

## Integrated The Unified Model of Aesthetics and The Categorical-Motivation Model

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To Link this Article: <http://dx.doi.org/10.6007/IJARBSS/v14-i2/20754>

DOI:10.6007/IJARBSS/v14-i2/20754

**Published Date:** 16 February 2024

### Abstract

This research reviews two aesthetic theory models – the Unified Model of Aesthetics (UMA) and the Categorical-Motivation (CM) model – and proposes an integrated theoretical framework for understanding aesthetic product preferences based on preference safety. The UMA model from evolutionary psychology views aesthetic choices as risk-averse motivations, where people favor stimuli that are familiar, typical, and consistent. The CM model from cognitive psychology sees aesthetic judgments as serving needs for stability and efficiency based on category knowledge structures. This paper puts forth a framework combining UMA's multidimensional exploration of aesthetics with CM's focus on category effects. The model has three levels – perceptual, cognitive, and social – each involving trade-offs between safety and risk. It also examines product categories as a moderator, proposing that rich vs. poor categories affect tolerance for aesthetic variables. Hypotheses are advanced, including that rich categories better promote preferences for diversity, novelty and autonomy. The integrated view of cognitive and motivational drivers shaping category-based aesthetic responses provides a comprehensive lens to advance practical design guidelines and consumer insights.

**Keywords:** Aesthetic Preferences, Unified Model of Aesthetics (UMA), Categorical-Motivation (CM) Model, Preference Safety

### Introduction

The importance of product aesthetics in shaping consumer purchasing decisions and satisfaction is undeniable, as it significantly impacts market competitiveness and brand value. Aesthetic preferences are reflective of consumers' personalities, culture, emotions, and values, providing valuable insights for designers to understand consumer needs and expectations (Bloch et al., 2003). Integrating aesthetic preferences into the design process drives innovation and optimization, enhancing both the functional and aesthetic characteristics of products (Reimann et al., 2010). Moreover, the aesthetic appeal of a

product contributes to the overall consumer experience and emotional connection, leading to increased consumer loyalty and satisfaction (Suher et al., 2021). Aesthetic models serve as valuable tools for designers to systematically grasp the fundamental aesthetic principles of products, improving design efficiency and quality, and enabling consumers to make choices aligned with their aesthetic preferences, thereby enhancing satisfaction and loyalty (Lee & Koubek, 2010). Additionally, aesthetic models facilitate the exploration of untapped aesthetic potential and value in products, promoting continued development and innovation in the field (Lee & Koubek, 2010). Two well-known aesthetic models, the Unified Model of Aesthetics (UMA) and the Categorical-Motivation Model, stand out as effective frameworks for comprehensively understanding aesthetic considerations and integrating them into the design and consumption process (Hekkert, 2014; Whitfield, 2000).

UMA is a five-year international collaboration involving the University of Cambridge (Engineering), TU Delft (Industrial Design Engineering), Swinburne University (Design) and the University of Vienna (Psychology) to Create a comprehensive aesthetic model covering perceptual, cognitive and social dimensions (Yahaya, 2017). In the first phase of the UMA project, research focused on the impact of opposing forces on human responses, particularly on aesthetic pleasure, experience and preferences (Suhaimi, n.d.). The project is based on a basic framework for understanding aesthetic responses to designed artifacts based on balancing two evolutionary pressures - needs for safety and accomplishment (Hekkert, 2014). At the perceptual level, people seek unity-in-variety. Unity facilitates processing and safety, variety enables exploration and learning. At the cognitive level, the MAYA (most advanced yet acceptable) principle balances preferences for familiarity/typicality and novelty. At the social level, people seek connectedness to affirm group membership but also uniqueness and autonomy (Hekkert, 2014). The basic idea of the UMA project is derived from Darwinism. In certain environments (such as dangerous situations), people's preferences may tend to be on the "safe" side. This theory believes that aesthetics is an evolutionary phenomenon whose essence is a primitive instinct, which is reflected in balancing safety (such as typicality, unity, connectedness) and risk (such as novelty, variety, autonomy) in aesthetics (See Figure 1) (Hekkert, 2006).

The second phase of the UMA project focuses on product value transformation and continues to focus on research on consumer demand for designed and manufactured product (Suhaimi, n.d.). The project uses empirical and scientific methods to quantify evidence. It is expected that on the basis of understanding the formation process of aesthetic preferences and the key factors that cause customers to like a certain finished product, the research results can be applied to the development of various handmade products, thereby promoting the development of the field of handmade product design.

