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การใช้วัสดุกระดาษรีไซเคิลในการทำเฟอร์นิเจอร์จากมุมมองของศิลปะโมเสก

The Approach of Waste paper Furniture from the Perspective of Mosaic Art

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บทคัดย่อ

บทความนี้มีวัตถุประสงค์เพื่อศึกษาวิธีการออกแบบเฟอร์นิเจอร์กระดาษในมุมมองของศิลปะโมเสก ผู้เขียนแบ่งการศึกษาออกเป็น 2 ส่วน คือ การออกแบบพื้นผิวด้านนอกของเฟอร์นิเจอร์กระดาษ และการออกแบบโครงสร้างภายในของผลิตภัณฑ์ กระบวนการออกแบบและพัฒนา ในขั้นแรก มีการสำรวจการประยุกต์ใช้กระดาษลูกฟูกและเยื่อกระดาษในรูปแบบโมเสก ผ่านการจำแนกประเภท การตัดและการต่อกระดาษลูกฟูก ตลอดจนการระบายสีและรูปร่างของเยื่อกระดาษเทียม เพื่อมองหาทัศนสัญลักษณ์ที่สื่อถึงศิลปะโมเสก จากนั้น ในระหว่างการทดลอง ได้ดำเนินการปรับสัดส่วนโครงสร้างของกระดาษลูกฟูกโดยการตัด ซ้อน และวิธีการอื่น ๆ เพื่อปรับปรุงสัดส่วนโครงสร้างของกระดาษลูกฟูก และศึกษาวิธีการเพิ่มความสามารถในการรับน้ำหนักของกระดาษลูกฟูกเพื่อให้ผลิตภัณฑ์มีความแข็งแรงและสามารถใช้งานได้จริง สุดท้าย มีการพัฒนาเพิ่มเติมโดยการสร้างโมเดลจำลองขนาดต่าง ๆ ตรวจสอบสัดส่วน โครงสร้าง และความมั่นคงแข็งแรงของการออกแบบอีกครั้ง ผลลัพธ์ของการพัฒนาการออกแบบสอดคล้องกับวัตถุประสงค์ที่กำหนดไว้ วัสดุประเภทกระดาษสามารถใช้งานได้จริงในฐานะวัสดุตกแต่งบ้าน และเมื่อผสมผสานกับศิลปะโมเสก จะช่วยยกระดับประสิทธิภาพของผลิตภัณฑ์ภายในบ้านในด้านสุนทรียภาพและรูปลักษณ์

การศึกษานี้ได้ค้นพบสิ่งสำคัญ 3 ประการ ได้แก่ 1) กระบวนการประยุกต์ใช้เยื่อกระดาษและกระดาษลูกฟูกในการออกแบบเฟอร์นิเจอร์ตกแต่งบ้าน 2) แนวทางการใช้เยื่อกระดาษเป็นวัสดุหลักในการสร้างสรรค์ศิลปะโมเสก 3) วิธีการเพิ่มความแข็งแรงและความสามารถในการรับน้ำหนักของเฟอร์นิเจอร์ที่ทำจากกระดาษ

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Abstract

This paper aims to study the design method of paper home decoration from the perspective of mosaic art. The author divided the research into two parts, namely the design of the external surface of the paper furniture decoration and the internal structure of the product. Firstly, the design and development process of the project investigated the application of mosaic forms based on corrugated fiberboard and pulp. Through the classification, cutting, and splicing of corrugated paper, as well as the artificial coloring and molding of paper pulp, for the purpose of finding the visual symbols that convey mosaic art. Then, during the experiment, the structural proportions of the corrugated paper were adjusted through cutting and stacking, aiming to find ways to improve the load-bearing capacity of the corrugated paper, thereby achieving product functionality. Finally, further development was carried out by creating scale models to re-examine the proportions, structure, and stability of the design. The conclusion of the design development is consistent with the stated objectives. Paper material is functionally feasible as a home material, and combined with mosaic art, it can enhance the performance of home products at the aesthetic level and visual form.

