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STUDY ON THE SENSIBILITY DESIGN OF RURAL TOURISM SOUVENIRS IN THE YELLOW RIVER BASIN

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Abstract. The **purpose** is to sort out the characteristics of rural tourism souvenirs and the design method of perceptual engineering, to analyze the cultural Yellow River Basin, and to put forward the strategy of perceptual design of rural tourism souvenirs in the Yellow River Basin, which will help develop rural tourism souvenirs with tourism characteristics and regional characteristics.

Methodology. Characteristics of rural tourism souvenirs, design methods, cultural imagery and design-related elements are analyzed through literature research method, case study method and cluster analysis method.

Results. The research centers on the design of regional cultural souvenirs of rural tourism, design thinking and design practice by perceptual design method, based on the perceptual experience of consumers, excavating the souvenir design elements of regional culture, combining the consumer's consumption demand and the cultural experience of rural tourism, converting the humanistic folklore of rural tourism and the regional culture, and providing for the development of the rural tourism souvenirs with tourism characteristics and regional characteristics. Countermeasures.

Scientific novelty. This study explores the integration of Kansei Engineering with tourism souvenir design pathways. From the perspective of cultural imagery and using rural tourism souvenirs in the Yellow River Basin as the design carrier, it derives systematic affective design strategies based on the cultural imagery-design element correlation model, providing theoretical paradigms for the digital transformation of cultural heritage.

Practical relevance. Through the research on the design path and countermeasures of rural tourism souvenirs in the Yellow River Basin, a set of more scientific, accurate and suitable design methods are proposed to assist designers to better complete the whole process of souvenir design. Abstract features are converted into concrete data as a reference to guide the design practice, which is conducive to guiding the design of products that meet the expectations of consumers and effectively elicit cultural identity, thus enhancing product competitiveness.

Keywords: tourism souvenirs, perceptual design, perceptual engineering, countryside, cultural heritage.

INTRODUCTION

Rural tourism souvenirs are an important service extension carrier of rural tourism, which can best reflect the regional cultural consumption demand of the tourist places. Rural tourism souvenirs as a connection between tourists and the emotional ties of tourism, its design is not only about the practicality and esthetics of the product, but also carries the inheritance and promotion of local culture. In the Yellow River Basin, as the important birthplace of Chinese civilization, the design of rural tourism souvenirs is even more important to deeply explore and show the natural, historical and cultural characteristics of the basin. However, the current rural tourism souvenirs in the Yellow River Basin lack the integration of local values, and the cultural connotation is shallow, failing to reflect the role of local natural and cultural resources. With the wide application of perceptual engineering in the field of design, the design of rural tourism souvenirs in the Yellow River Basin is gradually developing in the direction of perceptualization and emotionalization.

ANALYSIS OF RECENT RESEARCH

Tourism souvenirs are «a combination of the spiritual and the material» (Gordon, 1986) [4], which skillfully link the intricacies between objects, people, geographic locations, economic and cultural contexts, and ecological environments (Swanson, 2012; Lupu, C, 2024) [16;11]. Souvenirs can help tourists rebuild their memories and the meaning of their visit, and souvenirs with local characteristics can enhance tourists' sustained well-being (Liu et al., 2025) [10]. Scholars, such as Timothy, have studied the relationship between designing souvenirs and city iconography and image, and have used tourism souvenirs as an important factor in the development and promotion of destinations and as a vehicle for enhancing the cultural identity of tourism [6]. Tourism value co-creation, souvenir authenticity and psychological ownership of tourists have a positive impact on the perceived value of tourists (Deng, W. 2020) [2]. Rural tourism souvenirs are a branch of tourism souvenirs, which refers to the goods that tourists buy in rural tourism to commemorate the tourism experience. Studies have shown that tourists care more about whether souvenirs are creative and unique, and in addition to symbolic value, function, price, esthetics, and quality all have an impact on purchasing decisions (He, L, 2023) [8]. Tourism souvenirs are useful tools to enhance the image of a tourist destination (Thirumaran, K, 2013) [17]. These souvenirs usually carry local cultural symbols and natural

elements that reflect the characteristics of the place (Qian-qia 2013) [12]. As an important historical and cultural region in China, the development of rural tourism souvenirs in the Yellow River Basin shows unique regional and cultural characteristics.

