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Exploring Taiwan's Landscape Painting Aesthetic Preferences Through Evaluation Grid Method and the Continuous Fuzzy Kano Model

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Abstract: The primary objective of this study is to apply the Evaluation Grid Method (EGM) and the continuous fuzzy Kano quality model to explore the cognitive preferences of Taiwan residents regarding the beauty of Taiwan's landscape paintings. The aim is to contribute to the development of social and cultural art and promote the widespread appeal of art products. Through a literature review, consultations with aesthetic experts, and the application of Miryoku Engineering's EGM, this paper consolidates the factors that contribute to the attractiveness of painting art products among Taiwan residents, taking into account various aesthetic qualities. Simultaneously, the paper introduces the use of the triangular fuzzy golden ratio scale semantics, specifically the equal-ratio aesthetic scale semantics, as a replacement for the traditional subjective consciousness model. Departing from the traditional discrete Kano model that employs the mode as the standard for evaluating quality, this study applies triangular fuzzy numbers to the continuous Kano quality model to analyze the diverse preferences and evaluation standards of the public. The hope is that this research methodology will not only deepen Taiwan residents' understanding and aesthetic literacy of painting art but also serve as a reference for the popularization of art products.

Keywords: Aesthetic literacy; Taiwan's landscape painting; Miryoku engineering; Evaluation grid method (EGM); Fuzzy Kano model; Golden ratio scale semantics

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1. Introduction

This paper aims to delve into the research on the sensory aesthetic evaluation of Taiwan's landscape paintings through in-depth interviews with experts, employing the evaluation grid method (EGM), and utilizing the continuous fuzzy Kano model for perceptual qualitative research. Through this exploration, valuable insights were extracted into the key elements influencing overall evaluations that resonate with the masses. From this perspective, the identification of the qualitative factors contributing to the allure of Taiwan's landscape

paintings becomes apparent. Additionally, the research may shed light on people's familiarity, knowledge levels, and artistic appreciation of Taiwan landscape paintings, with the ultimate goal of enhancing the understanding and aesthetic literacy of painting art among Taiwan residents. This, in turn, could effectively advocate the importance of promoting local aesthetics.

Amidst the global trend of aesthetic popularization, aesthetic literacy has gained widespread acceptance and significance in the Taiwan region. More individuals are now paying attention to the impact of beauty on their personal experiences. Taiwan's landscape paintings, distinguished by their unique regional charm, not only focus on natural landscapes but also highlight the influence of cultural landscapes and human activities on the environment. Preferences for different aesthetic qualities can significantly impact people's interests. These visual charms, when identified and summarized, are integrated into the design of Taiwan's landscape painting elements. Perceptual cognitive research is then conducted to understand their meanings. Utilizing EGM and the continuous fuzzy Kano model, the primary research project focuses on exploring public awareness and aesthetic preferences concerning the visual beauty of Taiwan's landscape paintings. This investigation aims to unveil the public's perspectives on different types of paintings from the Taiwan region.

Moreover, departing from the traditional model of subjective consciousness, this study replaces it with the golden ratio scale semantics, specifically the equal-ratio aesthetic scale semantics. Moving beyond the conventional discrete Kano model that uses the mode as the quality evaluating standard, it adopts the equal-ratio aesthetic scale fuzzy continuous Kano quality model for Taiwan's landscape paintings (**Figure 1**), painted by the author of this article (Chin-Chin, Kuo). Online and paper-based questionnaire surveys were conducted to gauge the awareness and preferences of Taiwan residents regarding paintings. A total of 353 Kano valid questionnaires were collected and analyzed to discern people's diverse preferences and evaluation criteria. Based on the public's inclinations toward Taiwan's landscape paintings, the study aims to create innovative artistic and cultural products, thereby enriching the diverse aesthetic literacy of the people.