Three important discoveries were made during the project. 1) The process of applying paper pulp and corrugated fiberboard in the design of home decoration furniture. 2) The approach of using paper pulp as raw material to present mosaic art. 3) The method to improve the hardness and load-bearing capacity of paper furniture.

Keywords: Handmade paper furniture, Reuse of Waste cardboard, Mosaic art

1. Introduction

Paper product packaging refers to commodity packaging made of paper and pulp as the main raw material. Due to its high strength, low moisture content, low air permeability, no corrosion, and certain water resistance, paper products play a vital role in the field of packaging materials. In fact, developed countries spend tens of billions of dollars on packaging. Specifically, the proportion of paper and cardboard packaging exceeds 1/3 of all types of packaging materials in the world, which exceeds the proportion of plastic, metal, and glass packaging (Huang, 2017).

With the rapid development of logistics, fast-moving consumer goods (FMCG), food, and other industries, merchants' demand for paper packaging has increased. Generally, various products in daily life, such as food, clothing, electronic products, and home furnishings, are mostly transported in paper packaging. Although paper packaging has many advantages compared with other materials, from the perspective of environment and resources, the use and process of paper product raw materials inevitably have negative impacts. To be specific, the production of paper products requires a large amount of wood,

and the chemicals used in paper making are mixed with waste gas raw materials, which can seriously pollute surface water and groundwater. In addition, improper disposal of paper products also causes a negative impact on the environment. There are two main factors that cause the pollution of paper packaging, in terms of the pollution emissions from pulp and paper mills and the untimely recycling of waste paper packaging (Huang, 2017). According to Iveta Cabalova, there are some technologies that can solve those problems. One such process is recycling, which is more than just the next use of waste (2011). On the one hand, recycled paper waste can be recycled through technology to convert waste paper into recycled paper products, such as clothing tags, paper bags, commodity packaging, etc., thereby increasing resource recycling. On the other hand, by studying the design of household products for waste paper products, design practitioners can explore more possibilities of paper in the field of furniture design. This can promote the diversity of materials and design forms while reducing the consumption of other resources.

As a lightweight material, paper has become a trend in product design. There are currently some companies in the United States dedicated to producing kraft paper honeycomb panels and wood composite panels. These materials are placed in the packaging and furniture sectors. In addition, there is one growing custom manufacturer of kraft honeycomb furniture panels in Canada - Panolite Industries. Three main factors contribute to the growth of the industry, The first point is the increasing cost of wood used in traditional wood composite materials. The second point is the market's acceptance of thick and lightweight products. The last point is the business's control over the cost of component materials, labor costs, and transportation costs. (Semple et al., 2015, p. 107).

Furthermore, through the design of the structure and shape of waste paper, the collected waste paper can be used directly without processing to create new value. Recycling of waste materials is the process of decomposing natural, and man-made waste and various types of waste into multi-layer waste materials, and using them as products directly or indirectly as much as possible or using them as products after repair or renovation. By re-manufacturing waste or reusing part of waste as part of other products, the use time and strength of the product can be extended as much as possible to avoid the product becoming waste prematurely or excessively (Li, 2018). Therefore, recycling paper packaging or waste cardboard and converting it into products not only enhances the life cycle of the raw materials but also realizes the functional value of the products.

Mosaic (MOSAIC) was originally intended to be a detailed decoration spliced by inlays. The artistic expression of mosaic is very common in architecture, sculpture, and home furnishing. Mosaic art can be combined with the most of conceivable surfaces, and the types of substances applied to mosaics are as varied as the artists who create them (Locktov, 2005). Color and patchwork as key elements of mosaic make it a very important feature in the field of decorative arts, which fully demonstrates the aesthetic value. Artists and designers are exploring how best to present artworks and products in mosaic visual form constantly. and most of the mosaic products are made of stone, ceramic, and glass.

