

Design of Cultural and Creative Products under the Characteristic Analysis of Industrial Heritage Elements in Liaoning——Taking Dalian's Modern Industrial Heritage as an Example

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Abstract: Objective: Based on the comprehensive elements of Liaoning's industrial heritage characteristics, we try to use cultural and creative product design as an essential way to inherit industrial heritage characteristics and humanistic emotional memory. Methodology: The architectural and production elements of Dalian's industrial heritage were analysed and explored through the three simulation methods of the innovative thinking approach, namely: morphological simulation, structural simulation and functional simulation. Based on the analysis of the acceptance of the research questionnaire, the cultural and creative products with the characteristics of typical Dalian industrial heritage are generated. Results: Within the framework of applying the simulation method in innovative thinking, the method of designing cultural and creative products with the characteristics of typical industrial heritage elements was summarised. Conclusion: The combination of questionnaire research and innovative thinking method can balance the practicality and cultural value of the cultural and creative products, trigger the emotional resonance under the characteristics of industrial heritage cultural and creative products, and provide methodological reference for the design of industrial heritage type cultural and creative products.

1. Introduction

With the promulgation of documents on cultural and creative industries and the support of national policies in recent years, cultural and creative industries have been on the rise. The value of cultural and creative products in terms of science, technology, historical knowledge, and art is generally valued worldwide. Among them, the design of cultural and creative products for the image of industrial heritage buildings has also been presented. However, the orderly development of cultural and creative products for specific urban industrial heritage types of a particular period is still a gap. In order to implement the "Opinions on Promoting the Innovative Development of Cultural and Creative Industries"[1], which aims to "meet the diversified, multi-level, multi-faceted spiritual and cultural needs of the people, improve the modern cultural and creative industry system,

cultivate new cultural industries, promote the high-end, integrated, intensive and international development of the cultural and creative industries", the project launched a study on the design of Dalian's industrial heritage elements. The project is to carry out a systematic collation and analysis of Dalian's industrial heritage elements' characteristics and research the design of cultural and creative products.

2. Cultural and Creative Products of Industrial Heritage in Dalian

2.1 The Formation of Industrial Heritage in Dalian

Liaoning province is an essential part of the old industrial base in the northeast. It has produced a large number of industrial buildings, factory workshops, mines, machinery equipment, and other valuable industrial heritage during the historical years of the arduous process of industrialization and transformation by the people of the northeast that lasted for nearly more than a century and a half. Many of which have high social, historical, cultural, scientific, and technological value as a microcosm and typical representative of China's industrialization process and are "An important material support for reading the city [2]. The identification and preservation of this meaningful and distinctive industrial heritage and their rational use are of special significance for maintaining the historical appearance of cities, changing the image of a "one-sided city," and maintaining vibrant local characteristics[3].

Dalian had an early start in modern industry in Liaoning Province, known as the "eldest son of the Republic." Due to its strong industrial base, scientific and technological strength, convenient sea transport, and abundant tourism resources, Dalian has gradually developed into an industrial port tourism city focusing on the machinery industry[4]. The architectural part of its industrial heritage resources has a unique historical value. It can represent the regional characteristics of an era of the city and encapsulate the group memories of a generation. This industrial heritage provides a glimpse into the heritage of the city's spirit and civilization and the craftsmanship of the industrial workers. These scenes and stories have become explicit teaching materials for the formation and development of the standard memory of the city of Dalian.

The development of the city of Dalian in the modern era has certain peculiarities. The domination of the colonial powers, both Russian and Japanese, led to the emergence of the Dalian industry from scratch, directly marked by the machine industry, which was largely uncharacteristic of the craft stage. The significant development of industrialization was also the most basic and straightforward, and powerful social driving force behind the construction of Dalian's industrial urbanisation in modern times. The scale of total enterprise production expanded and increased with the subsequent development of commercial and mechanical manufacturing in Dalian, a modern industrial city in China. This further led to a high-density concentration of industries in China's working population, thus contributing to the economic development and scale pattern of China's modern industrial Dalian cities. Therefore, the industrial heritage of the modern city plays a vital role in the study of the evolution of Dalian's industrial development since the modern era.

2.2 The Significance of Dalian's Industrial Heritage Cultural and Creative Products

The success of the Forbidden City and Sanxingdui heritage sites as a type of national cultural heritage protection unit has provided important lessons for their development and promotion at the cultural and creative level. The transformation and upgrading of China's traditional SMEs have triggered a wave of humanistic entrepreneurship to flourish in recent years. These cultural and creative goods, which must form an emotional resonance with the consumer before the shopping behavior can be realised, allow each user to experience the cultural connotations in a relatively

novel and playful way, inspiring emotions in the consumer's heart. For example, in recent years, the Sanxingdui cultural site in southwest China, which is well known both at home and abroad, has been showcasing the ancient Shu civilisation. With the archaeological image of the Sanxingdui ruins and the integration of modern creativity, the relics come to life and strengthen the interaction between the Sanxingdui ruins and the public.

