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RESEARCH ARTICLE

Balancing typicality and novelty in ceramic design: A study on consumer aesthetic preferences

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ABSTRACT

This study addresses the challenge of balancing typicality and novelty in ceramic design to optimise consumer aesthetic preferences. The objective is to analyse how these two dimensions—typicality, which provides familiarity, and novelty, which introduces cognitive interest—influence aesthetic appeal using the Unified Model of Aesthetics (UMA) framework. Employing a sample of 120 Chinese participants, the methodology involved evaluating ten ceramic designs on a seven-point Likert scale. Data analysis was conducted using Repeated Measures Analysis of Variance (ANOVA), partial correlation, and Generalized Estimation Equations (GEE) to assess the roles of typicality and novelty. Results reveal that while typicality strongly influences aesthetic preference, novelty provides moderate cognitive engagement, aligning with the MAYA (Most Advanced Yet Acceptable) principle. Age and gender showed minimal impact on preferences, suggesting design elements as primary determinants of aesthetic appeal. This study underscores the importance of balancing typicality and novelty in ceramic design, offering practical insights for designers to enhance consumer satisfaction through controlled innovative elements.

Keywords: MAYA principle; Aesthetic preference; Safety; Accomplishment; Ceramic design

1. Introduction

In the field of product design, understanding consumer aesthetic preferences is critical for creating products that are not only functional but also visually appealing. The UMA offers a comprehensive framework to analyse aesthetic preferences by examining design features influencing aesthetic response, primarily through typicality and novelty. According to the UMA, typicality evokes familiarity and a sense of comfort, whereas novelty introduces cognitive interest and arousal, requiring a balanced approach to achieve optimal aesthetic appeal. This principle is encapsulated in the MAYA concept, which suggests that successful design harmonises innovative and familiar elements to maximise consumer appreciation. [6]

In recent years, ceramic design has attracted attention for its unique capacity to integrate traditional and contemporary design elements, making it an ideal medium for testing the UMA model's principles. Ceramic objects often serve functional and decorative roles, allowing consumers to interact with designs ranging from classic, highly typical forms to avant-garde, novel structures. [35] However, existing research offers limited insights into how variables like typicality and novelty contribute to aesthetic preference within ceramic

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design, specifically concerning demographic factors such as age and gender.

This study aims to address this gap by exploring aesthetic preferences in ceramic design through the lens of the UMA model. Using a sample of 120 participants from China, we evaluated how typicality and novelty influence liking for ceramic products. Additionally, we examined the effects of age and gender on aesthetic preferences to determine whether demographic factors modulate the UMA model's application in ceramic design.

This study seeks to quantify the independent and combined effects of typicality and novelty on aesthetic liking by employing methods such as ANOVA, partial correlation analysis, and GEE. Specifically, we aim to answer the following research questions: (1) How do typicality and novelty independently and collectively affect aesthetic preferences in ceramic design? (2) Do demographic variables, such as age and gender, significantly alter these aesthetic preferences?

Through these analyses, we hope to provide practical insights for designers, offering guidance on integrating typical and novel elements in ceramic design to optimise consumer appeal. Additionally, this study seeks to assess the UMA model's applicability in a complex aesthetic context, potentially extending its utility within product design.

2. Ceramic design and aesthetic preferences

Testing aesthetic preferences for ceramic design products involves a multifaceted approach that integrates psychological, cultural, and sensory dimensions. Aesthetic preferences significantly influence consumer choices and product success, particularly in ceramics, where visual appeal is paramount. Rodriguez-Artacho et al. [1] analysed how multisensory interactions between consumers and ceramic tiles during shopping influence their aesthetic evaluations and preferences. This research underscores the need for designers to consider not only the visual aspects of their products but also how tactile and auditory elements can enhance the overall consumer experience. By understanding these sensory dimensions, designers can create more appealing ceramic products that cater to consumer preferences. Toyong et al. [2] highlight that intuition among design experts plays a crucial role in accurately identifying and fulfilling user preferences. This insight can be applied to ceramic design, suggesting that while attributes like typicality and novelty are quantifiable, intuition-driven design decisions may more effectively align with consumers' aesthetic needs. This perspective supports the premise of our study, indicating that combining intuitive expertise with quantitative analysis can optimise user experience by achieving a well-calibrated balance between familiarity and innovation in design.

