The Study of Cultural and Creative Design for the Twenty-Four Solar Terms Intangible Cultural Heritage Based on the KJ Method and Kano Model

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Abstract. In recent years, the state has placed great emphasis on the protection and inheritance of intangible cultural heritage (ICH). As an important avenue for ICH transmission, the cultural and creative industry provides a platform for the display and dissemination of such heritage. This study focuses on cultural and creative products based on the Twenty-Four Solar Terms ICH. A qualitative analysis using the KJ method was conducted to categorize primary and secondary demand indicators. Based on these demand indicators, a Kano questionnaire was designed and distributed, followed by an analysis of the statistical data and the calculation of the Better-Worse coefficient. This process helped to determine the prioritization of various demands. Through the analysis of the Kano model, the study identifies user needs for cultural and creative products related to the Twenty-Four Solar Terms ICH and proposes effective design strategies to further promote the widespread dissemination and development of these products.

Keywords: Twenty-Four Solar Terms, Intangible Cultural Heritage, Cultural and Creative Design, KJ Method, Kano Model

1 Introduction

The Twenty-Four Solar Terms originated from the Yellow River Basin in China. It is a system in which the ancient Chinese divided the sun's annual movement into 24 equal segments, each representing a solar term. The division of these solar terms had a significant impact on traditional agricultural production and the daily lives of the people. With the advancement of time and significant improvements in science and technology, the role of the Twenty-Four Solar Terms in guiding agriculture has diminished. However, the profound cultural heritage and natural philosophy embodied within them continue to influence contemporary Chinese society.

In 2006, the 24 Solar Terms were included in the first list of representative items of China's intangible cultural heritage; in 2016, the 24 Solar Terms were inscribed on the Representative List of the Intangible Cultural Heritage of Humanity by UNESCO, which reflects the unique value and influence of the 24 Solar Terms among global intangible cultures, strengthens the sense of identity and pride of the Chinese people in

their own culture, and promotes the dialogue and exchange between Chinese culture and the world[1]. At the same time, it also provides new opportunities and challenges for the internationalization of cultural and creative industries. However, previous design methods and forms are difficult to accurately grasp the needs of users, thus making it difficult for cultural and creative products to be recognized in the market. For this reason, this study combines the qualitative analysis of the KJ method and the quantitative analysis of the Kano model to conduct a scientific and effective user demand analysis of the twenty-four solar terms non-heritage cultural and creative products, which provides an important basis for the design practice of the twenty-four solar terms non-heritage cultural and creative products.

2   The Current Situation of Research on Twenty-Four Solar Terms Non-Heritage Cultural and Creative Products

As one of the important intangible cultural heritages in China, the 24 Solar Terms have become a popular thematic study for design and development in the field of non-heritage cultural and creative products. In design practice, designers focus on exploring the rich knowledge systems and cultural connotations contained in the 24 Solar Terms, such as astronomy, agriculture, and folk customs. They investigate the natural phenomena, regional characteristics, and features of plants and animals corresponding to each solar term, extracting key characteristics and applying design methods to transform them into visual symbol elements, such as colors, textures, and decorative patterns. t is applied in the design practice process of cultural and creative products. ccording to research, cultural and creative products based on the 24 Solar Terms intangible cultural heritage have diversified, covering office supplies, daily household items, clothing design, food packaging, and tourist souvenirs. dditionally, with the development of technology, design creators are utilizing modern technological means such as mobile applications, virtual reality (VR), and augmented reality (AR) to imbue the 24 Solar Terms intangible cultural heritage with a stronger sense of modernity and interactive experiences[2].From a theoretical research perspective, relevant scholars are studying cultural and creative products related to the 24 Solar Terms intangible cultural heritage from various angles.For example, Wu Yuhong, in the study Research on the Design of Cultural and Creative Products of the 24 Solar Terms in the Context of Rural Revitalization: Taking Zhubei Town in Qingyang, Anhui as an Example, combined the 24 Solar Terms with the regional cultural and natural characteristics. ian Jiawei, in the study Design of 24 Solar Terms IP Cultural and Creative Products Based on Narrative Theory, primarily combined narrative strategy methods with cultural and creative products related to the 24 Solar Terms. ang Yitong, in the study Design of Xiang Embroidery Cultural and Creative Products with 24 Solar Terms Cultural Imagery, combined traditional Xiang embroidery techniques with the cultural imagery of the 24 Solar Terms, exploring design methods for Xiang embroidery cultural and creative products based on the 24 Solar Terms.