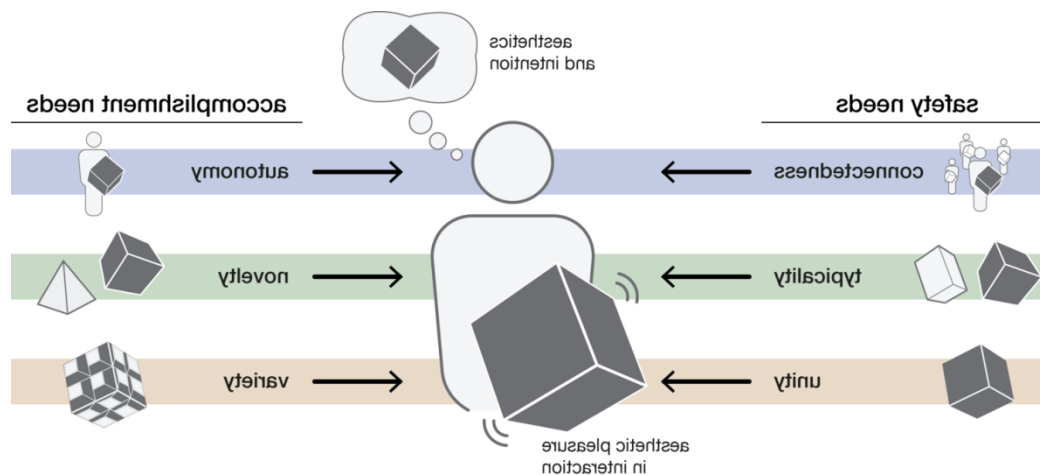


Figure 1 the Unified Model of Aesthetics (the UMA model — UMA (project-uma.com))

Early work by Whitfield and Slatter proposed a categorical model where aesthetic preferences are mediated by how well stimuli match cognitive representations of categories (Whitfield & Slatter, 1979). Through the room decoration experiment, the aesthetic responses they observed seemed to be achieved through the mediation of category processing, which is consistent with Rosch's (1975); Rosch & Lloyd (1978) view of category structure. This method of categorizing aesthetic responses had the useful feature that it provided an opportunity to explain the contradiction between the then-popular theory known as the Collative-Motivational models and other new findings. Whitfield (2000) proposed the categorical-motivation (CM) model to reconcile the opposing positions between the categorical model and the Collative-Motivational models. To achieve this goal, the CM model draws on Tversky's (1977) distinction between two forms of feature salience—intensive and diagnostic. Features of high intensive salience should possess high arousal potential, while features of high diagnostic salience should be the most prototypic. In the early CM model, aesthetic preferences linked prototype (typicality) and novelty to categorization motivations based on the openness/closure of the category (Whitfield, 2009). The CM model thinks that prototype favoring primarily determines preferences for well-formed categories, while arousal-related factors also contribute to less formed categories (Whitfield, 2000). Placing the CM model in an evolutionary context, researchers propose that there are ancestral preferences and acquired preferences driven by the pleasure of prototyping (Whitfield, 2009). Tyagi et al (2013) attributed the basis of novelty to the classification and information processing of individual object representations in the brain and divided product categories into rich and poor object categories.

UMA proposes a process model from perception to judgment and affective stages, while the CM model focuses on the role of product categories (including rich and poor object categories) in aesthetic responses. Combining these two models enables the association of product categories processing with broader sequences of aesthetic processing. UMA identifies fluency, implicit memory, and evaluation as key mechanisms (Leder et al., 2004). However, the CM model currently lacks an in-depth explanation of the psychological processes behind the impact of aesthetic categories, and integrating the UMA process can help solve this problem.

Product categories such as consumer goods and industrial design objects seem particularly amenable to an integrated approach. These categories have practical meaning and are susceptible to categorization/prototype effect Whitfield & Slatter (1979), but also involve complex perceptual processing. The CM model can explore how category knowledge interacts with perceptual fluency at early stages to influence intermediate evaluation processes leading to aesthetic emotions and judgments. This helps reveal category-based effects on fluency, evaluative patterns, or aesthetic responses that may differ in rich and poor object categorizations (Tyagi et al., 2013).

In summary, combining the category-focused CM model with the process-focused UMA can provide a richer framework for studying aesthetic responses to everyday objects and elucidate how category knowledge shapes aesthetic experience.