Cultural factors also significantly impact aesthetic preferences in ceramic design. Triyanto et al. [3] examined how local cultural characteristics influence the aesthetic adaptation of ceramic art in a specific community, suggesting that cultural context can shape consumer expectations and preferences. This finding highlights the importance of integrating cultural elements into design processes to ensure products resonate with local consumers. Furthermore, Wang et al.[4]delve into the quantification of perceptual characteristics in ceramic colour design, emphasising the role of colour in enhancing aesthetic appeal. Their work demonstrates that systematic approaches to colour matching and perceptual cognition can significantly influence the aesthetic quality of ceramic products. This aligns with Li's[5] exploration of visual aesthetics in ceramic art design, where the strategic use of colour is shown to enhance the overall aesthetic experience and consumer appeal. Both studies highlight the critical role of colour in shaping aesthetic preferences and market competitiveness in ceramic design.

The above literature review on ceramic design highlights the significance of psychological, sensory, and cultural dimensions in shaping aesthetic preferences, setting a solid foundation for understanding consumer behaviour in product design. Building upon these insights, the UMA offers a comprehensive framework integrating multiple aesthetic variables—typicality, novelty, unity, variety, connectedness, and autonomy—into a cohesive approach for evaluating aesthetic responses to designed products. By incorporating UMA into the analysis of ceramic products, designers and researchers can gain a deeper understanding of how various aesthetic dimensions interact to influence consumer preferences.

3. The unified model of aesthetics

Hekkert et al.'s study in 2003 is credited with developing the UMA. The theoretical groundwork for the UMA was established by this research, which jointly suggested and investigated the applications of typicality and novelty as predictors of aesthetic preference. It also introduced the "most advanced yet acceptable" design principle. These contributions were essential to the UMA's establishment and growth. The UMA, which addresses the relationship between accomplishment in aesthetic preferences and safety, provides a thorough theory on the aesthetics of product design. According to this approach, appreciating art comes from balancing these basic demands, expressed through concepts like autonomous but connected, most advanced yet acceptable, and unity in variety.[6]

The UMA posits that aesthetic preferences are deeply rooted in evolutionary psychology, suggesting that this perspective aligns with the notion that aesthetic choices are influenced by evolutionary pressures, where individuals tend to favour familiar and safe stimuli, thereby minimising risk in their decision-making processes. [7] The UMA integrates insights from the categorical motivation (CM) model, which emphasises the role of cognitive structures in shaping aesthetic judgments based on stability and efficiency [7] . This integration highlights how aesthetic preferences can be viewed as adaptive responses that have evolved to enhance survival and reproductive success. The UMA consists of three levels. The first is the perceptual level, which focuses on unity and variety. The second, the cognitive, concentrates on typicality and novelty; the third, the social, involves connectedness and autonomy.[8] By testing these two characteristics of ceramic design through the UMA model, it is possible to better understand consumers' cognitive processes in their aesthetic responses, allowing for the design of products that meet market demands and thus enhance consumers' aesthetic pleasure.

3.1. Cognitive level at the UMA

The UMA tests the balance of opposing forces at the cognitive level, specifically typicality and novelty. The MAYA principle posits that consumers prefer a blend of typical and novel elements in products, suggesting that both dimensions are crucial for aesthetic appeal. [9] The aesthetic principles outlined in the UMA model help explain human responses to designed objects by highlighting the ongoing tension between motivating forces that regulate behaviour and impulses rooted in human nature. [10] Typicality refers to the familiar and quickly processed, representing safety, while novelty denotes the unusual and more challenging to comprehend, embodying risk. [11] Together, typicality and novelty offer cognitive-level explanations for individual aesthetic responses. [12] Aesthetic preference or pleasure reflects individuals' aesthetic responses, influenced by symmetry, figure-ground contrast, clarity, unity, variety, typicality, and novelty.[13]

Researchers have investigated the cognitive impact of typicality and novelty on aesthetic preferences using artificial and natural objects, yielding mixed results. Some studies suggest that individuals favour objects with typical characteristics, as familiarity evokes a sense of safety. [14] In contrast, other research emphasises the appeal of novelty, proposing that exploring the unknown can expand knowledge. [15] For example, Kalinichenko et al. [16] blocking dopamine receptors in the hippocampus can impair memory for novelty, underscoring the neurological basis for how novelty is processed. Jamaludin et al.' 's [17] research investigates how the formal characteristics of a product shape user emotional responses. This perspective can be extended to the context of ceramic design, where the balance of typicality and novelty in form can similarly evoke emotional reactions from consumers. Such emotional connections significantly influence aesthetic preferences and purchasing decisions, underscoring the importance of form in design-driven consumer appeal. Chumiran et al.'s[18] study employs verbal protocol analysis (VPA) alongside pre- and post-observation methods to explore designers' cognitive processes. This approach provides valuable support for analysing typicality and novelty in design cognition.