In summary, while significant progress has been made in both design practice and theoretical research on the Twenty-Four Solar Terms ICH cultural and creative

products, there are still many issues in the design and development process. Firstly, some 24 Solar Terms intangible cultural heritage cultural and creative product designs are still focused on superficial symbol application, lacking depth in exploring the culture of the 24 Solar Terms. Additionally, a significant amount of product homogenization has emerged in the market. Secondly, the design of some products prioritizes form over function, excessively emphasizing visual effects while neglecting actual user experience and functional application. User satisfaction after purchase is not high, as the actual needs of users have not been properly understood, and there is a lack of market feedback. Therefore, the designed and developed products have not been able to adjust the overall design concept and strategy in a timely manner, resulting in the failure to realize the inheritance of the 24 Solar Terms intangible cultural heritage and its transformation into commercialization.

3   Research Methodology

3.1   KJ Method

The KJ method, also known as Affinity Diagram, was proposed by Jiro Kawakita, a famous Japanese anthropologist, in the 1960s. The method was initially applied to the analysis of data in social surveys, and was later widely used in user experience and design research, market research and brand strategy, software research and development, business management and teamwork, healthcare, urban planning, and many other fields, KJ method is an effective systematic method for information organization and problem analysis, which can classify and summarize the large amount of scattered and disorderly data, information and ideas in the survey, and establish the intrinsic connectivity and structural patterns, so as to form a clear cognitive organization[3]. At this stage, the KJ method has been applied in the design field, such as in the process of user interface design and development, a large number of user feedback requirements and observations were collected through user interviews, and the KJ method was used to summarize the research information into different demand groups, helping designers to find out the key needs and pain points of the users, which can further optimize the interface interaction design process; in the case of household product design, the design team generated a new set of requirements through brainstorming, and the design team was able to develop a new set of requirements through brainstorming. When designing household products, the design team generates a lot of creative ideas through brainstorming, and with the help of the KJ method, these creative ideas are categorized into environmentally friendly materials, effective space application, modular design, etc., exploring similar or related design concepts and design methods, and refining innovative design solutions in different categories of the hierarchy. It can be seen that in the field of design KJ method is applicable to user demand information, design ideas sorting and integration, generalization of design key points, and refining and generation of ideas.

3.2   Kano Model

The Kano model is a model proposed by Japanese professor Noriaki Kano in the 1980s to study user needs analysis. The model categorizes user needs into basic needs, expectation needs, excitement needs, and undifferentiated needs. Basic needs are the functions that must or should be available; if the basic needs of the user are satisfied, the user's satisfaction will not change. Expected demand refers to the expectations expressed by the user, if the expected demand is met, then the user's satisfaction will become higher, on the contrary, it will lead to user dissatisfaction. Excitement needs are functions or features that exceed the user's expectations. When the user's excitement needs are met, the user's satisfaction will increase, but even if the user's excitement needs are not met, the user will not be dissatisfied. Non-differentiated needs are needs that are not important to the user and will not have an impact on user satisfaction. Reverse demand means that for some user groups, some of the needs provided will instead lead to a decrease in satisfaction, and reverse demand is affected by the preference factors of different user groups[4].Kano model can stratify and prioritize user needs clearly, helping enterprises and designers to better understand the needs of users at different levels and to develop and implement optimization programs in a targeted manner.