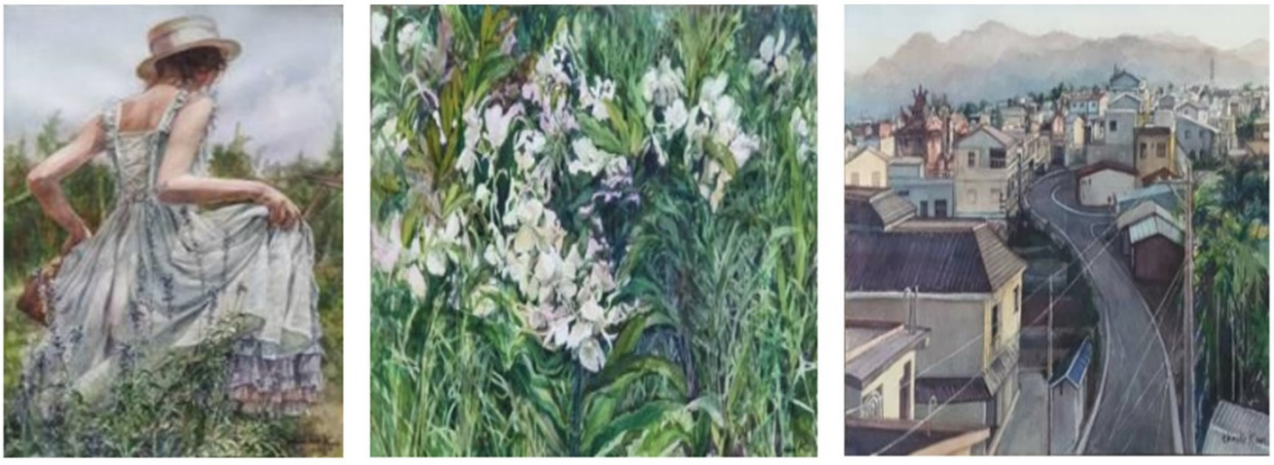

Figure 1. Taiwan's landscape painting by Chin-Chin Kuo. **(a)** Left: Back view; **(b)** Middle: Ginger lily; **(c)** Right: Looking at the morning light at Mountain Dawu.

2. Literature discussion

As painting has evolved into the 21st century, numerous academic theories have emerged, exploring the potential of painting in contemporary art. These theories emphasize that when Taiwan's painting conveys

aesthetic values, it should extend beyond the visual senses and consider the overall presentation context while resonating with the external world and societal connections.

Immanuel Kant, the 18th-century German philosopher, significantly influenced landscape painting with his groundbreaking views on the cognition of art and aesthetics, as presented in his work "Critique of Judgment" (Kant, 1790). Kant asserted that in landscape painting, artists should elicit the viewer's inner aesthetic experience through meticulous composition and the skillful use of color. He also underscored that landscape painting should remain independent of practical purposes. While Western art aesthetics are often used as benchmarks for judgment, Eastern artistic aesthetics, as noted by Lang Ye and Wan-Wei You [1,2], are seldom considered in the compilation of aesthetic viewpoints from Western art. Chong-Hong Lin highlighted that the formal principle of beauty involved the fusion of perceptual capture and rational judgment [3], suggesting that the Western aesthetic structure can be employed to establish Eastern natural aesthetics.

Two influential 20th-century Chinese art masters, Beihong Xu (1895–1953) and Fengmian Lin (1900–1991), advocated for "realism" and emphasized modeling, realism, and expressive conveyance. Pu Zhu acknowledged Fengmian Lin's contribution to infusing new vitality into the longstanding tradition of Chinese art by integrating Western painting's expressive form composition [4]. Kuan-Hsien Wu discovered gender, age, and education level significantly influence aesthetic literacy, with no notable differences based on residence [5]. Research methods, as proposed by Wu, offer a means to observe aesthetic literacy and integrate aesthetics into daily life, considering important aesthetic aspects.

However, creators often prioritize market trends, excessive packaging, and marketing methods without sufficient attention to promoting the aesthetic and educational concepts of Taiwan residents' art. Moreover, few studies explore the correlation between symbolic sensibility and elements such as imagery, historical connotation, customs, humanistic development, and aesthetic perspective in Taiwan's landscape paintings. Hence, this study focuses on applying EGM and the fuzzy continuous Kano quality model with an equal-ratio aesthetic scale to elucidate the correlation between the meaning, style, and perceptual image of Taiwan's landscape painting. Through paintings and artworks, this paper consolidates the preferences of Taiwan residents, offering a valuable reference for subsequent discussions and research in related fields.