More recently, Mulder found a negative correlation between typicality and novelty at the cognitive level, yet both factors positively influence aesthetic appreciation. This principle is supported by empirical studies demonstrating how a balanced mix of these attributes can enhance consumer satisfaction and product viability. [19] Additionally, the aesthetic appraisal of products, particularly in technology, has been examined through the lens of the UMA. Hu's [20] study on computer aesthetics revealed that consumer preferences are significantly influenced by shape typicality and novelty, suggesting that these cognitive dimensions are essential for understanding aesthetic responses in digital products. This aligns with the broader implications of the UMA, which posits that aesthetic models can enhance design efficiency and consumer satisfaction by systematically addressing typicality and novelty.[8]

As discussed, the MAYA principle explains how the balance between typicality and novelty shapes aesthetic preferences. In the design context of different product shapes, the balance between typicality and novelty should be associated with higher levels of aesthetic preference due to familiar comfort and novel satisfaction. This study derives the following hypotheses.

H1: Ceramic design leads to the highest aesthetic appreciation when simultaneously striking an optimal balance between nurturing a consumer's need for typicality and novelty.

3.2. The aesthetic differences in age and gender within the UMA

The UMA posits that aesthetic experiences are influenced by typicality and novelty, which can be further examined through age and gender differences. Research indicates that typicality and novelty significantly affect aesthetic preferences, but their relationship can be complex and context-dependent. For instance, Mulder-Nijkamp's[21] study highlights that typicality and novelty jointly influence consumer product preferences, suggesting that they can suppress each other's effects. This interplay is crucial in understanding how different demographics, such as age and gender, perceive aesthetic stimuli.

Research has indicated that gender may influence how individuals respond to typicality and novelty in product design. For example, studies by Tilburg et al. reveal that product aesthetics can be perceived differently based on gender, with implications for how products are marketed [22] and designed. This aligns with findings from Oyibo and Vassileva [23] , who noted that gender differences manifest in evaluating aesthetic designs, where females process information comprehensively while males are more selective. Such differences suggest that gender affects aesthetic judgments and influences the emotional responses elicited by design elements, as indicated by Yeh and Peng [24] , who found that aesthetic experiences can vary significantly based on individual backgrounds and expertise.

Moreover, the interplay between aesthetics and product gender has been explored in various contexts. For instance, research by Fugate and Phillips [25] demonstrates that males are more inclined to purchase products that align with traditional gender cues, suggesting that aesthetic evaluations are intertwined with gender identity and societal norms. The work of Gill et al. further supports this.[26], which emphasises the importance of understanding cultural and gender-specific preferences in product design. The findings suggest that designers must consider these differences to enhance user engagement and satisfaction. According to the above content, this study derives the following hypotheses: gender influences individuals' aesthetic preferences for typicality and novelty. Males prefer designs with novelty and technical elements, while females may prefer more unified designs with stronger typicality and evoke a deeper emotional connection.

In the past five years, a growing body of research has examined the differences in aesthetic evaluations of typicality and novelty across different age groups. For example, Soch et al.'s [27] study found that older adults exhibited lower activation in brain regions associated with novelty processing, indicating a decline in novelty-seeking behaviour with age. This shift may influence their aesthetic preferences, leading them to favour more typical and familiar designs, which are cognitively perceived as safer. Additionally, Steiger et al.[28] noted that the anticipation of novelty enhances memory recognition across age groups, suggesting that the cognitive processing of novelty is integral to aesthetic experiences. This implies that younger individuals may have a heightened sensitivity to novelty, potentially leading to different aesthetic preferences compared to older adults. This presents ample opportunity to explore typicality and novelty in ceramic design further. According to the above content, this study derives the following hypotheses.

H2: Individuals' preference for typicality (familiarity) increases as they age. Older adults are more likely to favour designs with higher typicality because such designs provide a sense of cognitive safety.

4. Method

This section provides a detailed overview of the study components, focusing on the procedures, participants selection, stimuli used, data scale, data collection, and analysis. This study investigates participants' aesthetic preferences for ceramic designs at the cognitive level of the UMA. Abidin et al.'s [29] study at the 2009 ICED conference explores VPA to uncover cognitive processes within design activities, especially in areas like creativity and problem-solving. This method supports the notion that understanding the impact of typicality and novelty on consumer preferences requires observing designers' thought processes and cognitive responses.