4   Investigation and Research

4.1   Demand analysis of Twenty-four Seasons Non-heritage Cultural and creative Design based on the KJ Method

In order to collect a wide range of user demand information, it is first necessary to determine the object of the visit survey, this survey object for the mass user groups, generation Z users, professional designers, researchers of traditional non-heritage culture or users interested in non-heritage culture, overseas users and so on, a total of 86 people. Taking the demand for the design of twenty-four solar terms non-heritage cultural and creative products as the topic of discussion, we used interviews and brainstorming to carry out thought diffusion and association, and selected 40 typical sample cases to understand the user groups' cognition of the twenty-four solar terms non-heritage culture from various perspectives of cultural and creative products' vision, function, design form, and cultural connotation, as well as to dig out the corresponding different needs.After the interview and investigation, although a large amount of information was obtained, however, the information obtained was fragmented and multi-perspective, and the information was first initially summarized and organized, and then it was necessary to cluster the keywords with the help of the KJ method and convert them into corresponding needs (see Table 1). Finally, five first-level needs and 24 second-level needs were formed: aesthetic needs, usage needs, humanistic needs, scientific needs and social needs (see Table 2).

Table 1. Keyword Clustering Using the KJ Method (Partial)

Interview Records (Partial)	Keyword Extraction	Keywords After KJ Method Clustering
Interview Quote 1: If the solar terms cultural and creative products have regional characteristics, they can be given as small gifts to friends.	Regional characteristics, gift	
Interview Quote 2: In the past, Twenty-Four Solar Terms cultural and creative products usually included physical items like calendars and notebooks, but now electronic mobile devices are more commonly used. It would be more convenient if the products had technological and smart features.	technological intelligence, convenience	Regional characteristics Social media Intelligence Functionality and practicality
Interview Quote 3: The Twenty-Four Solar Terms cultural and creative products I bought weren't very practical. As decorative items, their designs easily become outdated, so I'm not interested in purchasing similar products in the future.	practicality, outdated style	Sustainability Popularity
Interview Quote 4: In fact, some people are still not very familiar with the cultural heritage of the Twenty-Four Solar Terms. I hope that cultural and creative products can serve as educational or cultural promotional tools, becoming an important way to learn about the scientific knowledge, cultural background, and folk activities associated with the Twenty-Four Solar Terms.	education, cultural promotion, scientific knowledge, folk customs	Educational value Guidance Brand and cultural identity Personalization
Interview Quote 5: The Twenty-Four Solar Terms cultural and creative products on the market are all very similar. If there were options for personalized, handmade customization, or collaboration with certain brands, it would feel more meaningful.	Homogeneous, personalized handmade customization	Modern aesthetic expression

Table 2. Classification of Demand Categories for Twenty-Four Solar Terms Intangible Cultural Heritage Cultural and Creative Products

Primary Demand Categories	Aesthetic Needs(A)	Functional Needs(B)	Cultural Needs(C)	Scientific Needs(D)	Social Needs(E)
Secondary Demand Categories:	Artistry(a1) Permanence(a2) Craftsmanship(a3) Modern aesthetic expression(a4)	Functionality and practicality(b1) Ease of use and convenience(b2) Experiential value(b3) Interactivity(b4) Sustainability and environmental friendliness(b5) Comfort(b6)	Cultural inheritanc(c1) Cognition(c2) Emotional resonance(c3) Educational value(c4) Regional characteristics(c5) Personalization(c6)	Objectivity(d1) Popularity(d2) Guidance(d3) Intelligence(d4)	Gift-giving(e1) Brand and cultural identity(e2) Social media(e3) Symbolism(e4)