3. Research design and methods

3.1. Evaluation grid method (EGM)

The EGM stands as a crucial component within Miryoku Engineering's research framework. Functioning as a design concept rooted in consumer preferences, EGM serves as a communication interface between operators and consumers, fostering joint exploration and creation of charms. To dissect the factors contributing to attractiveness and comprehend interviewees' sentiments regarding product appeal, EGM employs an in-depth interview approach. By exposing participants to stimuli related to the sample subject, the method extracts the original concept through diverse interviewee reactions. Subsequently, participants are guided to delve deeper into their concepts, transforming them into tangible and abstract reasons. This process elucidates the genuine preferences and ideas of the participants, yielding credible evaluations and opinions. Ultimately, EGM construction diagrams are derived. This method excels in capturing abstract feelings that conventional research methods may struggle to obtain.

3.2. Fuzzy theory

The concept of fuzzy theory, first proposed by Zadeh in 1975 [6], underscores the inherent fuzziness in human thinking, reasoning, and perception of the surrounding environment. Recognizing that uncertainty and fuzziness

replace traditional subjective absolutes, this study employs triangular fuzzy semantics as a departure from the conventional subjective consciousness model. Breaking away from the traditional discrete model that uses the mode as the standard for quality evaluation, this study utilizes triangular fuzzy numbers, represented by $M=(l,m,u)$, where $l \leq m \leq u$. When $l>0$, M is termed a regular triangular fuzzy number, and its membership function is defined as follows:

$$\mu_M(x) = \begin{cases} \dfrac{x-l}{m-l}, l \leq x \leq m \\ \dfrac{u-x}{u-m}, m \leq x \leq u \\ 0, otherwise \end{cases}$$

In line with the center of gravity method introduced by Teng and Tzeng in 1993 [7], the study determines the center value of the fuzzy set to represent the entire fuzzy set. The fuzzy solving weight value is obtained through the following equation:

$$DM = \frac{(u-l)+(m-l)}{3} + l$$

Additionally, Zimmerman's fuzzy number operations, proposed in 1991 based on the properties and expansion principle of fuzzy numbers [8], are employed. If there are two triangular fuzzy numbers, $M_1=(l_1,m_1,u_1)$ and $M_2=(l_2,m_2,u_2)$, the fuzzy number operation is articulated through the following two equations:

(1) $M_1 + M_2=(l_1+ l_2,m_1+m_2,u_1+u_2)$

(2) $\lambda M=(\lambda l,\lambda m,\lambda u)$, $\lambda \in R$

The amalgamation of fuzzy theory and the continuous Kano model in the analysis methods prove effective in addressing decision-making problems characterized by ambiguity.

3.3. Kano model

Japanese scholar Noriaki Kano [9], drawing from psychologist Herzberg's "motivation-hygiene theory" proposed in 1959 [10], introduced the "Motivator and Hygiene Factor in Quality" in October 1979. This groundbreaking work incorporated quality management into a two-dimensional model of satisfaction and dissatisfaction, known as the Kano Model (**Figure 2**). On the X-axis, the degree of quality factors is depicted, with higher values representing adequacy and lower values indicating a lack of quality factors. The Y-axis represents consumer satisfaction, where higher values signify greater satisfaction, and lower values denote increased dissatisfaction. The model outlines five curves in the quadrant, illustrating the five quality element relationships of the Kano quality model. Contrary to common belief, satisfaction is not always directly proportional to quality adequacy, as it is influenced by different qualities. The model allows the comprehension of the connection between various quality factors and satisfaction, identifying crucial elements that significantly enhance consumer satisfaction.

The Kano Model categorizes quality attributes into five elements: attractive quality elements, one-dimensional quality elements, necessary quality elements, indifferent quality elements, and reverse quality factors. These are further classified into basic type (M), expectation type (O), charm type (A), indifference type (I), reverse type (R), and question type (Q).