This research aims to develop a sustainable home design method using waste paper as a material through the reuse of waste cardboard and the exploration of mosaic art. All of the above information becomes an important part of sources and design inspiration for designers who want to design products that display decorative aesthetics while being environmentally friendly. This study emphasizes the reuse of waste cardboard, the combination of waste paper color and texture, and the dissemination of mosaic art from a visual aesthetic level. Therefore, the research findings can assist design practitioners, home manufacturers, and other stakeholders in finding solutions and design processes for sustainable home furniture.

2. Research aims

2.1 Study the properties of "cardboard structures" suitable for production and use as home decoration. Create experimental work through design experiments.

2.2 Create mosaic decorative patterns made of paper. Create experimental works through the color, pattern, texture, and shape of materials.

3. Related Concepts and Theories

In the 1920s, paper furniture appeared in the UK. Asian countries Japan, Singapore, China, and other countries are gradually accepting paper furniture and entering people's lives. The development of paper materials is reflected in the furniture industry and interior decoration. As a renewable resource, paper furniture can alleviate the consumption of wood and promote the sustainable development of the environment. Environmental sustainability has become one of the essential issues for enterprise strategy and product innovation. This is necessary to pay significant attention to the development and consumption of green products by companies, customers, media, and regulators (Dangelico et al., 2013).

According to the physical characteristics of the paper, the designer changes its structure and load-bearing capacity by bending, folding, combining, and bonding, and presents the paper three-dimensionally.

3.1 Increasing the load-bearing capacity of cardboard through bonding and combination, so as to realize product functionality.

The Wiggle Side Chair (1972) is a key piece of architect Frank Gehry's "Easy Edge" furniture series. On the one hand, Gehry gave full play to the material characteristics of cardboard and bonded 14 layers of corrugated cardboard to transform from surface to block, improving the thickness and load-bearing capacity of the cardboard, thereby improving the functionality of the product. On the other hand, the cardboard material is endowed with new value from the aesthetic dimension through the curved and simple design. In Figure 1 and Figure 2 below (Gehry, 1972).

Figure 1 Wiggle Side Chair.

Source: Frank Gehry (1972)

Figure 2 Easy Edge.

Source: Frank Gehry (1972)

3.2 Use the honeycomb structure to realize product functionality and artistry

Most of the cardboard furniture or paper furniture are combined with the honeycomb structure, the main reason is the stability of the honeycomb structure. A honeycomb is a combination of hexagonal cells prepared by honeybees for storing honey and pollen. The structures provide high strength with low weight and less material. Due to these superior advantages, the form of sandwich structures's honeycombs was widely applied by designers (Thomas & Tiwari, 2019). In addition, due to the advantages of lightweight paper honeycomb sandwich panel products such as lighter weight, superior load-bearing performance, and convenient transportation, this material is often used in the furniture industry. (Barboutis & Vassiliou, 2005).

The Honey-pop chair is part of the permanent collections of the Center Pompidou, the Museum of Modern Art (MoMA), and the Vitra Design Museum. The material of Honey-pop is cellophane. In detail, the designer glued 120 sheets (hollowed out) of cellophane together and cut out the shape. When opened,

it forms a honeycomb structure. Different people will form different shapes when they sit on it, and It can also emit the unique sound of cellophane. In Figure 3 and Figure 4 below (Yoshioka, 2001).

Figure 3 Honey-pop chair.

Source: Tokujin Yoshioka (2001)

Figure 4 Honey-pop chair.

Source: Tokujin Yoshioka (2001)

3.3 Application of mosaic in home decoration

Materials such as plates, stones, and tiles are the main materials for furniture types. Mosaic is an ancient art form, and it is also a technique of collaging small pieces of stone, glass, tiles, and other materials of different colors together to form a pattern. Over time, mosaics have gradually evolved into a unique art form with rich historical and cultural connotations. Today, mosaics have become an integral part of modern architecture and interior design.

Figure 5 Nature's guestroom.