## **Literature Review**

### **The Unified Model of Aesthetics (UMA)**

In 2014 Hekkert created the Unified Model of Aesthetics (UMA) to explain our everyday aesthetic preferences for design artifacts. The purpose is to reconcile various factors of product design aesthetics. The UMA model is adapted to the perceptual, cognitive and social levels and is considered to be a fundamental balance between security and achievement in its different manifestations. For example: The perceptual level focuses on elements such as unity and variety, while the cognitive level explores typicality and novelty. The social level involves studying connectedness and autonomy.

### **The relationship between product categories and perception, cognition, and social aesthetics**

In the field of product design, unity and variety are two important aesthetic principles, which have a significant impact on the aesthetic evaluation of products. The balance between unity and variety is a classical aesthetic concept, that originates from the thoughts of Greek philosophers, who believe that when things maintain unity in variety, they can achieve the highest beauty (Loos et al., 2022). The application of unity and variety in product design can increase the familiarity and creativity of the product respectively, thereby satisfying people's perceptual and aesthetic needs. People tend to prefer products with a certain degree of unity because they reduce perceived complexity and load. However, if the product is too uniform, it will lead to sensory numbness and aesthetic boredom, which requires increasing variety to stimulate sensory activation and aesthetic interest (Post et al., 2016). Through three experiments, Post et al (2016) explored the impact of unity and variety of different product categories (lamps, car interiors, etc.) on product aesthetic evaluation, and how perceived visual complexity and individual regulatory focus moderate this influence. He found that while unity and variety inhibited each other, they also had a positive predictive effect on product aesthetic evaluation, supporting the balance principle of unity and variety. He also found that unity plays a dominant role in this relationship and that it promotes appreciation of variety. In addition, he found that preferences for unity and variety varied across product categories, suggesting that product category was an important influencing factor. However, the specific mechanisms of these differences are unclear, and further research is needed to explore aesthetic preferences across product categories.

How to balance the degree of innovation in product design is a challenging issue. While creating unique works, designers should also consider the relationship between typicality and

novelty in design. Typicality refers to the fit between a product and its prototype Whitfield & Slatter (1979), while novelty refers to an individual's perception of similarities or differences (Berlyne, 1973). Thus, typicality and novelty reflect product familiarity and originality, respectively. In the field of cognitive aesthetics, someone proposed the "advanced and acceptable" (MAYA) design principle, which advocates achieving a balance between typicality and novelty in design to increase product popularity (Hekkert et al., 2003; Thurgood et al., 2014). However, product typicality and novelty are not isolated but are affected by the product category. Thurgood et al (2014) found that product category (safety and risk) will affect the typicality and novelty of the product, which in turn affects the aesthetic evaluation of the product. However, their manipulation of safety and risk did not have the desired effect. (Suhaimi, n.d.) found that product category (practical and decorative) will affect the typicality and novelty of the product, which in turn affects the aesthetic evaluation of the product. To sum up, product category is an important factor affecting product typicality and novelty. Product design is not only functional and aesthetic but also social. They can convey consumers' personal characteristics and social identity, thereby affecting others' perceptions and evaluations of consumer (Blijlevens & Hekkert, 2019, 2015). When consumers choose products, they often consider whether the product can meet their intrinsic needs, including the need to establish connections and a sense of belonging with others (relatedness), and the need to express their independence and individuality (autonomy) (Baumeister & Leary, 2017; Brewer, 1991; Deci & Ryan, 2000). Therefore, autonomy and connectivity in product design are two important socio-aesthetic principles that can increase product appeal and satisfaction. Autonomy means that the product can reflect consumers' personal preferences and values, and connectivity means that the product can promote communication and communication between consumers and others. Designers should balance autonomy and connectivity in product design so that products can both reflect consumers' personalities and enhance consumers' social identities (Blijlevens & Hekkert, 2019, 2015). Blijlevens & Hekkert (2019) tested a new social aesthetic principle called "autonomous but connected", dividing different product categories into two types: "social risk" and "social safety". Social risk products are those products where consumer choices will significantly affect how others view them, such as sunglasses, sneakers, etc. Social safety products are those products in which consumers' choices will not have much impact on others, such as staplers, scissors, etc. They found that consumers differed in their preferences for autonomy and connectivity across different types of products. For social risk products, consumers value connectivity more, that is, whether the product can help them build good relationships with others. For social security products, consumers value autonomy more, that is, whether the product can showcase their personality and style. Their research results show that the social meaning attached to the product type will affect consumers' evaluation of product aesthetics. Therefore, designers should consider the social attributes of the product and the social needs of consumers when designing products.