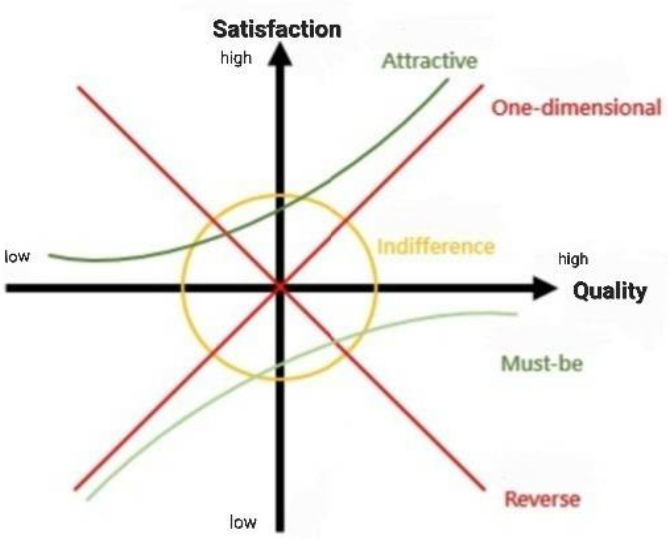

Figure 2. Kano Model

3.4. Golden ratio scale semantics and continuous fuzzy Kano model

Diverging from traditional equal-spaced semantic questionnaires, this study adopts the golden ratio scale of an unequal-spaced semantic questionnaire. This approach distinguishes the ratio of adjacent semantic preferences, underscoring the weighted emphasis on the importance of aesthetic vision. The semantic meaning of the golden ratio scale is akin to an equal-ratio aesthetic scale. In simple terms, if the adjacent importance of and satisfies , with being approximately 1.618 based on the quadrafic equation , the golden ratio, and the 5-equal golden ratio scale adhering to the Fibonacci sequence law. The corresponding triangular fuzzy golden section ratio scale is detailed in **Table 1**.

Table 1. Triangular fuzzy golden section ratio scale

Like	(4.236, 6.854, 6.854)
Must-be	(2.618, 4.236, 6.854)
Neutral	(1.618, 2.618, 4.236)
Live With	(1.000, 1.618, 2.618)
Dislike	(1.000, 1.000, 1.618)

To underscore the fuzzy nature of perceptual understanding, this study deviates from the traditional discrete-type Kano model that employs the mode as the standard for evaluating quality. Instead, it adopts the triangular fuzzy golden ratio scale semantics (**Figure 3**) and modifies William DuMouchel's continuous variable analysis (**Figure 4**) [11]. Fuzzy theory is employed to conduct fuzzy continuous Kano model analysis. This involves calculating the average triangular fuzzy number of forward and reverse problems from collected data. After defuzzification, analyzing **Figure 4** using continuous variables reveals the attributes to which the function belongs.

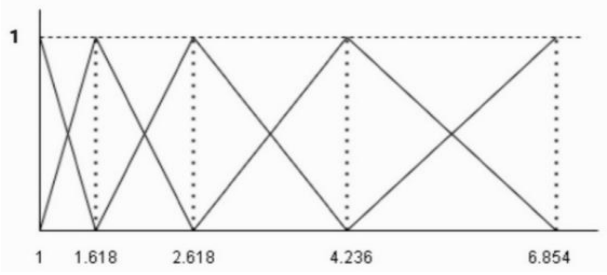

Figure 3. Triangular fuzzy golden ratio scale semantics

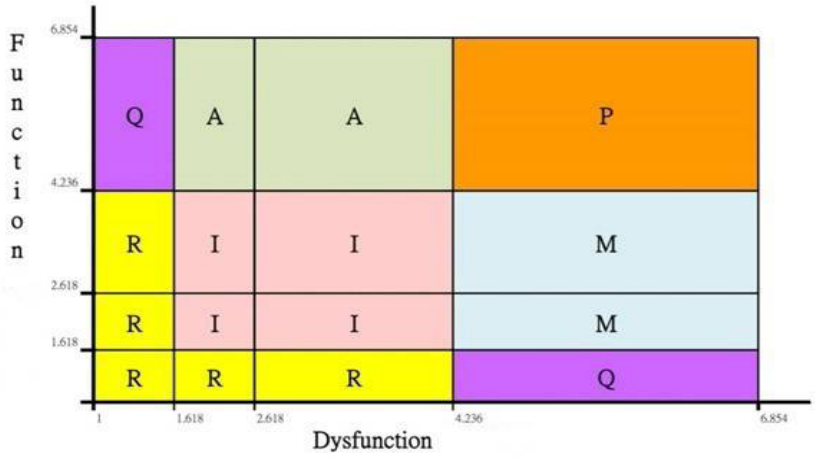

Figure 4. Modified Willian DuMouchel's continuous variable analysis

4. Data analysis results

4.1. Miryoku Engineering's network diagram of attractive factors

To initiate the investigation, highly involved individuals, including designers and scholars with extensive backgrounds in art creation and design, were invited to participate in focus group discussions. Subsequently, both in-depth qualitative interviews and quantitative questionnaires were conducted. Employing the EGM during in-depth interviews with these highly involved individuals, four foundational factors reasons, "composition form," "style expression," "color imagery," and "vitality display," were identified. Furthermore, seven specific reasons and six abstract reasons were uncovered, forming the basis for the charm network diagram of Taiwan's landscape painting as depicted in **Figure 5**.

