Research on the Application of Paper Art in E-commerce Packaging Design

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Abstract

The rapid development of e-commerce in China not only promotes the construction of the market economy, but also provides new opportunities for the packaging design industry to increase market share and change design concept. In our society, products on the e-commerce platform can only be seen in images or videos, which naturally highlights the role of product packaging played in stimulating the desire to buy. Accordingly, packages become the core link between consumers and e-commerce products. As e-commerce products are more frequently seen in daily life, demands for e-commerce packaging design are higher than before. Not only should the package ensures product integrity, but it is expected to be human-centered and environmentally-friendly. In light of this, we applied traditional Chinese paper arts to e-commerce packaging design. By analyzing paper-art types and connotations and the characteristics of e-commerce packaging design, we selected the paper-folding structure to establish paper packaging design model, its calculation formula, and the corresponding product evaluation model. Our purpose is to provide instructive references for the e-commerce packaging design so as to promote the sustainable development of the packaging design industry.

Keywords: Electric Commerce, Paper Art, Packaging Design, Model.

1. RESEARCH BACKGROUND

1.1 literature review

In recent years, many new businesses have arisen in the context of Internet +, among which the emerging e-commerce is quite influential in the whole society. It challenges the traditional transaction mode and provides extra ways of economic development. E-commerce is the product of platform economy and platform business supported by network technologies, which favors the economic construction in China (Sun and Zheng, 2013). Since the birth of e-commerce, it has been growing at an astonishing rate and has occupied a large proportion in the market economy in China. Online shopping has become the main mode of mass consumption in modern life. Alibaba Group and JD are two e-commerce giants with top-ranked online transaction values. The total transaction total online transaction values on Taobao.com reached 120.7 billion yuan on Double 11 in 2016 (91.2 billion yuan in 2015, and 57.1 billion yuan in 2014). The large volume of online transactions reflects the rapid development of e-commerce industries. According to the e-commerce industry data monitoring reports in recent years, e-commerce has been included in the national construction schedule. Against this background, the relation between consumers and online goods is much closer than before, which promotes the thriving of express delivery and packaging industry. Nevertheless, there are more challenges and development problems in the packaging industry (Chen and Xu,2015). At present, the overall design level of the packaging industry cannot meet the actual needs of e-commerce. The reasons for this imbalance are: First, inadequate knowledge of e-commerce packages; the responses of an e-commerce packaging survey (random sampling) show that many online purchasers are unfamiliar with e-commerce package and confuse it with express delivery package or hard paperboard, all of which are usually discarded after use. Sellers design faceless e-commerce packages in favor of their safe use and functionality (Chen and Xu, 2016). Second, the package design is not systematic enough. Related investigation results show that 75% online buyers care about the protective function of e-commerce packages, and that 32% consumers once received severely damaged delivery packages and thus think ill of the express delivery industry and the sellers. Therefore, in the background of e-commerce, the packaging design industry should redirect towards modernized development and satisfy the current needs of online buyers by adding personalized elements to packaging design schemes and strictly regulating the use of package materials.
1.2 Research Purpose

Considering the positive development trend of e-commerce and the actual demands of online buyers for packaging design, we think that packages are important to the express delivery industry and online shops. To enhance the solidness of e-commerce package and highlight its unique feature, we combine packages with the traditional Chinese paper art. First, an analysis is conducted on the types and connotations of paper art and the application of paper art in packaging design. Then, we expatiate on the e-commerce package forms and sizes. On these bases, a paper package design model is established in a systematic and scientific order: design the shape of paper packages, calculate the folding angle of the packages, and establish a comprehensive evaluation model for the paper packages. In this way, the designed e-commerce packages are solider, more meaningful, and of better sense of design. Our packages can provide new experience for online buyers and higher quality experience for e-commerce enterprises (Quan, 2015).

2. OVERVIEW OF PAPER ART AND E-COMMERCE PACKAGING DESIGN

2.1 The types and connotations of paper art

Paper art is an important part of traditional culture in China. It is a product of folk art needed for daily living and working and, moreover, organically integrates images with decorative graphics. Therefore, in addition to the practical value, paper art is rich in artistic and cultural value (Chen, 2015). Traditional methods to make paper art include paper cutting, paper folding, paper sticking, and paper dyeing. Paper art forms can be divided into 2D (Figure 1) and 3D (Figure 2).

Figure 1. 2d Paper-Cut

In common sense, traditional paper art conveys national connotations that are extracted and generalized from homophones, symbolism, or implications. On this basis, paper art crafts can be colorful and of different...
structures with a variety of design elements. Paper art fully reflects the good life and spiritual world of Chinese people and the social ideology. It is of high practical and artistic values and capable of satisfying different aesthetic needs (Yinand Ma, 2012). Paper art not only has a distinct uniqueness in the production process, but also vary with the thinking mode and image law in different languages. It is taken from daily life and serves for daily life. Paper art is most frequently seen in festivals and special days, such as window paper-cuts and paper lanterns in the Spring Festival and the “double happiness” (“囍” in Chinese) character in wedding banquet. The reason for the wide application of paper art in modern China is that paper art works embody the wish to live better lives and the greatness of humanity and extol honesty and kindness.