4.2   Questionnaire Design and Distribution

The Kano model provides a set of templates for the design of questionnaires to obtain public opinion through positive and negative questions, i.e., if the Twenty-four Sets of Seasons non-heritage cultural and creative products have this attribute, what do respondents think? If the non-heritage cultural and creative products of the 24 Solar Terms do not have this attribute, what do the respondents think? For each question, "like", "deserve", "don't care", "barely accept", "can't accept", "can't accept", "can't accept", "can't accept", "can't accept", "can't accept", "can't accept". "Unacceptable" was provided for each question. At the same time, in order to avoid too much text content in the questionnaire to cause the respondents to get bored and affect the reliability of the survey results, the organizer made appropriate changes and simplified the questionnaire, 24 product attributes to form a 48-question Kano questionnaire. The questionnaire was issued from September 2024 to October 2024, the questionnaire form was mainly online questionnaire, the questionnaire was recovered in one month, and a total of 88 questionnaires were obtained, 8 invalid questionnaires were eliminated, and 80 valid questionnaires were obtained. To organize the users' choice information, the users' answers to each demand quality question from Q1 to Q24 in the questionnaire were counted, and at the same time, the Kano Model Evaluation Comparison Table (see Table 3) was used for comparison, and the positive and negative answers of the demand measurement elements were synthesized and categorized into the final demand items, e.g., positively evaluated "should be", negatively evaluated "don't like", negatively evaluated "don't like", and negatively evaluated "don't like"[5]. For example, if the positive rating is "deserve it" and the negative rating is "don't like it", the need can be expressed as "M". In the end, the statistical results of the 24 demand measurement items were categorized into quality elements by selecting the ones with the higher number of responses, and the quantitative results were also normalized to produce the final attributes of the demand types (see Table 4).

Table 3. Kano model evaluation result classification comparison table

Function/Service		Negative question				
		Dislike(1)	Tolerable(2)	Indifferent(3)	Expected(4)	Like(5)
	Dislike(1)	Q	R	R	R	R
	Tolerable(2)	M	I	I	I	R
Positive question	Indifferent(3)	M	I	I	I	R
	Expected(4)	M	I	I	I	R
	Like(5)	O	A	A	A	Q

Table 4. Summary of Kano Model Analysis Results

Function/Service	A	O	M	I	R	Q	Classification Results
a1	11.25%	13.75%	18.75%	56.25%	0.00%	0.00%	I
a2	17.50%	20.00%	33.75%	28.75%	0.00%	0.00%	M
a3	25.00%	21.25%	13.75%	38.75%	1.25%	0.00%	I
a4	12.50%	31.25%	11.25%	43.75%	0.00%	1.25%	I
b1	35.00%	15.00%	18.75%	31.25%	0.00%	0.00%	A
b2	16.25%	12.50%	40.00%	31.25%	0.00%	0.00%	M
b3	8.75%	11.25%	25.00%	52.50%	0.00%	2.50%	I
b4	10.00%	23.75%	6.25%	58.75%	1.25%	0.00%	I
b5	35.00%	17.50%	13.75%	33.75%	0.00%	0.00%	A
b6	3.75%	2.50%	20.00%	73.75%	0.00%	0.00%	I
c1	36.25%	30.00%	6.25%	27.50%	0.00%	0.00%	A
c2	21.25%	7.50%	15.00%	55.00%	1.25%	0.00%	I
c3	18.75%	28.75%	18.75%	33.75%	0.00%	0.00%	I
c4	13.75%	8.75%	20.00%	57.50%	0.00%	0.00%	I
c5	37.50%	11.25%	18.75%	32.50%	0.00%	0.00%	A
c6	38.75%	12.50%	16.25%	32.50%	0.00%	0.00%	A
d1	7.50%	22.50%	20.00%	50.00%	0.00%	0.00%	I
d2	33.75%	15.00%	17.50%	33.75%	0.00%	0.00%	I
d3	18.75%	13.75%	11.25%	56.25%	0.00%	0.00%	I
d4	7.50%	17.50%	10.00%	58.75%	1.25%	5.00%	I
e1	28.75%	33.75%	12.50%	23.75%	0.00%	1.25%	O
e2	8.75%	12.50%	12.50%	66.25%	0.00%	0.00%	I
e3	37.50%	7.50%	15.00%	40.00%	0.00%	0.00%	I
e4	13.75%	7.50%	27.50%	50.00%	1.25%	0.00%	I

