transforms the packaging into a "cultural ambassador," promoting regional heritage beyond its immediate context. One expert noted, "By capturing the essence of Chaoshan's cultural symbols, the packaging appeals to consumers and educates them on our heritage, enhancing the value of the product."

Thirdly, the use of eco-friendly materials received high praise. Design students and environmentally conscious participants highlighted how the new packaging aligns with current sustainability trends. They noted that the shift from non-biodegradable materials to eco-friendly paper not only addresses environmental concerns but also enhances the product's appeal in a market that increasingly values sustainability.

The experimental results confirm that this approach enhances consumer engagement and approval. Integrating traditional peach cake mold patterns into eco-friendly paper materials has revitalized classic designs with a modern touch. The findings indicate that the product combines practicality and aesthetic value, fulfilling daily needs while attracting strong consumer interest. Additionally, using biodegradable materials addresses environmental concerns and aligns with contemporary ethical standards, effectively revitalizing the cultural heritage symbolized by peach cake molds.

Table 3. Survey Objects

Category	Number of People	Percentage
Chaoshan Locals	30	37.5%
Peach Cake Mold Experts	10	12.5%
Non-local Tourists	30	37.5%
Design Students	10	12.5%
Total	80	100%

Table 4. Survey Questionnaire Scoring Results

Dimension	Chaoshan Locals	Peach Cake Mold Experts	Non-local Tourists	Design Students	Weighted Average	Standard Deviation
Overall Innovation	4.7	4.6	4.4	4.7	4.58	0.14
Cultural Content Transmission	4.8	4.7	4.3	4.6	4.58	0.22
Practicality	4.5	4.4	4.2	4.5	4.38	0.14
Aesthetic Appeal	4.8	4.7	4.5	4.8	4.68	0.14
Purchase Intent	4.6	4.5	4.2	4.6	4.44	0.19
Total Average Score	4.68	4.58	4.32	4.64	4.53	0.16

By continuously exploring and reinterpreting traditional cultural elements and integrating them with modern design concepts, it is possible to create a greater variety of cultural products that reflect regional characteristics and contemporary relevance. This endeavor enriches and expands the Chaoshan peach cake mold culture and offers valuable experiences and insights for the preservation and innovation of other traditional handicrafts, fostering the prosperity of traditional culture in the modern era.

CONCLUSIONS

1. This study conducted a symbolic analysis of the Chaoshan peach cake mold culture, thoroughly exploring the intrinsic relationship between its material forms and cultural connotations. It revealed the cultural roots that underpin the artistic characteristics of peach cake molds.
2. The unique visual effects and richly meaningful patterns of these molds embody the long-standing historical and cultural heritage of the Chaoshan region. By creatively reinterpreting and reorganizing traditional peach cake mold patterns, this approach not only preserved their historical and cultural significance but also infused them with a distinctive modern touch, achieving a harmonious fusion of traditional culture and contemporary design.
3. The innovative design approach introduces fresh ideas and momentum for the preservation and development of Chaoshan peach cake mold culture.

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