2.2 Paper art and packaging design

The shapes and elements in paper art are widely used in modern packaging design, which provide extra design materials and thoughts with national characteristics. The use of paper art structure is a strong and impressive visual shock to consumers, attracting more consumers and stimulating their desire to purchase. Modern packaging designers usually think that 3D design and 2D design have an equal amount of importance. They consider different possibilities of packages and make them into novel, hyperbolic works with artistic effects (Shen, 2014). Folded papers, embossed papers and foam sheets have different stereoscopic structures, which expands the space of e-commerce packaging design and other modern packaging designs.

![Figure 3. Coffee Tote Bag](image1.jpg)

![Figure 4. Egg Packing Box](image2.jpg)

Folded paper is the structure of packages in Figure 3 and Figure 4. All that is needed is to manually fold the paperboard. Since no other materials are required for this package structure, it is seen as the most environmentally-friendly and low-carbon way of modern packaging design. This structure has the advantages of strong sense of artistic vision, good performance with secure fixing, economical use of design materials, and aesthetic pleasure with paper texture. Moreover, the product space creates a sense of gradation and develops paper art.

2.3 E-commerce packaging design
As e-commerce packaging design is mainly used for logistics and transportation, the packages should not only have strong stability but also convey product information and its characteristics. In this paper, a market survey was conducted on e-commerce product packages by means of information gathering, measurement and statistical analysis. We collected 455 valid e-commerce package samples in 15 express delivery stations in Harbin, analyzing their size, structure and mode in depth (Li and Cao, 2012). The analysis results show that due to the special patterns of sales and delivery for e-commerce, the products of most online stores are small in size and easy for transport. The majority of package samples has a box structure of small-to-medium size. 335 samples (75.3% of the total) have a smaller size than 40cm. Figure 5 shows the size distribution of the package samples, which is mainly influenced by freight terms. E-commerce packaging design has gradually developed towards light weight and small size, fueled by the large quantity of online orders with diversified and smaller items and the continuously reduced logistics cost.

3. THE ARCHITECTURE OF THE E-COMMERCE PAPER PACKAGING DESIGN MODEL

3.1 Paper Packaging Design Model

As the traditional packaging design is usually targeted at a specific product, the design level is determined by the comprehensive ability of designers, but the design quality cannot be guaranteed. Although products and circulation are considered in designing packages, the commonalities of different products should have been kept in mind (Wang and Zhang, 2013). To conform to e-commerce development, we suggest to add traditional elements to packaging design. Paper art forms are an alternative. Modern packages can be designed both horizontally and vertically with professional packaging knowledge, which can not only embody the design connotations, but also improve the practicability and quality of packages in all aspects. In doing so, the schematic diagram of PMP structure is used in this paper to establish a new packaging design model.
According to the characteristics of the PMP system structure, a frame is used to demonstrate PMP, which is mainly composed of PC, PF, S and the sum of their information. To realize the interoperation between the triad and the automation of product packaging design, we apply some knowledge to the PMP framework. The basic structure of the framework is:

<frame name>:

Slot name I: facet name il (whose numerical values are i1, i2, ...)

(default: numerical value): 

Facet name i2 (whose numerical values are i21, i22)

Slot name J: <framework name X>

Slot name K: <additional flow>

The PMP frame is expressed as:

<Package for Products>

Products: <Products>

Circulation: <Circulation>

Package Functions: <Functions>

Schemes: <Schemes>

In which the “Package for Products” is the frame name; Products, Circulation and Functions are slot names, each of which represents another frame (Liet al., 2014). A packaging design system is completely designed when every slot name directs at another frame. Designers distinguish product types based on frame names and further create packaging design schemes for the corresponding frames. Product information is the important guidance for packaging design. Therefore, <Products> should record all the product information, whose major framework should be:

<Products>

Name: (the Name of the Products)

Type: (Food, Pharmaceutical, Textile, ...)

State: (<Liquids>, <Solid>, ...)

Property: (Volatility, Deliquescence, ...)

Precision: (High, Middle, Low)

According to the above framework, the slot name in each model is determined. Then, the slot value in S is calculated based on the numerical values in PC and PE and the PMP rules. In this way, the whole packaging design is completed.
3.2 The Calculation Formula of Folding Angles in Paper Packaging Structure

Based on the e-commerce paper packaging design, the compressive ability and the damage scale of packages should be taken into full account in the transport process. Folded paper structure is an innovative measure of package structure. By applying the folded paper structure to packaging design, the integrity and stability of the whole structure can be guaranteed, provided that the folding angles are calculated through folding angle formulas (Han and Cao, 2016).