4.1. Participants and stimuli selection

This section builds on previous research related to the UMA. Hekkert et al.[6] used 20 stimuli in their study with 300 participants. Although they had a larger sample size and more stimuli, research shows that fewer stimuli can also yield statistically significant results. For example, Post et al.[30] tested 85 participants, evaluating eight stimuli. Tyagi [31] recruited 200 and 246 study participants to assess 8 and 16 stimuli, respectively. While these studies had a larger sample size, the stimuli ranged from 8 to 16. Suhaimi tested 207 participants, evaluating seven industrial boiler designs. Although the sample size was slightly more significant, the stimuli were more minor (7). This suggests that even with a smaller sample, a limited number of stimuli (such as 7) can still yield meaningful results.

By comparing the studies, the design of this study, which uses 120 participants and ten stimuli, is reasonable and academically sound. Most related studies show considerable variation in sample size and the number of stimuli, and this study falls within a reasonable range. Specifically, the design is similar to that of Tyagi (8-16 stimuli) and Post (8 stimuli), indicating that the methodology used in this study can produce statistically significant results. This sample size is sufficient to effectively evaluate aesthetic preferences for typicality and novelty across different populations. The participants were mainly from China. To ensure accurate results, the gender and age ratios were balanced as much as possible during the data collection process.

While previous research has explored the psychological, sensory, and cultural dimensions influencing aesthetic preferences in ceramic design, one fundamental design element—shape—remains critical in determining consumer preferences. The shape of ceramic products can evoke different aesthetic responses, contributing significantly to the product's overall visual appeal and usability. The UMA has been employed in various studies to evaluate aesthetic judgments, particularly concerning shapes [8,12,20,32] . Given the centrality of shape in ceramic product design, this study employs the UMA model to test participants' aesthetic preferences for shape specifically. By analysing the typicality and novelty of different ceramic shapes, this study seeks to understand how these critical aesthetic variables influence consumer preferences and the aesthetic pleasure derived from ceramic products.

For this study, ten ceramic designs were designed to explore participants' aesthetic preferences, mainly focusing on the variables of typicality and novelty. These vases were selected to represent a broad spectrum of design styles, ranging from more traditional and typical forms to highly novel and unconventional shapes, as shown in **Figure 1**. Ceramic Products 1 and 2 embody classic and recognisable forms in ceramic design, evoking familiarity and high typicality. These designs align with traditional expectations of symmetry and simplicity, often associated with a sense of safety and ease in cognitive processing. Ceramic products 3, 4 and 5 incorporate elements that balance typicality and novelty. These forms show moderate deviations from traditional shapes by introducing slight distortions, layered patterns, or geometric innovations, offering a mild cognitive challenge without completely straying from conventional ceramic designs. Ceramic products 6, 7, 8, 9, and 10 exhibit highly creative and intricate designs, pushing the boundaries of what is commonly seen in ceramic design. These include animalistic elements, complex textures, and organic, flowing patterns that evoke novelty and are designed to provoke the participants' cognitive solid engagement and exploration.

Figure 1. Ceramic design.

4.2. Procedures

The online survey used in Study 1 involved ten black-and-white stimulus images presented one at a time against a white background to minimise distractions and focus on aesthetic judgments. Each image was accompanied by a set of statements, which participants rated on a 7-point Likert scale, ranging from 'disagree' to 'agree.' These ratings helped assess their aesthetic preferences based on perceived characteristics of the stimuli, such as typicality, novelty, uniformity, and social relevance. The final rating for each stimulus was based on the "Pleasing to See" scale, a validated measure adapted from Blijlevens et al.[33] to capture overall aesthetic preference. Upon completing the ratings for one stimulus, the following image was presented, continuing until all were rated.

This study employed three statistical methods: ANOVA, Partial Correlation Tests, and GEE. ANOVA allows us to determine whether there are statistically significant differences in aesthetic preferences for the different ceramic designs (stimuli). Partial Correlation Tests can help determine if there is a substantial relationship between novelty and aesthetic pleasure while holding typicality constant, offering more profound insights into the independent effects of these variables on the participants' aesthetic judgments. The

GEE method helps predict how typicality, novelty, and other variables influence aesthetic preferences on average across the population. It helps to generalise the findings beyond the specific participants in the study, ensuring that the results can be applied more broadly to the target population. Although typicality and novelty can be quantitatively studied through statistical methods (such as ANOVA and partial correlation analysis), the aesthetic value of these attributes remains inherently subjective and culturally contextualised. Abidin et al.'s [34] research provides theoretical support for this study, indicating that balancing quantitative and qualitative methods in the design field allows for a more comprehensive understanding of user preferences.

5. Result

This study employed ANOVA to evaluate differences in responses across ten stimuli for each statement on a 7-point Likert scale. The primary focus was on assessments of liking and the influence of covariates such as age and gender. When examining the impact of cognitive variables, repeated measures ANOVA was used, incorporating Mauchly's sphericity test. The calculated results are shown in **Table 1**.