The spider diagram results synthesized the factors used to evaluate the creative attributes of Taiwan's landscape painting. The four foundational reasons – "composition form," "style expression," "color imagery," and "vitality expression," – fall within the realm of aesthetic design attributes. The seven specific reasons, namely "color expression," "light and shadow presentation," "plant performance," "action performance," "scenery expression," "material presentation," and "visual presentation," represent the material properties conveyed by the artwork to the viewer. The abstract reasons for design factors were categorized into six groups: "emotional expression," "physical presentation," "visual description," "light perception display," "seasonal changes," and "life performance." These categories provide intuitive descriptions for users.

After consulting with experts and analyzing the spider chart results, the factors evaluating the creative attributes of Taiwan's landscape painting were distilled. These include "color expression," "landscape realism," "presentation of power and beauty," "presentation of lush plants," "presentation of a sense of emptiness,"

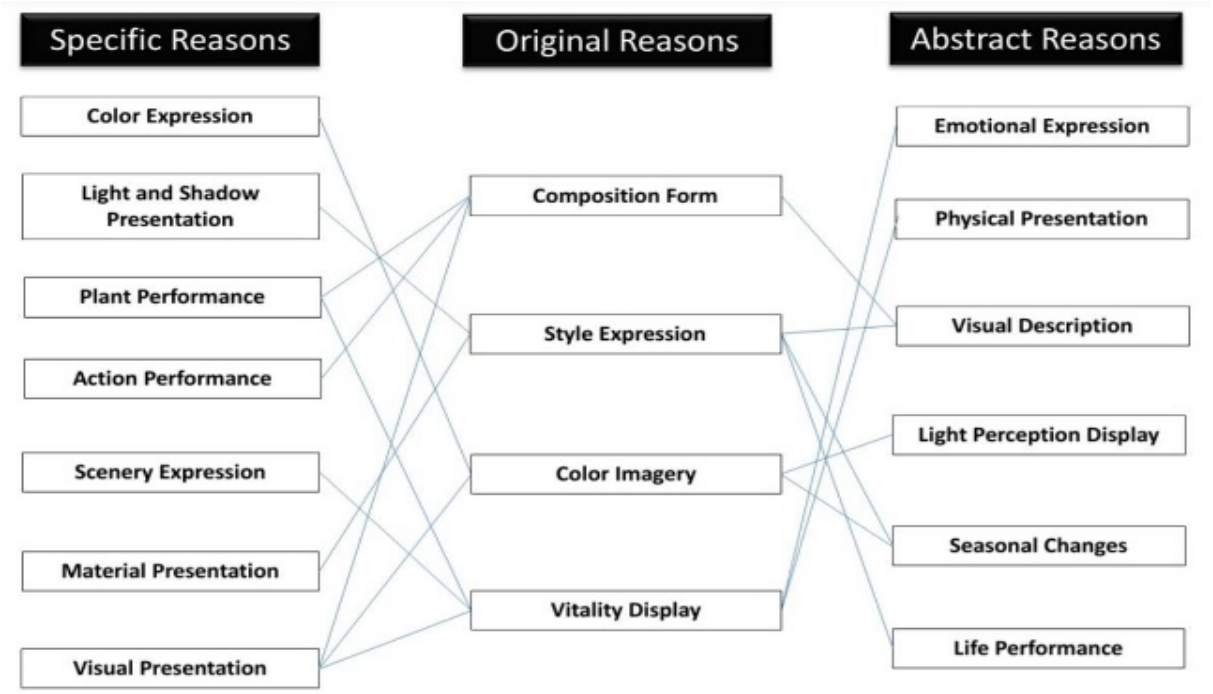

Figure 5. EGM diagram

"presentation of a sense of tranquility," "presentation of changes in light and shadow," and "presentation of a sense of slowness." These eight evaluation factors serve as crucial components in evaluating the artistic attributes of Taiwan's landscape painting.