Perceptual engineering was applied to the design of the automobile industry after it was introduced by Kenichi Yamamoto in the 1980s (Kikumoto, Kurita, and Ishihara 2021) [9]. The term perceptual is understood as a person's subjective impressions and emotions about objective objects in his or her environment. Perceptual engineering is a technique that translates consumer perceptions into product design elements. The main method is to quantify the human sensibility by means of engineering to find out the relationship between this amount of sensibility and design elements, and apply it to product design. As users and the market pay more attention to their own experience, the scope of application of perceptual engineering gradually becomes wider, expanding from material design to non-material design, and from the quantitative research of common industrial products to the quantitative research of cultural imagery. At the present stage, the engineering-style perceptual design method can be divided into quantitative research method and qualitative research method. One develops from psychology, consumer behavior, design psychology and other related fields, following the mature methods used in psychology, sociology and other fields. The quantitative approach, on the other hand, is based on design psychology, where sensory preferences are quantified and conclusions are drawn through mathematical and statistical methods. Shen, HC combines associative creative thought processes with fuzzy perceptual engineering in order to explore new forms of products that meet the needs of future customers [14]. Perceptual engineering is now well developed and widely used in product design (Quan, H, 2018) [13].

After fifty years of development, user perceptual cognition research has matured at the technical level and has been successfully applied in many fields. In terms of measurement methods, from the early subjective evaluation methods, such as semantic difference method and questionnaire survey, to the biological signal measurement methods, such as eye tracking and fMRI, to the computer science computation methods, such as NLP and CNN, the methods are becoming more and more diverse and accurate. Subjective evaluation methods are easy to operate but have problems such as time-consuming and high cost. Biosignal measurements

are accurate but costly and have few samples. Computer science computing methods can comprehensively extract user perceptual cognition from large amounts of data (Andreas Fürst, 2024) [3]. For design applications, perceptual cognition data are transformed into design information to assist product design through perceptual feature extraction and product physical attribute mapping (Chun-Chih Chen, 2008) [1]. For example, combining data mining, gray theory, neural network and other technologies to establish association models and develop design systems to provide effective guidance for designers. Perceptual engineering techniques are very effective in the development of various consumer products such as automobiles, electrical appliances, architecture and clothing (Kim and Lee 2016) [7]. Shieh and Yeh used the semantic differential method to grasp the consumer's perceptions, processed the data with statistical analysis to establish a correlation between the consumer's perceptions and the features of the product design, and used this correlation to guide the design process [15]. Well-known companies such as Ford, Philips, Mazda and Nike attach great importance to perceptual design and use perceptual design strategies to enhance the intangible advantages of their products.

In summary, rural tourism souvenirs, as a branch of tourism souvenirs, integrate the cultural symbols and natural elements of rural areas, and scholars have explored their diversified values from different perspectives, but there are not many research results that combine perceptual design with the design path of local tourism souvenirs. Perceptual design research provides scientific guidelines for the design of rural tourism souvenirs, which can more objectively fit the perceptual needs of users, enhance user satisfaction, and thus increase the competitiveness of products. The main body of this study is the design of rural tourism souvenirs, and the entry point is the rural tourism area of the Yellow River Basin to explore the specific methods and implementation procedures of perceptual design. By analyzing the association between cultural imagery and design elements of rural tourism souvenirs in the Yellow River Basin, the perceptual design strategy is proposed.