From a small coastal fishing village to a modern city, Dalian, with only a hundred years of history, exudes endless charm. The industrial heritage of Dalian, as an essential piece of physical evidence reflecting the industrial history of the city and the formation of modern urban civilization, is a medium that, on the one hand, reflects the background and cultural characteristics of the city and on the other presents the cultural landscape of Dalian. However, there is still a paucity of unique cultural and creative products that can be developed in a targeted manner using them as a research background.

The main problems facing Dalian's cultural and creative industries are: in terms of the industry itself, the products are old-fashioned, monotonous in terms of variety and style, lacking in artistic aesthetics, lacking in originality and poor in practicality. In terms of the consumer audience, during the research of tourist attractions, it was found that most tourist souvenirs in Shengya Ocean World and the Forest Zoo were plush toys. Although sales figures for these products were good, the consumer base was minimal.

Dalian's industrial heritage resources cover a wide range of content, with the industrial chain's intangible cultural heritage characteristics, including architectural landscapes, production scenes, processes, and production products. Its innovative use can rely on the Dalian Museum to establish a digital database of Dalian's industrial heritage, a cultural and creative link between products and consumers' emotions, stimulating the inherent emotions within consumers, increasing the communication and exchange between Dalian's industrial heritage and people, and increasing the following economic benefits and heat effect of Dalian's industrial heritage cultural and creative products.

3. Dalian Industrial Heritage List and Characteristic Types

3.1 Summary of Dalian's Industrial Heritage Protection List

Dalian's industrial heritage meets the criteria for industrial heritage assessment and has specific historical, technical, social and architectural values. The surviving industrial heritage can relatively reflect the industrial landscape. By the relevant provisions of the Notice on the Issuance of Provisional Measures for the Management of Industrial Heritage in Dalian (Da Zheng Fa [2020] No. 65)[5], the first batch of the list of industrial heritage protection in Dalian, China, includes thirteen great industrial heritage sites, ten relatively crucial industrial heritage sites, and thirteen general industrial heritage sites, after a census of industrial heritage in each region, on-site investigation, planning, and expert evaluation, and information network release. Thirteen sites. The distribution of industrial heritage is closely linked to the regional environment. The heritage types and resources are relatively wealthy, with outstanding heritage values of great significance and influence in the country.

3.2 Characteristics of Dalian's Industrial Heritage

Although the city of Dalian has a history of more than a hundred years, its unique natural geography and rich local history and human characteristics constitute the unique characteristics of the city's industrial heritage. The rich and diverse industrial heritage also carries Dalian's ancient city's deep historical and humanistic memories.

Dalian has more than a hundred large and medium-sized backbone industrial enterprises as an essential industrial base in China. It has now formed a solid and comprehensive industrial system with machinery, metallurgy, shipbuilding, petrochemicals, building materials, textiles, clothing, light industry, electronics and foodstuffs [6]. The old buildings and factories in the industrial heritage have paved the history of Dalian's development for more than 100 years. To this day, some of the big spinning houses still have some of the production workshops from that time, where countless female workers dedicated their beautiful youth to the textile business. The preservation of industrial memory elements in the renovation and renewal of industrial heritage is mainly reflected in the static three-dimensional characteristic prototypes of architectural elements and interior elements but also includes a small number of dynamic characteristic prototypes of more significant processes, such as chimneys, blast furnaces, grain silos or water towers. Incorporating industrial heritage into historical cultural and creative products will allow these old factories and facilities to be reborn on a formal and functional level and retain the historical lineage of Dalian's urban industry through the consumption of historical and humanistic products.

The process of transforming architectural elements and interior elements of industrial heritage into cultural and creative applications: firstly, the transition from the language of modeling to the language of product modeling needs to be realised, so that the three-dimensional characteristics of space are transformed into the three-dimensional characteristics of the product; the dynamic characteristics of the process are transformed into the basis for nodal changes in the product portfolio; the product text and images, as language characteristics attached to the modeling, become the industrial culture of the product and packaging design. The product text and images as additional language features on top of the shape become the industrial culture elements of product and packaging design. How the design prototype is transformed into a cultural and creative product is related to the simulation method of the New Thinking approach, which contains a choice of three simulation methods: form, structure, and function. The transformation method determines how similar and recognizable the final image of the cultural creation is to the prototype. Using the design of a typical industrial heritage cultural and creative case in Dalian as a case study, it is concluded that the choice of prototype and the choice of the three simulation methods are guided by different themes, as evidenced by the modeling of thematic prototypes.

4. Dalian Industrial Heritage Features Below the Creative Product Simulation Method Transformation

4.1 Morphological Simulation and Shape Abstraction

The morphological simulation method uses a specific external morphological feature, such as the shape of the outer contour of a graphic, color generalization, and texture, to simulate the prototype from a morphological bionic perspective to convey an idea or express a particular meaning. The morphological mimicry process is intuitive and visual. It does not consider the internal components so that the shape features of the industrial heritage design prototype are directly translated into the external shape of the cultural product. A comparison of the identification of prototypes in cultural and creative products at this stage shows that morphological simulation is the most common approach to artistic and creative design.