Source: Arvis Rubenis (2019)

Compared with synthetic board, stone, and ceramic tile furniture, paper furniture realizes energy saving and environmental protection in a real sense from the processing of materials to the use of materials. Although there are art forms combined with mosaics in the home furnishing industry, most of them are based on ceramic glass, while the research on paper furniture is mostly limited to the structural field, and there are few paper handmade home decorations or furniture combined with mosaic patterns.

In this paper, the designer will emphasize pixel patterns as the main research direction of mosaic vision. Actually, Pixel is a special art style for lots of people, it is contemporary and iconic. Kids who grew up playing games in the 1980s and 1990s have an underlying affinity for this aesthetic form, and generally speaking, this style triggers nostalgia for many in this generation (Silber, D., 2015). Most pixel artists support that a pattern can only be classified as pixel art when the pixels play a significant and unique role in the composition of the artwork. This usually requires designer control over the placement of individual pixels intentionally. Artists use different brush sizes (e.g. 1x1 or 2x2 pixels) and different tools such as freehand/pencil, lines, rectangles, etc.

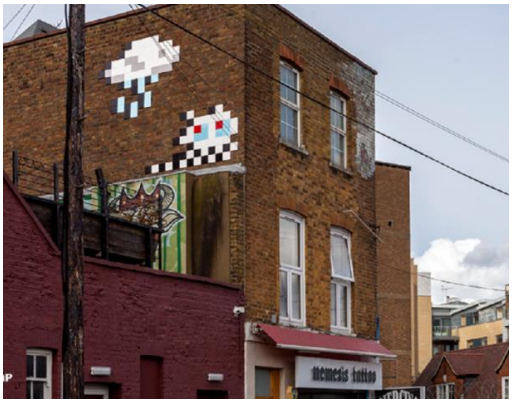

Figure 6 Space Invaders, London.

Source: Invader (2016)

4. Methodology

4.1 Research and creative process

4.1.1 Research, experiment, and summarize the characteristics of corrugated paper furniture that constitute mosaic art. Create experimental works through hands-on practice.

Figure 7 Collected cardboard.

A large amount of waste cardboard was collected during the experiment as shown in Figure 7. The designer used recycled cardboard splicing to form a stable internal structure, and the external surface was experimented in two ways. Figure 8 shows the first method, the researcher cut the collected corrugated paper into pieces according to the size of 5cm*5cm, and each piece represents one pixel (1x1 pixel). The researcher will retain the pattern and color of the cardboard and use bonding methods to create experimental works. Besides, Figure 9 presents the second method, through soaking, mixing, gluing and other processes, the collected waste paper is hand-made into pulp bricks, with a size of 5cm*5cm and a thickness of about 5mm (1x1 pixel). Each piece represents one pixel as well as the first method. Designer created experimental pieces using artificial coloring and the natural texture of paper pulp.

Figure 8 Cut cardboard pieces.

Figure 9 Hand-made pulp brick.

4.1.2 Develop a draft of the “PIXEL ART” of the furniture design.

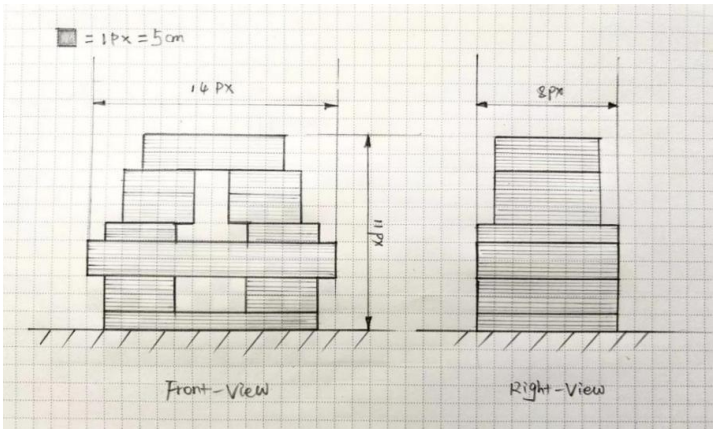

Figure 10 Front view and right view of the inner structure.