Liking shows a significant main effect, $F(9, 1008) = 10.11$, $p < .001$, $\eta^2 p = .83$, This indicates that there are substantial differences in aesthetic preference across different measurement conditions among all participants, with a large effect size ($\eta^2 p=0.83$), suggesting that this variable contributes substantially to the overall variance. The interaction between aesthetic preference and gender is also not significant, $F(9, 1008) = 1.07$, $p = 1.37$, $\eta^2 p = .09$. This indicates that differences in aesthetic preference between genders are not statistically significant, with a small effect size, suggesting that gender has a limited influence on aesthetic preference. The interaction between aesthetic preference and age is also not significant, $F(9, 1008) = 1.19$, $p = .23$, $\eta^2 p = .31$. This suggests that the effect of aesthetic preference on the outcome variable did not differ significantly across different age groups. The partial eta-squared value indicates a small effect size for this interaction.

Table 1. Analysis of variance (ANOVA) results for all scales.

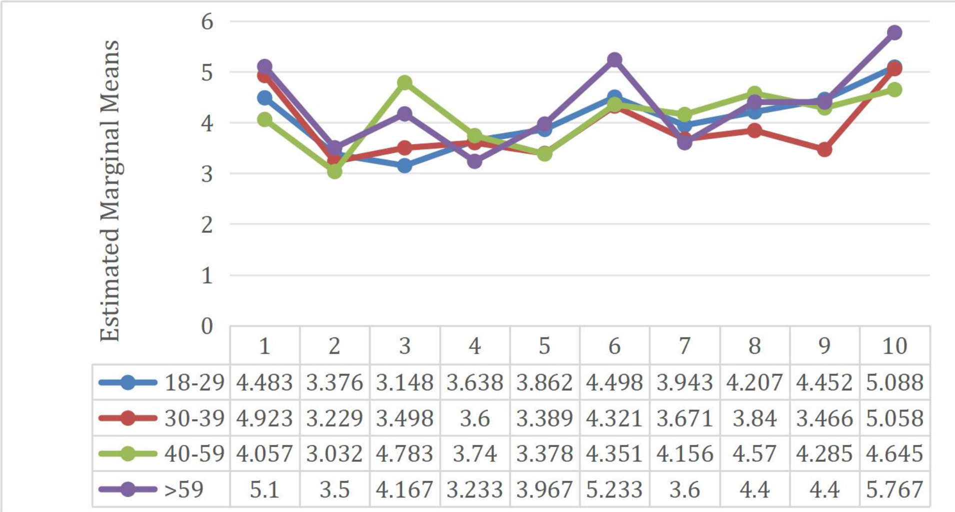
	Sum of Squares	*df*NUM[1]	*df*DEM[2]	Mean Square	*F*	*p*	Ƞ²p[3]
Liking	346.87	9	1008	1.15	10.11	0.00	0.83
Liking and Age	122.87	27		1.02	1.19	0.23	0.31
Liking and Gender	36.85	9		0.93	1.07	1.37	0.09

[1] *dfNUM indicates the degrees of freedom numerator.*

[2] *dfDEM indicates degrees of freedom enumerator.*

[3] *Ƞ²p indicates partial eta-squared.*

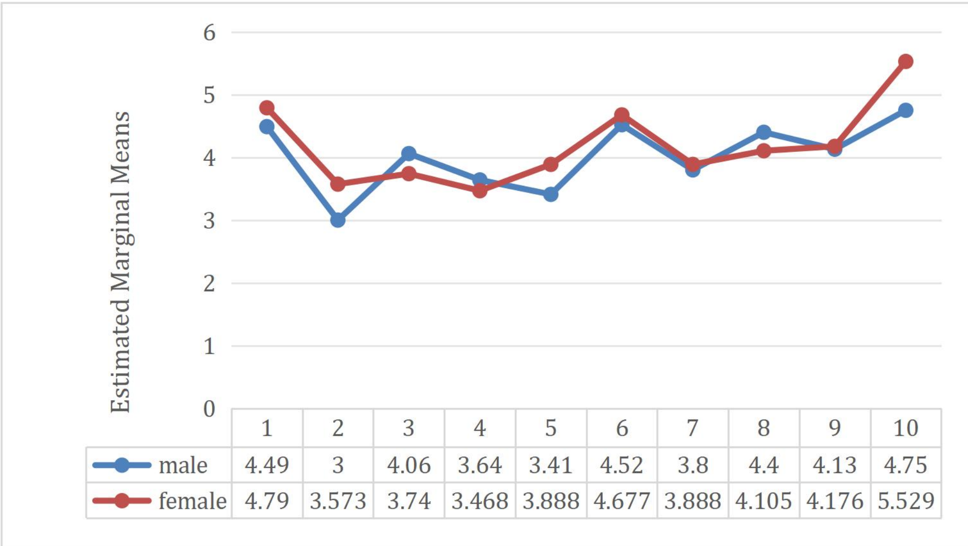
Figure 1 illustrates the estimated marginal means of aesthetic preference across different age groups for 10 stimuli. The oldest age group (60+ years) consistently rated the stimuli higher, particularly for Stimuli 1, 6, and 10. Younger groups (18-29 and 30-39 years) showed lower ratings for certain stimuli (e.g., Stimuli 2 and 8). These results suggest that aesthetic preferences for ceramic designs may vary with age, with older participants generally exhibiting higher preference scores for specific designs.