4.3   Statistics and Analysis of the KANO Questionnaire

The 24 demand elements for cultural and creative products related to the Twenty-Four Solar Terms were classified according to their Kano attributes. Based on the model, essential attributes, indifferent attributes, expected attributes, and attractive attributes were identified. Additionally, the priority of each attribute was determined by calculating the Better-Worse coefficient[6]. The formulas for these calculations are as follows:

$$Better/SI = (A + O) / (A + O + M + I)$$

$$Worse/DSI = (M + O) / (A + O + M + I) \times (-1)$$

Using these formulas, the Better-Worse coefficients for the attributes of the cultural and creative products of the Twenty-Four Solar Terms were calculated. Based on these coefficients, a classification quartile diagram was plotted (see Fig. 1).
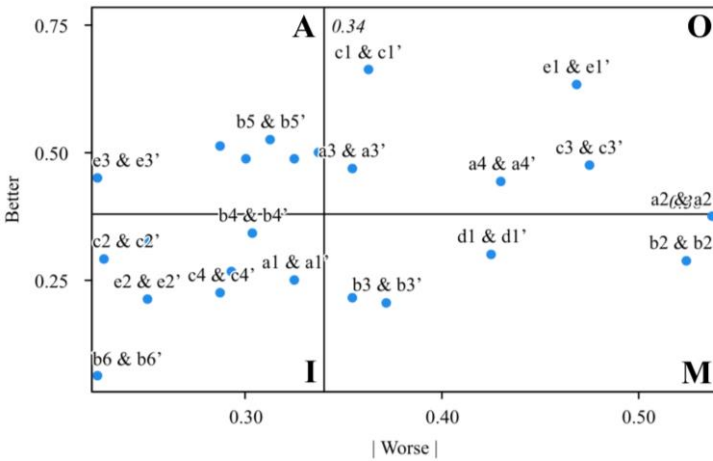
Fig. 1. Better-Worse coefficient chart

The four quadrants in the diagram represent different user need attributes. The first quadrant represents performance needs, the second quadrant represents excitement needs, the third quadrant represents indifferent needs, and the fourth quadrant represents basic needs. From this diagram, it can be observed that the original need types have undergone some adjustments, forming new categories of demand attributes.

The satisfaction sensitivity, denoted as 'S', is represented by the distance from the point (using S_{SI} and $|D_{DSI}|$ as coordinates) to the origin. Based on the characteristics of S_{SI} and D_{DSI}, the larger the 'S' value, the higher the user satisfaction, indicating that the degree to which this need is met has a greater impact on user satisfaction[7]. Therefore, the importance of needs within the same category is ranked based on the size of 'S'. After calculations, the corresponding values were obtained, resulting in the optimized table of the questionnaire results, as shown in Table 5.

Table 5. Functional requirement attribute statistics

Primary needs	Func-tion/Service	Original demand type	Better	Worse	New category	S	Ranking
	a1	I	0.25	0.325	I	0.41	18
Aesthetic needs	a2	M	0.375	0.5375	M	0.66	4
(A)	a3	I	0.4684	0.3544	O	0.59	10
	a4	I	0.443	0.4304	O	0.62	5
	b1	A	0.5	0.3375	A	0.60	7
	b2	M	0.2875	0.525	M	0.60	8
Usage needs	b3	I	0.2051	0.3718	M	0.42	16
(B)	b4	I	0.3418	0.3038	I	0.46	15
	b5	A	0.525	0.3125	A	0.61	6
	b6	I	0.0625	0.225	I	0.23	24
Cultural needs	c1	A	0.6625	0.3625	O	0.76	2
(C)	c2	I	0.2911	0.2278	I	0.37	22

	c3	I	0.475	0.475	O	0.67	3
	c4	I	0.225	0.2875	I	0.37	21
	c5	A	0.4875	0.3	A	0.57	12
	c6	A	0.5125	0.2875	A	0.59	9
	d1	I	0.3	0.425	M	0.52	13
Scientific needs	d2	I	0.4875	0.325	I	0.59	11
(D)	d3	I	0.325	0.25	I	0.41	19
	d4	I	0.2667	0.2933	I	0.40	20
	e1	O	0.6329	0.4684	O	0.79	1
Social needs	e2	I	0.2125	0.25	I	0.33	23
(E)	e3	I	0.45	0.225	A	0.50	14
	e4	I	0.2152	0.3544	M	0.41	17