In summary, it can be seen that product categories have an impact on perception, cognition, and social aesthetics. Therefore, it is necessary to further understand that certain characteristics of product categories will affect aesthetic evaluation. The CM model proposes to study aesthetic preferences based on the classification and information processing of individual object representations in the brain, and object classification that divides product categories into rich and poor.

### **The Categorical-Motivation (CM) Model**

The richness and poverty of product categories are important factors affecting product aesthetic preferences, and they are closely related to the product's conceptual representation, prototype gradient, and classification fluency. Rosch's (1988) classification theory points out that different product categories have different internal structures. Rich categories contain multiple hierarchical subcategories and diverse attributes, such as furniture, fashion, etc., while poor categories have a single prototype and limited attributes, such as piano, headphones, etc. Rich categories allow for a greater range of variation, whereas impoverished categories are less tolerant of novelty. Martindale (1984) neural network model explains the relationship between categorization fluency and aesthetic pleasure, arguing that stimuli consistent with prototypes will cause spreading activation in the brain, resulting in moderate arousal and positive hedonic experiences. Based on these theories, Whitfield proposed the Categorical-Motivation (CM) model, which takes the richness and poverty of product categories as principles of social aesthetics and explores the relationship between product categories and aesthetic preferences (Whitfield, 2000).

Currently, the CM model has been empirically studied in the cognitive field. Tyagi and Whitfield selected sample product stimuli from established rich categories (chairs) and poor categories (chest of drawers). Develop typical and novel versions of products in both categories by manipulating visual features such as shape, color, materials, etc (Tyagi et al., 2013). Ensure that different categories of actions are equally novel in perception. Aesthetic judgments of the typical and novel versions were collected using a rating scale, which also included a measure of novelty perception, comparing the mean/decrease in aesthetic ratings between the typical and novel versions in each category. Research shows that impoverished categories are less tolerant of novel manipulations than rich categories (Tyagi et al., 2013). Later Yahaya conducted an empirical study using poor category products such as toothbrushes and computer mice, and the tolerance for novelty is low in these categories (Yahaya, 2017). Dennaë, in studying the effects of inconsistent and consistent conceptual novelty on aesthetic preferences for everyday objects, again used stimuli: a chair (rich category) and a chest of drawers (poor category) and found that rich categories were more accommodating than poorer categories. Consistent and inconsistent colors and materials. To sum up, it can be seen that the categories of rich and poor have universal laws in cognitive aesthetics. Based on the fact that both the UMA model and the CM model focus on the co-originality of aesthetic experience preference safety, the rich and poor categories of the CM model are further applied to the perception and social levels of the UMA model.

### **Both UMA and CM Models Focus on Preference Security**

Aesthetic preference is an adaptive result in the process of human evolution, and it is closely related to the needs of survival and security. Different aesthetic theories explain the formation mechanism and motivation of aesthetic preferences from different perspectives. This article mainly reviews two aesthetic theories, namely the Unified Model of Aesthetics (UMA) and the Categorical Motivation (CM) Model. Both models view aesthetic preferences as an aesthetic system that favors safety but focus on different dimensions of safety.

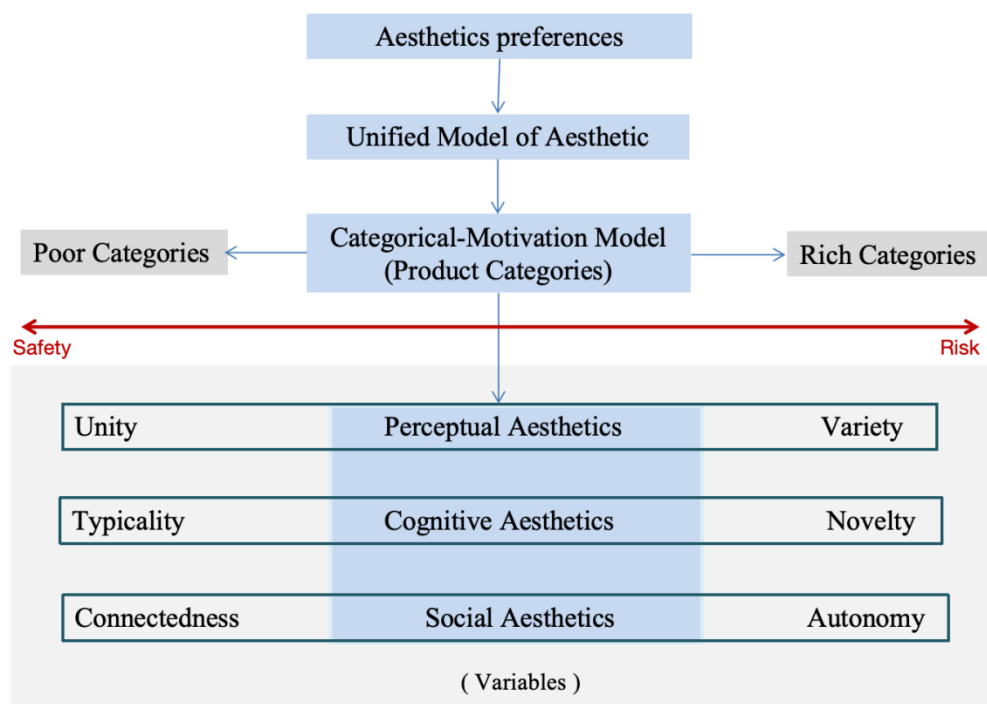
The UMA model is based on the perspective of evolutionary psychology, which believes that aesthetic preferences evolved to promote adaptive behavior (Leder et al., 2004). The UMA model proposes three key aesthetic principles, namely unity, diversity, and connectedness, which respectively reflect coherence, familiarity, and group belonging, which are psychological factors that serve core safety drives (Leder & Nadal, 2014). The UMA model