	1	2	3	4	5	6	7	8	9	10
18-29	4.483	3.376	3.148	3.638	3.862	4.498	3.943	4.207	4.452	5.088
30-39	4.923	3.229	3.498	3.6	3.389	4.321	3.671	3.84	3.466	5.058
40-59	4.057	3.032	4.783	3.74	3.378	4.351	4.156	4.57	4.285	4.645
>59	5.1	3.5	4.167	3.233	3.967	5.233	3.6	4.4	4.4	5.767

Figure 1. Estimated marginal means of age and liking.

Figure 2 illustrates the estimated marginal means of aesthetic preference across genders for 10 stimuli. While females generally rated the stimuli higher than males, particularly for Stimuli 1 (4.79 vs. 4.49) and 10 (5.53 vs. 4.75), the overall pattern shows similar trends across genders. These findings suggest that while specific ceramic designs may appeal more to females, gender differences in aesthetic preference are limited for most stimuli. These results does not support the hypothesis H2.



	1	2	3	4	5	6	7	8	9	10
male	4.49	3	4.06	3.64	3.41	4.52	3.8	4.4	4.13	4.75
female	4.79	3.573	3.74	3.468	3.888	4.677	3.888	4.105	4.176	5.529

Figure 2. Estimated marginal means of age and liking.

Figure 3 This figure indicates that participants' aesthetic preferences vary from typical to novel designs. While traditional designs (Ceramic Products 1) were appreciated, there was a clear preference for highly novel designs (especially Ceramic Product 10), suggesting that novelty and creative complexity significantly shape aesthetic appeal in ceramic products. This trend aligns with the study's focus on exploring how typicality and novelty influence aesthetic preferences.

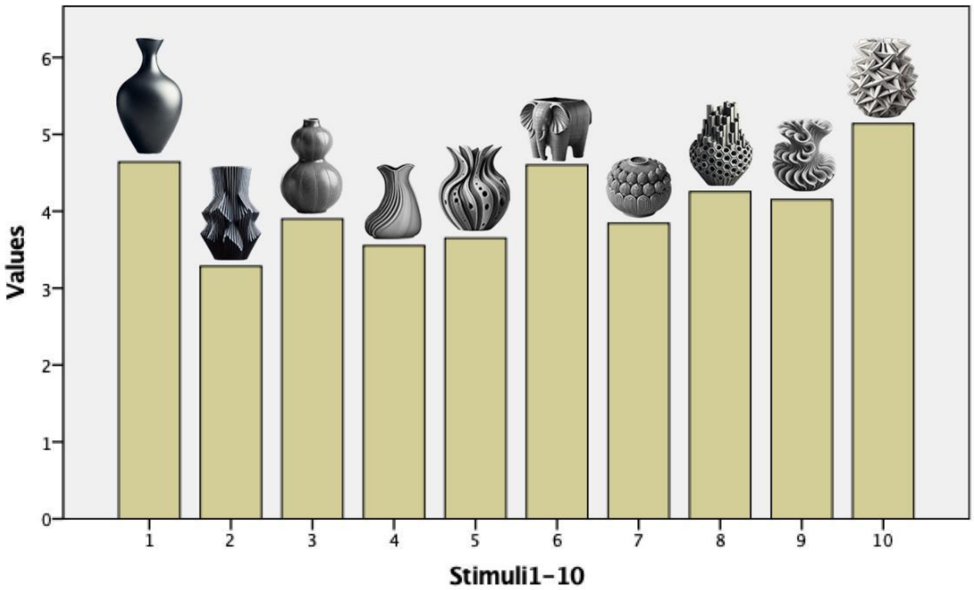


Figure 3. Estimated marginal means of age and liking.