Figure 10 Manuscript The load-bearing capacity and stability of the structure are increased by overlapping the structure multiple times.

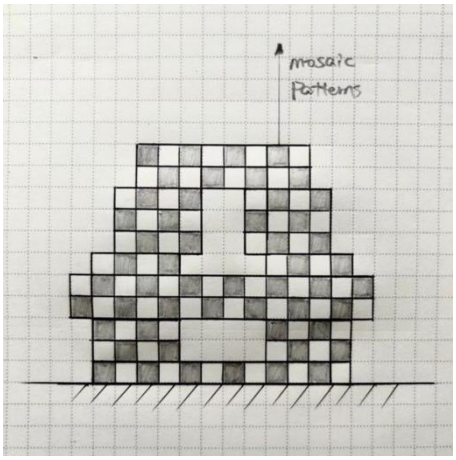

Figure 11 Sketch of surface graphic.

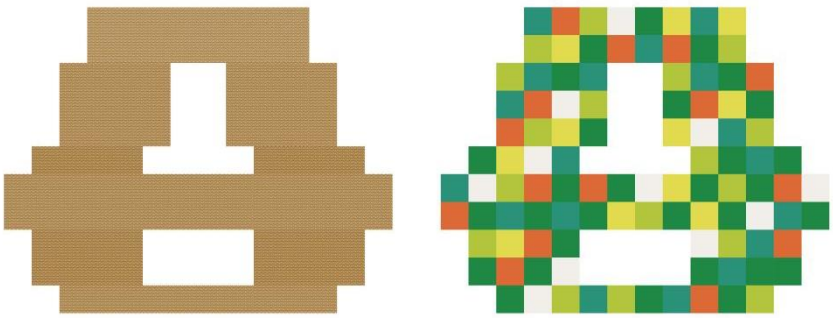

Figure 12 Vector rendering by Adobe Illustrator.

The designer enhanced the stability of the product's internal structure through multiple overlapping methods. As shown in Figure 11 and Figure 12, each square represents one pixel, and adjusting the colors and graphics of designated "pixels" can enhance the decorative nature of the product's appearance.

4.1.3 Make a preliminary prototype based on the pixel pattern design sketch. Check the suitability of product proportions and structural stability. There are two design methods for the pixelation presentation of external graphics, as shown in Figure 14 and Figure 15.

Figure 13 Image of inner structure.

Figure 13 shows the internal structure of the actual product. The hollow part can be used to store books, slippers and other sundries. The stacking method enhances the load-bearing capacity of the cardboard and achieves the practical function of the decorative stool.

Figure 14 “pixel pieces” made by cardboard.

Figure 15 “pixel bricks” made by paper pulp.

4.1.4 Make a life-size paper stool prototype (Figure 16). The researcher chose to use the second approach of the initial prototype to present the exterior graphics of the decorative stool. Because the second method can present richer colors and textures, thereby achieving the aesthetics of home decoration. In addition, the author observed that the dried "pixel bricks" can enhance the thickness and hardness of the product to improve structural stability. In this process, “pixel bricks” were made and arranged in random sequences.