PURPOSE

Rural tourism souvenir design in the Yellow River Basin currently suffers from superficial cultural interpretation and ambiguous mechanisms linking design elements to cultural imagery, leading to severe homogenization, insufficient emotional resonance, and a lack of empirical validation. Employing Kansei Engineering

methodology, this study establishes a systematic affective design framework that analyzes the mapping relationships between cultural imagery and design elements. Through proposing comprehensive affective design strategies, the research aims to bridge the gap among cultural inheritance, user sentiment, and design practice, offering theoretical foundations and methodological guidance for creating souvenirs that authentically reflect the Yellow River Basin's rural distinctiveness while fulfilling tourists' profound emotional needs.

RESULTS AND DISCUSSION

1. Characteristics of rural tourism souvenirs

Rural tourism souvenirs to show the unique charm of the tourist places, the regional characteristics of the products are not only reflected in the cultural connotations contained in the souvenirs themselves, but also in the whole process of their design, production and marketing. For example, the porcelain bamboo weaving product (Fig.1) is a unique traditional handicraft in Chengdu, a craft that can only be made locally with cizhu bamboo that grows for two years and has a node length of more than 66 centimeters, and the product is made with a unique production technique, which can not only serve as a path for the spread of local intangible cultural heritage skills, but also deepen the identification of the product and form a benign interactive cycle of culture and economy.

Rural tourism souvenirs have commemorative nature. Unlike other consumer products, although rural tourism souvenirs need material concepts to express their appearance and form, reflecting regional culture, the more important element is the abstract concept of rural tourism souvenirs. The most crucial role in rural tourism souvenirs is to enable buyers to recall the feelings they had while traveling and resonate with the local experience. Emphasize the regional characteristics to the target audience and induce the willingness to travel. Rural tourism souvenirs are the continuation of a journey in which tourists and tourist places have a sense of identity, and their commemorative nature is one of the most important product attributes that consumers pay attention to. For example, the tourist souvenirs of Hongcun Village in Anhui Province (Fig. 2) are presented as refrigerator stickers with unique carvings on the local traditional architecture to attract consumers' eyes and induce emotional resonance.

Rural tourism souvenirs are cultural in nature, and the differences between regions mainly come from the natural environment and the human culture and folklore formed based

on the natural environment. Therefore, cultural nature is an important feature of rural tourism souvenirs, and rural tourism souvenirs are essentially the figurative carrier of rural culture, conveying local cultural characteristics to tourists. Take Yunnan tile cat ornaments as an example (Fig. 3), placing a «tile cat» on the roof of the main house, the eaves or the ridge of the main door has the meaning of driving away evil spirits and good luck. Focus on the cultural nature of tourism souvenirs, can enhance the humanistic feelings of the product, will focus on restoring the visual attributes sublimated to emphasize the spiritual culture, sublimation of the spiritual value of the product.

Rural tourism souvenirs are practical and decorative. Rural tourism souvenirs can be used as decorations, but also often have practical use

functions, such as household goods, stationery, etc., which enhances their practical value. With the rise of rural tourism, many souvenirs have gradually become market-oriented, combining modern design concepts to meet tourists' consumption needs and expand sales channels. For example (Fig. 4), the tools and production process of prints made during local festivals are repackaged and designed to enhance tourists' participation and sense of belonging by involving them in the design or production process.

2. Sensual Engineering Design Path of Rural Tourism Souvenirs

Perceptual engineering design method is a comprehensive design method that integrates multidisciplinary knowledge of psychology, statistics and mathematics to deeply understand and satisfy users' perceptual needs. It mainly



Fig. 1. "Porcelain and bamboo side handle pots" tourist souvenirs [19]



Fig. 2. Tourist souvenirs from Hongcun, Anhui [21]



Fig. 3. Yunnan Tile Cat Pendant [22]



Fig. 4. Zhao Wang Nian Hand-carved Woodblock Prints Set [20]

includes Imagery Scale Method, Semantic Difference Method, Eye Movement Experiment Method, Gray Correlation Analysis Method, Kano Model, and Multiple Linear Regression Method. In this study, the eye-tracking experimental method and multiple regression model are mainly used to visually describe users' interests and explore the multiple influences between cultural imagery and design elements (2021) [18]. Therefore, this study is centered on the above two methods of perceptual engineering.