Five folding/overlapping angle formulas are involved in designing e-commerce product packages, also known as the TLIC formula. One of them is the rotation angle calculation formula which will not be elaborated in this paper. The rest of the formulas are used to calculate folding angles in different cases, whose details are:

--- the second TLIC formula, which calculates the auto end-locking structure of tubular packages.
--- the third TLIC formula, which calculates the inner folding angle of the tray packages.
--- the fourth TLIC formula, which calculates the inner folding angle of the tray packages.
--- the fifth TLIC formula, which calculates the folding angle of tubular packages when $\omega \geq 180^\circ$.

The TLIC formulas share the following common characteristics: 1. Each has two side boards and one bottom board which intersect with each other in the three-dimensional space. They constitute the sides and angles of the lozenge of the carton. In the cases of a single bottom board or three paper boards that do not meet at a point, all the formulas represent the cartons with the same structural angles. 2. All the referential values used in the formulas are the structural angles of three paper boards, which may be different in sign. The folding angles are the included angle between the folding line that passes the intersection point and the rhombic side that intersects with the board plane which the folding line is on. 3. The formula to calculate auto end-locking tubular cartons is completely the same with the formula that calculates the inner folding angle and overlapping angle of auto-folding tray cartons (Li, 2014). Therefore, it can be fully seen that the common purpose of the four formulas and the folding structures is to explore a universal calculation formula of folding angle.

Therefore, to simplify the computation and application of folding angle, we use A, B and C to represent the three paper boards that intersect with each other to constitute a packing box. The front folding board (A) is the one that the folding line and the targeted folding angle are on; the base board (B) is diagonal plane of the front folding board; the last one is the lateral folding board (C), as shown in Figure 7.

![Figure 7. The Sketch Map of Three Paper Boards](image)

When the carton is formed by parallel folding, A is positive if folded inside of the base board, or it is negative if folded outside. B is the structural angle of the base board. C is positive if folded inside of the base board, or it is negative if folded outside. Therefore, the uniform formula to calculate the folding angle is:

$$Z = \frac{1}{2}(A + B - C) \quad (1)$$

This formula can suit the simultaneous use of four TLIC formulas (Feng, 2014). By changing the signals into the
variables in TLIC, we can convert the formula to the TLIC formulas. Thus, we have the calculation formula of the angle between the folding line that passes the intersection point and the intersection line of the bottom board and the side board:

\[ Z = \frac{1}{2}(A + B - C) = \frac{1}{2}(\omega + \gamma_1 - \gamma_2) \]  

(2)

In parallel folding, the front folding board \( A = \gamma_1 \) if folded inside of the base board, the lateral folding board \( C = \gamma_2 \) if folded inside of the base board, and the base board \( B = \omega \). Therefore, the inner folding angle formulas are:

\[ Z = \frac{1}{2}(A + B - C) = \frac{1}{2}(\gamma_1 + \omega - \gamma_2) = \frac{1}{2}(\omega + \gamma_1 - \gamma_2) \]  

(3)

By changing the sign of variables in the inner folding angle formulas, we have the outer folding angle formulas:

\[ Z = \frac{1}{2}(A + B - C) = \frac{1}{2}(-\gamma_1 + \omega - \gamma_2) = -\frac{1}{2}(\gamma_1 + \gamma_2 - \omega) \]  

(4)

3.3 Comprehensive Evaluation Model of E-Commerce Paper Packaging

In order to better promote the development of packaging design against the background of e-commerce, we should comprehensively analyze the designed packages. In doing so, the elaboration likelihood model (ELM) is used in this paper:

The basis of packaging design evaluation should be the psychological processes of change and psychological characteristics of consumers. There are two routes for a consumer to obtain product information through a third-party channel: under the central route, and under the peripheral route (Gao, 2010). The central route is the main route of information processing that is suitable to convey the information processing ability and the original intentions. The peripheral route is suitable in other cases. In other words, the central route can be regarded as an effective system approach, while the peripheral route is a heuristic approach. Therefore, e-commerce product packages can be equated with ads in terms of the publicity function. Furthermore, it is possible to pre-design reasonable packages according to the consumers’ participative degree and re-purchasing information.

4. CONCLUDING REMARKS

The thriving e-commerce business has driven the transformation of marketing approaches in all industries. It provides extra consumption channels and helps consumers convert consumption concepts, marking the entering of the e-commerce era on all fronts. E-commerce has simultaneously brought development opportunities and challenges to the packaging design industry. In order to the long-term development of the packaging design
industry under such situations, packaging design ideas should change positively. In addition, we should fully understand the aesthetic needs and expected package specifications of the mass. In this paper, by applying the structures of traditional Chinese paper arts to packaging design, we add a spice of cultural connotations to e-commerce packages and enhance their practicability. Our design results can provide higher-quality service to e-commerce packaging design and better experience for online consumers.

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