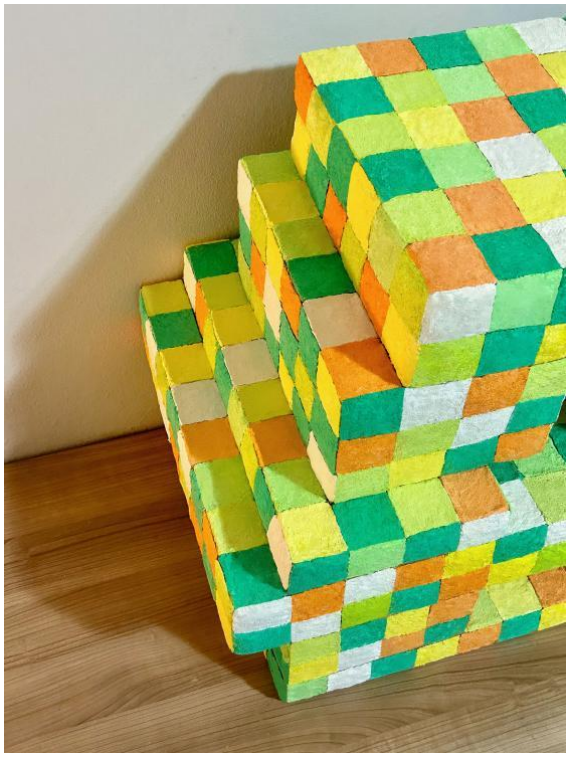

Figure 16 Actual size prototype image.

5. Research result

5.1 Pictures of the completed work

Figure 17 Image of final work (1)

Figure 18 Image of final work (2)

Figure 19 Image of final work (3)

The purpose of this study is to find design methods for home decorations made of waste cardboard and waste paper from the perspective of mosaic art. Mosaic elements in home decorations can improve the decorative function of the product while conveying the decorative aesthetics of the mosaic. After completion, as shown in Figure 17-19, the internal structure and external surface of the product are all handmade. It is designed as a regular geometry and can be easily assembled using bonding technology. The staggered geometric space not only enriches the shape but also enhances the storage function of the product. In addition, the reuse of waste cardboard also plays an important role in solving environmental problems. The author found that due to the plant fiber of pulp coming from wood, during the experiment,

glue, pulp, and flour were mixed, and the cured mixture could obtain stronger hardness. Using paper pulp as the material of “pixel bricks” is beneficial for shaping the external surface of the product and enhancing the stability of the internal structure.

5.2 Dimensions of the work

40 cm wide, 70 cm long, and 55 cm high. The decorative stool consists of 9 cubes in total, and the surface is covered with 334-pixel bricks to form the exterior decoration.

5.3 Materials

corrugated paper waste paper white latex

5.4 Molding technology

Cut and assembled by hand

5.5 Knowledge gained from creative work

5.5.1 The production process of "Pixel brick" using paper pulp as raw material.

5.5.2 Shape and structure to improve the load-bearing capacity of corrugated fiberboard.

5.5.3 The method to present Mosaic art using paper pulp as raw material.

5.5.4 Mosaic Paper Home Decorative Product Design.

6. Discussion of results, conclusions and recommendations

As mentioned above, the design and development of the "Pixel Paper Stool" is consistent with the stated research objectives. The main design function of "pixel bricks" in home decoration products is to enhance the decorative performance of the product through pixel symbols. This concept differentiates itself from the mosaic home decorations on the market that are made of ceramic tiles, glass or stone. It also proves the feasibility of paper as a material to present mosaic forms. In addition, the manual production method can reflect the texture and quality of the pulp, allowing the product to convey a handmade beauty. During the production process, the author discovered that the "pixel bricks" have a cement-like texture after curing, and the blend of color and texture also enhances the artistic expression of the product. However, during the experiment, the author found that it took a long time to make the "pixel paper stool" by hand. The author believes that in the case of mass production, automatic cutting equipment can be used to cut the corrugated paper, assemble the internal structure, and then decorate the exterior according to the size of the exterior pattern. The combination of manual work and mechanization improves production efficiency while ensuring the beauty of handwork. The author believes that the design of the "Pixel Paper Stool" is an attempt to integrate mosaic elements into paper furniture decoration, breaking the traditional mosaic decorations material system. The design process and method can provide designers or furniture manufacturers with some paper furniture design creativity.

The author hopes that paper can also create more possibilities for home decoration through inlay technology and stable structure. In addition, the designer's design decisions affect the life cycle of the

product. The research and development of paper mosaic home decorations not only provides a new design idea in the field of paper home decorations, but also contributes to the recycling of resources and the harmony of the ecological environment.

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