From the perspective of perceptual design, a product is not only a functional tool, but also an experiential vehicle that establishes an emotional connection with the user, and emotion and experience play an extremely important role in product design (Kim et al, 2019) [8]. The basic research idea of perceptual engineering is to determine the quantitative values of perceptual imagery and product elements and establish the connection between them accordingly to guide the subsequent product design. Therefore, obtaining and measuring the imagery of target consumer groups for perceptual analysis research is the focus of perceptual engineering. The research process of perceptual engineering is basically divided into three stages, namely, perceptual imagery acquisition, model building and analysis, and design optimization (Fig. 5).

In the stage of perceptual imagery acquisition through questionnaires, interviews and other ways, collect the emotional needs of tourists for rural tourism souvenirs in the Yellow River Basin, such as nostalgia, cultural identity, and so on, and transform them into specific

design elements, such as color, material, shape and so on. In the model building stage, dig deep into the history and culture of the Yellow River Basin, folk customs and other cultural elements, and refine and integrate them into the design of the souvenirs, so as to make the products have a stronger cultural flavor and regional characteristics. In the design optimization stage, the use experience of rural tourism souvenirs is optimized through the method of perceptual engineering, such as improving the ease of use and comfort of the product, so as to enhance the satisfaction and loyalty of tourists to the product.

3. Analysis of Cultural Imagery and Design Elements of Rural Tourism Souvenirs in the Yellow River Basin

Unlike other product designs that divide consumer groups by function, rural tourism souvenirs inherently have an emotional group. Culture is not a superficial and isolated element, but requires designers to invest a long time to dig deeper and combine with the human environment and other factors for in-depth understanding. When designing rural tourism souvenirs, local residents, designers, and consumers are involved in multiple stakeholder groups. Due to this cultural difference and diversity of understanding, it is difficult for rural tourism souvenirs to form a wide resonance and recognition in the mass market. Through quantitative data, perceptual design accurately captures the feelings of consumer groups towards regional culture, and reduces designers' mistakes in conveying cultural imagery due to regional cognitive differences. It directly reflects consumer needs and helps design tourism souvenirs that are more in