believes that people have an inherent preference for stimuli that have the characteristics of unity, diversity, and connectivity because these stimuli can satisfy people's original evolutionary motivations for certainty and security. The assumptions of the UMA model have been supported by a series of empirical evidence. For example, fluency research shows that people process stimuli quickly that conform to prototypes or typicality, thereby satisfying the need for predictability and certainty (Reber et al., 2004). Evaluative conditioning experiments further demonstrate how stimulus-affect congruence can be strengthened over time, resisting change to maintain preference stability (Hekkert, 2014). Furthermore, studies of mere exposure effects provide neural explanations based on uncertainty minimization and threat avoidance (Zajonc, 2001). Overall, the UMA model considers aesthetic choice to be a safety-centered preference system that treats factors that violate consistency or stability as risks or threats. Beauty is the balance between security and the drive to take risks. In essence, the UMA model proposes an aesthetic system that favors safety as an evolutionary adaptation.

The CM model is based on the perspective of cognitive psychology and believes that aesthetic judgment is based on the desire for preference security, that is, to be consistent with the classification knowledge structure in order to maintain perceived control and stability (Whitfield, 2009). The CM model divides aesthetic preferences into two types, namely ancestral preferences and acquired preferences, which correspond to the categories of poverty and abundance respectively. Poor categories are those with very limited, well-defined archetypes that are closely tied to ancestral evolutionary preferences ingrained deep in our history. These tap into preferences for safety, stability and security. Rich categories are those that are more open and have blurred boundaries, bringing greater novelty, change, and exploration, and more in line with established preferences. The CM model holds that people are more motivated to prototype exemplars that match internal category representations because these exemplars can improve fluency and efficiency, supporting this safety motivation (Rosch, 1975; Whitfield & Slatter, 1979). The CM model also points out that the degree of category closure affects the security of aesthetic preferences. Closed categories with different prototypes are more secure because they have well-defined limits and structures. Open categories create uncertainty because they require novelty and exploration. In essence, the strict prototypical structure of poverty categories caters more directly to baseline security preferences based on human evolutionary history. Rich categories can accommodate novelty due to their conceptual breadth but still address security needs through their hierarchical archetypes. The origins of the CM model's aesthetic preference system lie in prelinguistic sensory knowledge that helped early humans understand the world. Building knowledge around prototypes with adaptive security capabilities. Deviations destroy stability. In essence, the core of the CM model holds that aesthetic judgments serve evolutionary motivations for perceived safety, coherence, and efficiency.

To sum up, the UMA model and the CM model explore the origin and motivation of aesthetic preferences from different perspectives. They both believe that aesthetic choices are closely related to safety needs, but focus on different safety aspects. The UMA model emphasizes the principles of unity, diversity and connectivity, embodies the need for security in the evolutionary process, and believes that aesthetic preferences are ancient risk-averse motivations. The CM model focuses on the relationship between classification knowledge structure and security and believes that aesthetic judgment is based on the pursuit of security. In real life, these two models can be understood as how people weigh the needs for safety and risk when facing aesthetic problems. The UMA model suggests that people tend to choose

stimuli that are familiar, typical, and consistent to satisfy risk aversion motives. The CM model



points out that in the process of aesthetic judgment, people will maintain perceptual control and stability based on the classification knowledge structure. The two models are complementary to a certain extent, and together they paint a complex and rich picture of human aesthetic preferences.