4.2. Continuous type of fuzzy Kano quality

The Kano Model quality survey aligns with the two-dimensional concept, employing a two-way inquiry method with positive and negative items. The questionnaire corresponds to the aesthetic scale of **Table 1**, namely the triangular fuzzy golden section ratio scale, and utilizes a five-point Likert Scale. The scale scores measure responses on a spectrum from "Like" to "Dislike" for positive and negative questions. A total of 354 valid questionnaires were collected for analysis.

For reliability testing, statistical software SPSS 17.0 was employed, yielding a Cronbach's Alpha value of 0.858 for the overall questionnaire, indicating a high level of reliability. Utilizing triangular fuzzy numbers and conducting defuzzification, analysis of continuous variables based on **Figure 4** revealed the quality classification of the golden ratio scale semantic continuous type of fuzzy Kano Model, which includes three necessary qualities and five attractive qualities, as detailed in **Table 2**.

Drawing from the fuzzy continuous Kano quality classification results derived from the EGM network diagram, among the eight quality factors, "color expression," "presentation of power and beauty," "presentation of a sense of emptiness," "presentation of a sense of tranquility," and "presentation of a sense of slowness" are classified as highly attractive qualities. These attributes are not only very appealing to viewers but also crucial competitive advantages in the design of Taiwan's landscape paintings. Additionally, the three characteristics of "landscape realism," "presentation of lush plants," and "presentation of changes in light and shadow" are classified as must-be qualities with high added value, significantly contributing to the enhancement of consumer value.

Table 2. Golden ratio scale semantic fuzzy continuous Kano model quality classification

Quality factors	Function (positive)		Dysfunction (negative)		Classification attributes
	Triangular fuzzy numbers	Defuzzification numbers	Triangular fuzzy numbers	Defuzzification numbers	
Color expression	(3.607, 5.837, 6.536)	5.327	(2.985, 4.756, 5.718)	4.486	Attractive Quality
Landscape realism	(2.677, 4.275, 5.391)	4.114	(2.768, 4.409, 5.609)	4.262	Must-be Quality
Presentation of power and beauty	(3.482, 5.634, 6.462)	5.193	(2.597, 4.128, 5.465)	4.064	Attractive Quality
Presentation of lush plants	(2.712, 4.385, 5.457)	4.185	(2.726, 4.357, 5.751)	4.278	Must-be Quality
Presentation of a sense of emptiness	(2.939, 4.739, 5.719)	4.466	(2.390, 3.798, 5.156)	3.781	Attractive Quality
Presentation of a sense of tranquility	(3.592, 5.811, 6.438)	5.280	(2.526, 4.017, 5.398)	3.980	Attractive Quality
Presentation of changes in light and shadow	(2.778, 4.401, 5.313)	4.164	(2.834, 4.524, 5.625)	4.328	Must-be Quality
Presentation of a sense of slowness	(3.175, 5.124, 6.032)	4.777	(2.461, 3.920, 5.440)	3.940	Attractive Quality

5. Conclusion

This study, using Taiwan residents as a sample population, delves into their cognitive preferences regarding the beauty of local landscape paintings. The aim is to uncover the charm factors that resonate with viewers and shift the traditional subjective approach in the creation of painting artworks towards one that prioritizes the factors that captivate an audience. By providing creators with a framework for contemplating the creative aspects of art commodity culture, the study seeks to foster the development of social art culture and advance the popularization of art commodities.

The research methodology begins by utilizing the EGM and interviews to construct an EGM network diagram, identifying factors that evaluate the creative attributes of Taiwan's landscape painting. Departing from the conventional discrete-type Kano model that employs the mode as the quality evaluation standard, the study introduces the triangular fuzzy golden ratio scale semantics, also known as the equal-ratio aesthetic scale semantics. This replaces the traditional subjective consciousness model and is applied to the continuous fuzzy Kano quality model, facilitating the analysis of diverse preferences and evaluation standards among the public. This approach serves as a valuable reference for fostering interaction between painting art creators and viewers.

This study primarily introduces novel research concepts, elucidates the theoretical underpinnings of the research, and seeks to comprehend the perceptual evaluations of viewers. The results contribute to the commercialization of paintings and artworks, conveying artistic concepts while creating an emotional experience for viewers. Through positive impressions and beautiful imaginations, the study aims to popularize the beauty and meaning of paintings. It is anticipated that this research methodology will further enhance the understanding and aesthetic literacy of painting art among Taiwan residents, simultaneously providing a reference for the broader popularization of art products.

Disclosure statement

The authors declare no conflict of interest.

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