Based on the ANOVA results in **Table 2**, the study examines the impact of "Liking," "Typicality," and "Novelty" on aesthetic appraisal. Liking substantially affects aesthetic appraisal, $F(9, 1071) = 10.37$, $p < .001$, $\eta^2 p = .80$. The large effect size suggests that liking explains most of the variance, highlighting its dominant role in aesthetic evaluation.

Typicality also demonstrates a significant impact on aesthetic appraisal, $F(9, 1071) = 4.62$, $p < .001$, $\eta^2 p = .37$. With a moderate effect size, typicality appears to influence participants' aesthetic liking considerably, indicating a positive response to familiar design characteristics.

Novelty shows a significant yet minor effect, $F(9, 1071) = 5.40$, $p < .001$, $\eta^2 p = .04$, indicating a limited contribution to aesthetic liking. Although novel designs arouse some interest, their contribution to aesthetic liking is relatively modest.

Table 2. Analysis of variance (ANOVA) results for typicality and novelty.

	***df*NUM**[1]	***df*DEM**[2]	**Epsilon**	***F***	***p***	**Ƞ²p**[3]
Liking	9	1071	0.94	10.37	0.00	0.80
Typicality	9	1071	1.00	4.62	0.00	0.37
Novelty	9	1071	0.95	5.40	0.00	0.04

[1] *dfNUM indicates the degrees of freedom numerator.*

[2] *dfDEM indicates degrees of freedom denumerator.*

[3] *Ƞ²p indicates partial eta-squared.*

Table 3 presents the results of the partial correlation analysis conducted to examine the relationships between "aesthetic preference," "novelty," and "typicality" in the context of ceramic design. This analysis includes correlations under three conditions: without any control variables, controlling for "typicality," and controlling for "novelty." The table displays the correlation coefficients, significance levels (p-values), and degrees of freedom (df) for each variable pair.

Initially, without any control variables, the correlation between "aesthetic liking" and "novelty" was r = .05, which was not statistically significant (p = .09). The correlation between "aesthetic liking" and "typicality" was r = .02, also non-significant (p = .57). Similarly, the correlation between "novelty" and "typicality" was r = .02, with a non-significant result (p = .57). These findings indicate that, in the absence of control variables, the direct correlations among these three variables are weak and do not reach statistical significance.

After controlling for "typicality," the partial correlation between "aesthetic liking" and "novelty" was r = .05, which remained non-significant (p = .09). This result suggests that even when "typicality" is controlled, the relationship between aesthetic liking and novelty remains weak and statistically non-significant, indicating that "typicality" does not have a significant effect in enhancing or diminishing the impact of "novelty" on "aesthetic liking."

When "novelty" was controlled, the partial correlation between "aesthetic liking" and "typicality" was r = -.02, which also did not reach statistical significance (p = .54). This finding indicates that controlling for "novelty" does not significantly alter the relationship between "aesthetic preference" and "typicality." The above results show that aesthetic preference is not strongly influenced by typicality or novelty alone in the ceramic design process, suggesting preferences may depend on more complex factors.

Table 3. Results of partial correlation test for ceramic design[1].

Control Variables			**Liking**	**Novelty**	**Typicality**
-none-[a]	novelty	Correlation	0.05	1.00	0.02
		Significance (2-tailed)	0.09	。	0.57
		df	1198	0	1198
	typicality	Correlation	-0.02	0.02	1.00
		Significance (2-tailed)	0.55	0.57	。
		df	1198	1198	0
typicality	novelty	Correlation	0.05	1.00	
		Significance (2-tailed)	0.09	。	
		df	1197	0	
novelty	typicality	Correlation	-0.02		1.00
		Significance (2-tailed)	0.54		。
		df	1197		0

[1] *Cells contain zero-order (Pearson) correlations.*

Table 4 presents the results of the GEE analysis, examining the role of "typicality" and "novelty" in predicting "aesthetic liking" (Pleasing to See) for ceramic designs. The analysis results include the unstandardised regression coefficients (B), standard errors (SE B), 95% confidence intervals (95% CI for B), and significance levels (p-values).

The GEE analysis showed that the unstandardised regression coefficient for typicality in predicting aesthetic liking was -0.02, with a standard error of 0.03, a 95% confidence interval of [-0.07, 0.37], and a p-value of 0.53. This indicates that typicality's effect on aesthetic liking is insignificant, as it does not reach the standard significance threshold (p < .05). In other words, the typicality characteristic in ceramic design does not significantly influence participants' liking ratings.