### The theoretical Framework

Figure 2 Theoretical framework

This study uses the preference security integrated UMA and CM model as the theoretical framework to explore the influencing factors and mechanisms of people's aesthetic preferences for different product categories. UMA is an aesthetic theory based on evolutionary psychology, which believes that aesthetic pleasure is an emotional response that guides people's behavioral choices to make them beneficial to survival and adaptation (Reber et al., 2004). The CM model is an aesthetic theory based on product categories, which believes that product categories are a cognitive structure that includes a group of products with similar features and functions, as well as people's expectations and evaluations of these product (Veryzer Jr & Hutchinson, 1998). This article integrates these two theoretical models to form a theoretical framework based on preference security, as shown in Figure 2. This theoretical framework holds that people's aesthetic preferences for rich and poor product categories are the result of the joint action of evolutionary psychology and aesthetic theory, where evolutionary psychology provides the roots and functions of aesthetic preferences, while aesthetic theory provides the form and function of aesthetic preferences. content. This theoretical framework divides aesthetic preferences into three levels, namely the perceptual level, the cognitive level and the social level, with each level involving the trade-off and balance of safety and risk. This theoretical framework also considers the moderating role of product category, that is, product category affects people's tolerance of aesthetic preference variables at different levels. Based on this framework, this article proposes the following hypotheses



H1: Rich product categories can better promote people's aesthetic preferences for diversity than poor product categories.

H2: Rich product categories can better promote people's aesthetic preference for novelty than poor product categories.

H3: Rich product categories can better promote people's aesthetic preference for autonomy than poor product categories.

### **Directions for Future Research**

This study aims to integrate the joint use of UMA and CM models through preference security and build a theoretical framework. To further validate and extend the comprehensive aesthetic preference model, additional empirical research across a wider range of product categories and consumer groups is crucial. More research is warranted that manipulates and tests aesthetic variables using rich and poor product types, including further exploration of visual, tactile, auditory, and other aesthetic sensory modalities. Processing mechanisms can be revealed by testing the relative effectiveness of judgments of unity, diversity, typicality, novelty, autonomy, and connectedness within each sensory channel. Furthermore, investigating consumer preferences for aesthetic products across different cultural backgrounds can help test the generalizability of the core hypothesis in the model regarding the early evolutionary origins of preference for safety trade-offs. Analyzing whether there are general trends across age, gender, personality, and cultural backgrounds would provide strong evidence for the core arguments of the integrated framework.

Research methods should incorporate ecologically valid tools such as virtual reality prototypes and retail laboratory environments to better simulate real-world product exposure and laboratory research. By empirically testing the robustness of the aesthetic choice principle using multi-category stimuli covering the sensory spectrum and extracting models from a diverse global sample of consumers, researchers can build confidence in the aesthetic preference principle based on preference safety and category processing trade-offs.

### **Conclusion**

The combination of UMA and CM models in exploring product aesthetic preferences is an effective method to understand consumer behavior and design choices. This article focuses on the theoretical foundation of this study, which combines UMA's multidimensional aesthetic exploration with CM's focus on category-based judgments. This approach provides an integrated view of the cognitive and motivational processes that shape aesthetic preferences, promoting a holistic understanding of the perceptual, cognitive, and social contexts within product categories in rich and poor countries. This study aims to advance understanding of the role of perceptual, cognitive, and social context in shaping aesthetic preferences. It also explores how category-based variables influence the interaction of UMA dimensions under different conditions, revealing the interaction between categories and aesthetics. Practical implications for designers include guidelines for manipulating perceptual, cognitive, and social aesthetics to create more attractive products, reduce transition risks from product concept to final design, and align products with user preferences.