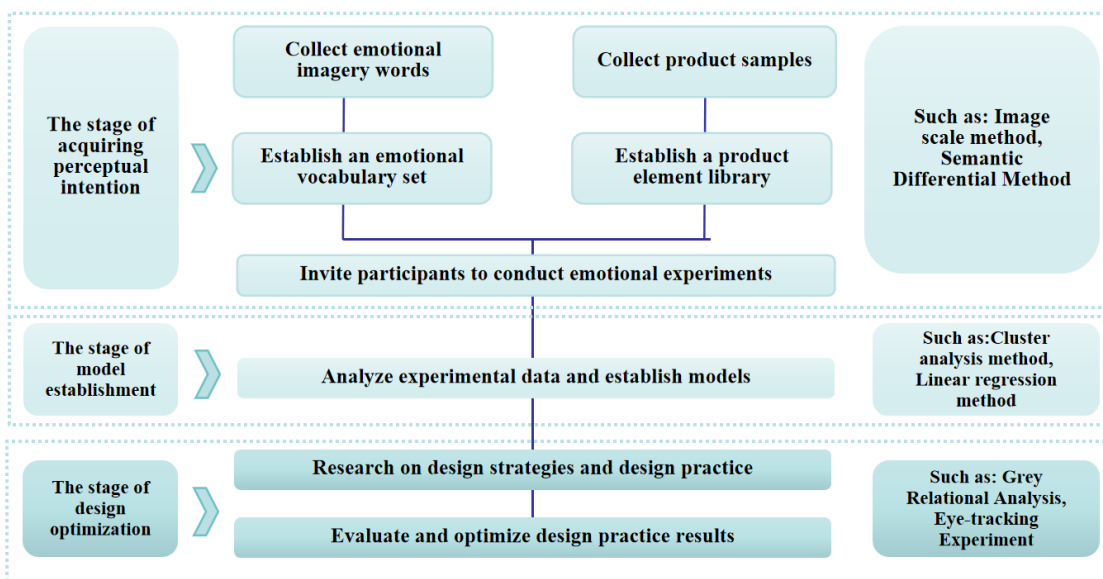


Fig. 5. Flowchart of perceptual engineering design (drawn by the author)

line with expectations. These souvenirs are rich in regional characteristics, which can strengthen the regional impression and promote the development of local tourism.

Firstly, the collection and organization of rural tourism cultural resources in the Yellow River Basin (tab. 1), based on the criterion of «most representative of the cultural image of rural tourism in the Yellow River Basin», i.e., representativeness, popularity and culture, six rural tourism cultural resources in the Yellow River Basin are selected as the most representative of the region. On the basis of the six selected cultural resources samples, combining pictures, official website information and tourists' evaluation and other information to help association, summarize and organize the sample corresponding to a total of 24 imagery words, and then screening and organizing the sample of imagery word association, and finally get 15 imagery words. In order to get the overall impression dimension of users' cultural imagery of rural tourism in the Yellow River Basin, the author takes the original sample pictures as reference, designs questionnaires based on the criterion of whether the imagery words are in line with users' tonal impression of the samples, and selects 9 students who have design-related learning experiences, 5 students who have Chinese language-related learning experiences, and 6 ordinary users who have some knowledge of the Yellow River Basin, totaling 20 people, to judge the imagery matching degree. The imagery matching degree was judged. The three categories obtained after clustering of imagery phrases show that food, esthetics, and phonetics are important components in the cultural resources of rural tourism in the Yellow River Basin. This indicates that these three cultural characteristics are the most characteristic of the Yellow River Basin region, and are also the main points on which users' cognition is concentrated when buying rural tourism souvenirs in the Yellow River Basin. However, the three are not completely independent, but show more focused parts on different cultural resources. The recognition of rural tourism souvenir design is affected by many elements, such as the cultural level of tourists, esthetic level and so on. Therefore, when expressing this kind of cultural imagery information in souvenir design, it is necessary to grasp the relationship between this kind of information and design elements, and choose the perception channel with priority to establish the connection between souvenir design and rural tourism in the Yellow River Basin, and form the use environment with regional characteristics. Each imagery word represents

the targeted cultural image imagery description of rural tourism in the Yellow River Basin in the imagery cluster.

The data collection of perceptual research is carried out by accomplishing the connection and mapping between the cultural imagery of rural tourism in the Yellow River Basin and the design of rural tourism souvenirs. On the one hand, research is carried out from the research object to collect the current rural tourism cultural resources in the Yellow River Basin and organize and classify them according to the characteristics of the cultural resources to get the independent variables of the perceptual data model. The perceptual design research is centered on the rural tourism culture in the Yellow River Basin area. Conduct imagery association on selected cultural resources, organize the cultural imagery words of rural tourism in the Yellow River Basin region and score them by users, obtain the recognition degree of users for these cultural imagery words and complete the clustering grouping to determine the user perception dimension of rural tourism souvenirs in the Yellow River Basin region. On the other hand, we organize and classify the rural tourism souvenirs on the market to carry out the design research, and extract their design commonalities, decompose them into design items, and abstract the design categories, so as to provide variable elements for the establishment of the perceptual data model between the cultural imagery and the design categories, i.e., the dependent variable (Guo et al., 2020) [5]. By organizing the extracted cultural imagery and design categories to match, establish a linear regression relationship, observe the correlation degree of cultural imagery groups corresponding to design categories, analyze the results of linear regression, and understand the correlation degree of design categories of object groups to illustrate the correlation degree of design categories.