For novelty, the unstandardised regression coefficient was 0.05, with a standard error of 0.03, a 95% confidence interval of [-0.01, 0.10], and a p-value of 0.07. Although the effect of novelty on aesthetic liking is positive and approaches significance, it does not reach statistical significance ($p < .05$). This suggests that novelty may have a moderately positive effect on aesthetic liking. Still, the evidence is insufficient to confirm a statistically significant impact. The lack of significant interaction between typicality and novelty suggests that aesthetic appreciation involves complex factors beyond typicality and novelty, encouraging a more holistic approach to understanding design preferences.

The hypothesis (H1) that ceramic design achieves the highest aesthetic appreciation by balancing typicality and novelty is only partially supported. While both factors contribute to aesthetic appreciation, their combined effect is not strongly evident. Typicality shows moderate significance at a broader level, and novelty has minimal impact, with no clear interaction driving the highest appreciation. Other factors, such as overall liking, may play a more critical role in aesthetic evaluation.

Table 4. Summary of generalized estimating equation analysis for variables predicting pleasing to see for ceramic design.

Variable	B[1]	SE B[2]	95%CI[3] for B	p
Typicality	-0.02	0.03	[-0.07, 0.37]	0.53
Novelty	0.05	0.03	[-0.01, 0.10]	0.07

[1] *B indicates Unstandardized Beta.*

[2] *SE B indicates Standard Error for the Unstandardized Beta.*

[3] *CI indicates a Confidence Interval.*

6. Discussion and conclusion

This study's results provide insights into the Unified Model of Aesthetics (UMA) application in ceramic design. They highlight the roles of typicality and novelty and the influence of demographic factors, such as age and gender, on aesthetic preferences.

The ANOVA results revealed differences in aesthetic evaluations across different age and gender groups. While aesthetic preferences vary significantly across conditions, the impact of age and gender on these preferences was relatively minor, with no significant interactions observed. This suggests that aesthetic preferences in ceramic design are likely driven primarily by the characteristics of the design itself rather than by demographic factors. The finding aligns with the UMA model, which emphasises the central role of design features in shaping aesthetic responses. In this case, the effect of typicality and novelty on aesthetic preferences appears to outweigh the influence of individual demographic characteristics.

The ANOVA results further indicate that "pleasing to see" (aesthetic liking) and typicality are vital factors influencing aesthetic evaluation, whereas novelty has a positive but comparatively weaker effect. This suggests that typicality provides familiarity and comfort and enhances aesthetic liking for ceramic designs. On the other hand, novelty adds cognitive interest but should be used in moderation to avoid deviating from consumers' aesthetic expectations. These findings support the core principle of the UMA model known as MAYA (Most Advanced Yet Acceptable), which advocates for a balance between typicality and novelty in design to achieve optimal aesthetic experience.

The partial correlation analysis explored the relationships among "Liking," "Typicality," and "Novelty" with control variables in place. Even after controlling for typicality or novelty, the correlations between "Liking" and the other two variables remained insignificant. This suggests that while typicality and novelty contribute to aesthetic preference, they are not the sole determining factors. Other design or contextual factors not directly emphasised by the UMA model may also significantly influence aesthetic preferences. This finding implies that, although the UMA model is partially validated in the context of ceramic design, its applicability in explaining more complex design contexts may require the inclusion of additional factors.

The Generalized Estimating Equation (GEE) analysis was conducted to quantify the independent effects of typicality and novelty on aesthetic liking and to provide confidence intervals for these effects. The results showed that typicality does not have a significant independent impact on aesthetic liking, while the positive effect of novelty approaches significance but does not reach it. This suggests that while typicality and novelty play roles in aesthetic evaluation, their independent impacts may be limited. It further implies that other design characteristics, beyond typicality and novelty, may substantially influence aesthetic preferences in ceramic designs.

In conclusion, the application of the Unified Model of Aesthetics (UMA) to ceramic design offers valuable insights but reveals certain limitations. While UMA emphasises balancing typicality and novelty, this study shows that their roles, though meaningful, are not dominant in predicting aesthetic preferences. The MAYA principle within UMA remains relevant, highlighting the importance of balancing familiarity and innovation to achieve optimal aesthetic appeal, as typicality provides comfort and novelty adds cognitive interest. However, the findings also suggest that other factors, such as emotional responses, cultural influences, and usability, likely play a significant role, which UMA does not fully address. Expanding the model to incorporate these variables could enhance its explanatory power in complex design contexts. Thus, while UMA provides a solid framework for understanding the role of design features in aesthetic evaluation, its application in ceramic design requires refinement to account for additional factors influencing aesthetic preferences.

Conflict of interest

The authors declare no conflict of interest.

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