**References**

- Baumeister, R. F., & Leary, M. R. (2017). The need to belong: Desire for interpersonal attachments as a fundamental human motivation. *Interpersonal Development*, 57–89. <https://doi.org/10.4324/9781351153683-3>
- Berlyne, D. E. (1973). Interrelations of verbal and nonverbal measures used in experimental aesthetics. *Scandinavian Journal of Psychology*, 14(1), 177–184. <https://doi.org/10.1111/j.1467-9450.1973.tb00107.x>
- Blijlevens, J., & Hekkert, P. (2019). “Autonomous, yet Connected”: An esthetic principle explaining our appreciation of product designs. *Psychology & Marketing*, 36(5), 530–546. <https://doi.org/10.1002/mar.21195>
- Blijlevens, J., & Hekkert, P. P. M. (2015). “Autonomous, yet connected”: A social design principle explaining consumers’ aesthetic appreciation of products. *2015 Academy of Marketing Conference-the Magic in Marketing*, 1–8. <https://researchrepository.rmit.edu.au/esploro/outputs/conferenceProceeding/Autonomous-yet-connected-A-social-design/9921862866501341>
- Bloch, P. H., Brunel, F. F., & Arnold, T. J. (2003). Individual differences in the centrality of visual product aesthetics: Concept and measurement. *Journal of Consumer Research*, 29(4), 551–565. <https://doi.org/10.1086/346250>
- Brewer, M. B. (1991). The Social Self: On Being the Same and Different at the Same Time. *Personality and Social Psychology Bulletin*, 17(5), 475–482. <https://doi.org/10.1177/0146167291175001>
- Deci, E. L., & Ryan, R. M. (2000). The “What” and “Why” of Goal Pursuits: Human Needs and the Self-Determination of Behavior. *Psychological Inquiry*, 11(4), 227–268. [https://doi.org/10.1207/S15327965PLI1104\\_01](https://doi.org/10.1207/S15327965PLI1104_01)
- Hekkert, P. (2006). Design aesthetics: Principles of pleasure in design. *Psychology Science*, 48(2), 157.
- Hekkert, P. (2014). *12 Aesthetic responses to design: A battle of impulses*. [https://www.researchgate.net/profile/Paul-Hekkert/publication/289986796\\_Aesthetic\\_responses\\_to\\_design\\_A\\_battle\\_of\\_impulses/links/58ae04b7a6fdcc6f03f0088d/Aesthetic-responses-to-design-A-battle-of-impulses.pdf](https://www.researchgate.net/profile/Paul-Hekkert/publication/289986796_Aesthetic_responses_to_design_A_battle_of_impulses/links/58ae04b7a6fdcc6f03f0088d/Aesthetic-responses-to-design-A-battle-of-impulses.pdf)
- Hekkert, P., Snelders, D., & Van Wieringen, P. C. W. (2003). ‘Most advanced, yet acceptable’: Typicality and novelty as joint predictors of aesthetic preference in industrial design. *British Journal of Psychology*, 94(1), 111–124. <https://doi.org/10.1348/000712603762842147>
- Leder, H., Belke, B., Oeberst, A., & Augustin, D. (2004). A model of aesthetic appreciation and aesthetic judgments. *British Journal of Psychology*, 95(4), 489–508. <https://doi.org/10.1348/0007126042369811>
- Leder, H., & Nadal, M. (2014). Ten years of a model of aesthetic appreciation and aesthetic judgments: The aesthetic episode – Developments and challenges in empirical aesthetics. *British Journal of Psychology*, 105(4), 443–464. <https://doi.org/10.1111/bjop.12084>
- Lee, S., & Koubek, R. J. (2010). Understanding user preferences based on usability and aesthetics before and after actual use. *Interacting with Computers*, 22(6), 530–543. <https://doi.org/10.1016/j.intcom.2010.05.002>