4. Sensibility Design Strategy for Rural Tourism Souvenirs in the Yellow River Basin

The process of rural tourism souvenirs should think about how to show the local characteristics of the natural landscape, history and culture, special crafts, humanities and folklore.

The souvenir design of rural tourism culture is different from ordinary product design, and designers have to undertake the tasks of cultural understanding, cultural translation and satisfying the market at three stages in the design of rural tourism souvenirs. Using the method of perceptual design, users are invited to participate in the design at the stage of cultural imagery clustering. In the linear regression of cultural imagery and design projects, users

Table1

Organization of cultural resources for rural tourism in the Yellow River Basin

Intangible tourism culture	folk culture	folk arts and crafts	Ansai Waist Drum performance, Yellow River Hauling Chant, South Yellow River Mud Inkstone, Western Henan Paper-cutting, Tang Tri-color Pottery, Yuzhou Jun Porcelain
		Festival culture	Spring Festival, Lantern Festival, Dragon Boat Festival, Mid -Autumn Festival
		performing art	Henan Opera, Qinqiang Opera, Gansu Flying Apsara Dance, Mongolian Dance, GuShu Singing and Storytelling
	Humanities and culture	eminent persons in history	Yu the Great, King Tang of Shang, Xu Xiake, Yue Fei
		tales of legend	Kuafu Chasing the Sun, Yu the Great's Flood Control, Nuwa Mending the Heaven
Material tourism culture	Production culture	Featured diet	Lanzhou Beef Noodles, Yinchuan Hand-Grabbed Mutton, Hohhot Shaomai, Shanxi Knife-Sliced Noodles
		Special local product	Heyin Pomegranate, Gaoqing Watermelon, Kenli Yellow River Floodplain Wheat, Mawan Watermelon, Huanghekou Rice
	Living culture	natural landscape	Magnificent Qingtongxia Yellow River Grand Canyon, the awesome power of the Hukou Falls of the Yellow River, and the scenic areas along the Yellow River in Zhengzhou
		purpose-built	Mongolian yurts, the cave dwellings on the Loess Plateau, the quaint and courtyard houses of Shanxi, the sturdy stone-slab houses of Henan, and the elevated water-resistant dwellings in the Yellow River floodplain. elevated water-resistant dwellings in the Yellow River floodplain.
	Humane places	Historic sites	Pingyao Ancient City, Longmen Grottoes, Yungang Grottoes, Yuan Shangdu Site
		Collection of scenic spots	Qiachuan Scenic Area, Hancheng Dangjia Village Scenic Area, Chiniuwo Folk Culture Museum

are also asked to choose the relevant design effects according to their own understanding and preferences. Allowing different users to participate in the whole process of design can help designers understand the cultural connotation of the region and, at the same time, better access to user preferences and needs. The design of different rural tourism culture samples will reflect different focuses, and these differences also have something in common.

In the design optimization phase of perceptual engineering, a combination of subjective and objective methods is used to optimize the design results. The subjective evaluation is used to obtain consumers' opinions on whether the design results meet the requirements of each level proposed by the design strategy, and the gray correlation method is used to calculate the order of meeting the requirements of each level and optimize and modify the design elements that are ranked at the bottom of the list. The optimized solution is then shown to the users using objective eye movement experiments, and whether the optimized solution can arouse the users' interest is judged according to the results of the users' eye movements, so as to prove whether the optimized solution can satisfy the users' expectations for the rural tourism souvenirs. The influence relationship between cultural imagery and design elements

is effectively established through multiple linear regression to provide rational data support for design practice. In this study, the main body of the research is rural tourism souvenir design. The entry point is the rural area of the Yellow River Basin. The research idea is applicable to other areas of rural tourism cultural analysis and souvenir design, and according to the different regions will produce different data results and strategic solutions, targeted to help different regions to complete the design of rural tourism souvenirs, to establish the regional characteristics of rural tourism.