5   Analysis of Survey Results

Based on the data analysis, among the 24 product demand elements, the following were identified as performance attributes: gift-giving, cultural inheritance, emotional resonance, modern aesthetic expression, and craftsmanship. The elements classified as excitement attributes include sustainability and environmental friendliness, functionality and practicality, personalization, and regional characteristics. The essential attributes include permanence, ease of use and convenience, objectivity, experiential value, and symbolism. Indifferent attributes include popularity, interactivity, artistry, guidance, intelligence, educational value, cognition, brand and culture, and comfort.By calculating user satisfaction values, the importance of each attribute was ranked (see Table 6).

Table 6. Importance ranking of user needs for 24 Solar Terms intangible cultural heritage creative products

Type of needs	Importance ranking
One-dimensional attributes	e1>c1>c3 >a4 >a3
Attractive attributes	b5>b1>c6>c5
Must-be attributes	a2 >b2>d1 >b3>e4
Indifferent attributes	d2>b4>a1 >d3 >d4>c4>c2> e2>b6

Based on the ranking of the importance of user needs for cultural and creative products related to the Twenty-Four Solar Terms, it can be observed that, in terms of performance attributes, the highest demand from users is for gift-giving, followed by cultural inheritance. Regarding excitement attributes, sustainability and environmental friendliness rank highest, followed by functionality and practicality. As for essential attributes, the highest demand is for permanence, followed by ease of use and convenience.

6   Design Practice of Cultural and Creative Products Related to the Twenty-Four Solar Terms

Based on the analysis of the survey results, the design of cultural and creative products related to the Twenty-Four Solar Terms should emphasize gift-giving and highlight the cultural inheritance aspects of the products. The products can be designed as diverse gift sets to meet the needs of various social occasions. In-depth exploration of the cultural connotations of the solar terms is essential, and these cultural elements can be transformed into visual symbols, stories, or audio elements to enhance the cultural richness of the products.Additionally, sustainability and environmental friendliness in terms of materials and usage should be emphasized in design practice, leading to the development of multifunctional cultural and creative products. Finally, the design should consider the product's timelessness and durability, ensuring that the products are easy to carry and use, while avoiding overly complicated designs.

The following describes the design practice of cultural and creative products related to the Twenty-Four Solar Terms. Figure 2 showcases a jewelry series with a theme based on the four seasons—spring, summer, autumn, and winter—integrating elements of Wuwei palace lanterns. Each earring adopts the classic lantern shape, combined with corresponding solar terms to form unique visual symbols. The material used is eco-friendly alloy, with sections incorporating enamel techniques, making these pieces exquisite and culturally rich as gift items.Figure 3 presents a series of silk scarves, blending the natural imagery of the solar terms: the blooming flowers of the Spring Equinox, the lushness of the Summer Solstice, the harvest of the Autumn Equinox, and the tranquility of the Winter Solstice. These seasonal scenes are expressed through decorative patterns and colors. Users can enjoy aesthetic experiences while using these scarves, which are both practical and embody cultural heritage, making them suitable gifts for friends and family.

Fig. 2. Series of jewelry cultural and creative products

Fig. 3. Series of scarf cultural and creative products

7   Conclusion

This study focused on cultural and creative products related to the Twenty-Four Solar Terms ICH, utilizing qualitative analysis through the KJ method and quantitative analysis via the Kano model to explore and clarify user needs for this category of products. Additionally, some Twenty-Four Solar Terms ICH cultural and creative products were designed and showcased. The findings provide valuable guidance and reference for designers in the practical design of such products. In future research, the scope of user surveys and sample size can be expanded to gather more comprehensive user needs, further promoting the transmission and development of the cultural heritage of the Twenty-Four Solar Terms.

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