- Loos, S., Wolk, S. V. D., Graaf, N. D., Hekkert, P., & Wu, J. (2022). Towards intentional aesthetics within topology optimization by applying the principle of unity-in-variety. *Structural and Multidisciplinary Optimization*, 65(7), 185. <https://doi.org/10.1007/s00158-022-03288-9>
- Martindale, C. (1984). The pleasures of thought: A theory of cognitive hedonics. *The Journal of Mind and Behavior*, 49–80.
- Post, R. A. G., Blijlevens, J., & Hekkert, P. (2016). 'To preserve unity while almost allowing for chaos': Testing the aesthetic principle of unity-in-variety in product design. *Acta Psychologica*, 163, 142–152. <https://doi.org/10.1016/j.actpsy.2015.11.013>
- Reber, R., Schwarz, N., & Winkielman, P. (2004). Processing Fluency and Aesthetic Pleasure: Is Beauty in the Perceiver's Processing Experience? *Personality and Social Psychology Review*, 8(4), 364–382. [https://doi.org/10.1207/s15327957pspr0804\\_3](https://doi.org/10.1207/s15327957pspr0804_3)
- Reimann, M., Zaichkowsky, J., Neuhaus, C., Bender, T., & Weber, B. (2010). Aesthetic package design: A behavioral, neural, and psychological investigation. *Journal of Consumer Psychology*, 20(4), 431–441. <https://doi.org/10.1016/j.jcps.2010.06.009>
- Rosch, E. (1975). Cognitive representations of semantic categories. *Journal of Experimental Psychology: General*, 104(3), 192. <https://doi.org/10.1037/0096-3445.104.3.192>
- Rosch, E., & Lloyd, B. B. (1978). *Principles of categorization*. [https://www.google.com/books?hl=zh-CN&lr=&id=zw5REAAQBAJ&oi=fnd&pg=PA91&dq=Rosch,+E.+\(1988\).+Principles+of+categorization.+Readings+in+Cognitive+Science,+312-322.+https://doi.org/10.1016/b978-1-4832-1446-7.50028-5&ots=PKxImusfs1&sig=lymRmGI\\_rNJ5EpWDChahHGNFhyc](https://www.google.com/books?hl=zh-CN&lr=&id=zw5REAAQBAJ&oi=fnd&pg=PA91&dq=Rosch,+E.+(1988).+Principles+of+categorization.+Readings+in+Cognitive+Science,+312-322.+https://doi.org/10.1016/b978-1-4832-1446-7.50028-5&ots=PKxImusfs1&sig=lymRmGI_rNJ5EpWDChahHGNFhyc)
- Suhaimi, S. N. (n.d.). *Investigating the Significance of Typicality and Novelty in the Aesthetic Preference of Industrial Products*. Retrieved December 30, 2023, from [https://researchbank.swinburne.edu.au/items/e069be04-9dbc-4da9-b01f-2b2f1334992d/1/Safia\\_Suhaimi\\_Thesis.pdf](https://researchbank.swinburne.edu.au/items/e069be04-9dbc-4da9-b01f-2b2f1334992d/1/Safia_Suhaimi_Thesis.pdf)
- Suher, J., Szocs, C., & Van Ittersum, K. (2021). When imperfect is preferred: The differential effect of aesthetic imperfections on choice of processed and unprocessed foods. *Journal of the Academy of Marketing Science*, 49(5), 903–924. <https://doi.org/10.1007/s11747-021-00783-1>
- Thurgood, C., Hekkert, P., & Blijlevens, J. (2014). The joint effect of typicality and novelty on aesthetic pleasure for product designs: Influences of safety and risk. *Congress of the International Association of Empirical Aesthetics*. <https://opus.lib.uts.edu.au/bitstream/10453/36796/4/The%20joint%20effect%20of%20typicality%20and%20novelty%20on%20aesthetic%20pleasure%20for%20product%20designs.pdf>
- Tversky, A. (1977). Features of similarity. *Psychological Review*, 84(4), 327. <https://doi.org/10.1037/0033-295X.84.4.327>
- Tyagi, S., Thurgood, C., & Whitfield, T. A. (2013). Unravelling Novelty. *Consilience and Innovation in Design: Proc of the 5th IASDR Conf. Tokyo*. <http://design-cu.jp/iasdr2013/papers/1808-1b.pdf>
- Veryzer Jr, R. W., & Hutchinson, J. W. (1998). The influence of unity and prototypicality on aesthetic responses to new product designs. *Journal of Consumer Research*, 24(4), 374–394. <https://doi.org/10.1086/209516>

- Whitfield, T. W. A. (2000). Beyond Prototypicality: Toward a Categorical-Motivation Model of Aesthetics. *Empirical Studies of the Arts*, 18(1), 1–11. <https://doi.org/10.2190/KM3A-G1NV-Y5ER-MR2V>
- Whitfield, T. W. A. (2009). Theory Confrontation: Testing the Categorical-Motivation Model. *Empirical Studies of the Arts*, 27(1), 43–59. <https://doi.org/10.2190/EM.27.1.c>
- Whitfield, T. W. A., & Slatter, P. E. (1979). The effects of categorization and prototypicality on aesthetic choice in a furniture selection task. *British Journal of Psychology*, 70(1), 65–75. <https://doi.org/10.1111/j.2044-8295.1979.tb02144.x>
- Yahaya, M. F. (2017). *Investigating typicality and novelty through visual and tactile stimuli* [PhD Thesis, Swinburne University of Technology Melbourne]. [https://researchbank.swinburne.edu.au/items/daaa042a-f94b-4d59-845b-dacbdb6fb349/1/mohd\\_yahaya\\_thesis.pdf](https://researchbank.swinburne.edu.au/items/daaa042a-f94b-4d59-845b-dacbdb6fb349/1/mohd_yahaya_thesis.pdf)
- Zajonc, R. B. (2001). Mere Exposure: A Gateway to the Subliminal. *Current Directions in Psychological Science*, 10(6), 224–228. <https://doi.org/10.1111/1467-8721.00154>