CONCLUSIONS

Traditional villages in the Yellow River Basin, as an important carrier of Chinese civilization, carry rich history, culture and national memory. With the promotion of rural revitalization strategy and the rise of regional tourism, the traditional villages in the Yellow River Basin have gradually become an important destination for tourists to explore history and experience culture, but the design of local tourism souvenirs can not meet the cultural esthetic consumption requirements of consumers. The study first analyzes the characteristics and elements of rural tourism souvenirs in the Yellow River Basin, and then studies the use of perceptual design methods, inviting users to participate in the clustering of cultural imagery

and the design process, to ensure that the design is consistent with the cultural connotation of the region, but also to meet the needs of the user's preferences. At the same time, multiple linear regression is used to establish the relationship between cultural imagery and design elements, and abstract features are converted into concrete data as a reference for guiding design practice, providing new perspectives and methods for the design of rural tourism souvenirs. The study uses perceptual design method to base on consumers' perceptual experience, excavate the souvenir design elements of regional culture, convert rural tourism humanities and folklore and regional culture, combine consumers' consumption demand and cultural experience of rural tourism, and develop rural tourism souvenirs with tourism characteristics and regional characteristics. The research provides a kind of perceptual design ideas and methods for rural tourism souvenir design, so that rural tourism souvenirs are more in line with consumers' perceptual needs and consumption tendencies.

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АНОТАЦІЯ

Лю Ан, Чупріна Н. В. Дослідження перцептивного дизайну сувенірів сільського туризму в басейні річки Хуанхе

Мета. Робота має на меті систематизувати характеристики сувенірів сільського туризму та методи перцептивної інженерії (кансей-інженерії); проаналізувати культурні образи та асоціативні зв'язки елементів дизайну сувенірної продукції в басейні річки Хуанхе; запропонувати стратегію перцептивного дизайну, що сприятиме розробці сувенірів з унікальними туристичними та регіональними характеристиками.

Методологія. Характеристики сувенірів сільського туризму, методи дизайну, культурні образи та відповідні елементи дизайну проаналізовано за допомогою методу аналізу літературних джерел, методу тематичних досліджень та кластерного аналізу.

Результати. Дослідження зосереджено на розробці регіональних культурних сувенірів сільського туризму, дизайн-мисленні та практиці із застосуванням методу перцептивного дизайну. На основі перцептивного досвіду споживачів здійснюється виявлення елементів дизайну, притаманних регіональній культурі. Підхід поєднує споживчий попит із культурним досвідом сільського туризму, трансформуючи гуманістичний фольклор та регіональну культуру в дизайн-рішення, що забезпечує розвиток сувенірної продукції з виразними туристичними та регіональними особливостями.

Наукова новизна. Досліджено інтеграцію перцептивної інженерії у процес проєктування туристичних сувенірів сільського туризму басейну Хуанхе. Сформовано систематичні стратегії емоційного дизайну на основі моделі кореляції між культурними образами та дизайн-елементами, що забезпечує теоретичні парадигми для цифрової трансформації культурної спадщини.

Практична значущість. На основі дослідження шляхів проєктування та стратегій розробки сувенірів сільського туризму в басейні річки Хуанхе запропоновано комплекс більш наукових, точних та відповідних методів проєктування. Це допоможе дизайнерам якісно реалізувати весь процес створення сувеніру. Абстрактні характеристики трансформуються в конкретні дані, що слугують орієнтиром у практичній діяльності. Це сприяє створенню продуктів, які відповідають очікуванням споживачів та ефективно транслюють культурну ідентичність, підвищуючи таким чином конкурентоспроможність продукції.

Ключові слова: туристичні сувеніри, перцептивний дизайн, перцептивна інженерія, сільська місцевість, культурне надбання.

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