Table 1. Extraction and combination process of elements under the morphological simulation method

The "South Manchurian Railway Electric Railway" at Ganjingzi Coal Terminal, Dalian			Elemental integrated design
Element extraction			
Element name	Prototype characteristics	Prototype characteristics	
Electric moving car	External contours, Scale variations	Box form	
Track wires	Contour forms	Pull-out tissue	

As shown in Table 1, the "South Manchurian Railway Electric Train," a remnant of the "Dalian Ganjingzi Coal Terminal," which is included in the "Dalian Outstanding Industrial Heritage," was used as the prototype for the "Impression of the Train." The design prototype for the "Impression of a Moving Train" tissue box. The design is mainly based on the shape and color of the vehicle's outer contour from the heritage resource. The doors and windows of the tram façade are abstractly simplified and scaled, with a simple and recognizable shape and familiar green color, making it easy to associate with the design prototype and thus awakening people to the "living" industrial heritage that is still in use today. The design is easily reminiscent of the prototype and thus evokes the memory of the "living" industrial heritage "South Manchurian Railway Electric Train" still in use today.

4.2 Structural Simulation and Structure Extraction

The structural simulation method combines the prototype elements in terms of structural support or the combination of original elements within the object. It then uses methods such as transplantation and bionics to simulate a model that resembles the internal or external structure of the prototype. The model simulated through the structure enhances the process of prototype interpretation and increases the connotation behind the product. This is reflected in the combination of prototypes of industrial heritage cultural and creative design, which consists of two main elements: firstly, the combination of spatial units of industrial heritage buildings or structures; secondly, the combination of components of industrial heritage production products, which are transplanted and mimicked from the perspective of structural similarity and structural simulation.

Table 2. Extraction and combination process of elements under structural simulation method

Dalian Old Tieshan Lighthouse - Shell (Structure 1) Lighthouse Theme Light-illumination (function 1) Cultural Creation			Elemental integrated design
Element extraction			
Element name	Prototype characteristics	Prototype characteristics	
Lighthouse	Frame structure	Essential apparatus for the shipbuilding industry	

Lamp head	Functional reproduction	Indicative lighting	
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The Old Tieshan Lighthouse, a remnant of the Lushunkou District, is located at the tip of the southwest foot of the Old Tieshan Mountain. In Table 2, the main body of the lighthouse is used as the main prototype for the new functional candlestick product, and the internal structure is replaced with a candlestick. The top area of the lighthouse and the outer parapet was chosen to abstractly extract the outline elements of the lighthouse shape, giving the product an industrial and structural feel that is both aesthetically pleasing and restores the lighthouse's existing lighting and indication function.

4.3 Functional Simulation and Experience Reproduction

The functional simulation method refers to using models to describe the functions of a system's production process, production flow, or the product itself to simulate the system's behavior. That is the method of using functional models to imitate the functions and behavior of an object prototype. From the perspective of product design, functional simulation can solve the problem of prototyping the design requirements of cultural and creative products and maximize the product's interactivity.

Table 3. Extraction and combination process of elements under the functional simulation method

Sunjiagou Water Purification Plant Cultural Creations	Water purifier-housing (Form 1) Water purification platform-base (Form 1) Rotary cleaning-body use (function 1)	Elemental integrated design	
Element extraction			
Element name	Prototype characteristics	Prototype characteristics	
Purifier	Cylindrical form	Cover	
Water purification platform	Loading device	Base	
Rotating cleaning	Rotating	Internal rotation of the body	

The main element of the purifier was extracted from the process of the former Sunjiagou Water Purification Plant and used as a prototype for the design of the fruit and vegetable purifier product shown in Table 3. At the same time, the function of the cultural and creative product - water purification - is highly consistent with the design prototype in terms of functional properties and functional experience. The cultural and creative product replacement and translation of the industrial heritage product's functional characteristics were mainly achieved from the perspective of the functional simulation method. In order to ensure the recognisability of the prototype, the external shape, color and material match the prototype of the "Sunjiagou Water Purification Plant," based on the structure of a generic purifier in the market.

5. Conclusion

By combing the resources of typical industrial heritage in Dalian and analyzing the characteristics of the elements, and combining the three methods of form, structure, and function in the innovative thinking simulation method, we attempt to design cultural and creative products with the characteristics of industrial heritage elements. This study is expected to evoke a deep urban memory of industrial heritage in Dalian and even in Northeast China and address the shortcomings in the innovative design of industrial heritage cultural and creative products in Dalian. At the same time, the selection and application of the method of elemental feature extraction and innovative thinking simulation can also provide a theoretical basis for innovative thinking and design methods for heritage type cultural and creative products of the same type or with the same elemental attributes.

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