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# Examining the multidimensional impact on soft drink packaging preferences through the unified model of aesthetics

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**Consumer psychology has been proven to have an essential influence on aesthetic preferences. Previous research on aesthetics focused on long-lasting product categories and was conducted at a single level. However, aesthetics is multidimensional, which has been overlooked. Our research is based on the unified model of aesthetics (UMA), which aims to investigate the unique contributions of the perceptual (unity, variety), cognitive (typicality, novelty), and social (connectedness, autonomy) levels to aesthetic preferences for packaging designs. The studies used soft drink packaging from the fast-moving consumer goods (FMCG) category as stimuli, and Chinese participants evaluated the packaging on a 7-point Likert scale. Study 1 shows that people gravitate toward safety over accomplishment and that connectedness, typicality, and unity are the main determinants of aesthetic pleasure. Study 2 added two scenarios: for "going to a very formal meeting," stimuli with unity, typicality, and connectedness could best induce aesthetic pleasure. For "going to a good friend's rave party," the novelty, autonomy, and variety of designs were the most pleasing. Furthermore, two studies showed that for the overall stimulus, unity consistently evoked more positive aesthetic preferences than variety. Overall, this research provides new insights into aesthetic influences at the perceptual, cognitive, and social levels in soft drink packaging and offers new perspectives on aesthetic preferences for new product development.**

The aesthetic process evokes sensory pleasure, particularly in the visual domain, and it directly impacts aesthetic experience and perception. Aesthetic preferences can increase the sense of order and user satisfaction, they play a crucial role in our day-to-day existence, and aesthetic appreciation influences consumer experience[1,2]. Not only is the field of aesthetics reflected in traditional artworks, but the objects of any product category around them can also enhance user experience through aesthetic preferences[3]. Understanding how to make attractive designs that arouse feelings of aesthetic pleasure is fundamental to the design profession[4]. People's aesthetic pleasure is achieved through specific product design attributes (typicality, symmetry, novelty, unity, and variety). The unified model of aesthetics (UMA) created by Hekkert in 2014, which integrates the perceptual, cognitive, and social levels, aims to reconcile various factors that stand out in product design aesthetics, and studies have revealed that the design attributes that affect aesthetic pleasure are contradictory[5]. For example, some research has suggested that variety and unity impact aesthetic pleasure and inhibit each other's influence. Therefore, a product design demonstrates that perfect harmony among variety and unity is aesthetically pleasing[6]. Other studies have shown that participants tend to choose typical designs of stimulus categories[4,7,8], whereas other studies have shown that people prefer novel designs[9–11]. In addition, some people suggest products with typical and novel features to maximize appreciation of product design[12]. Furthermore, there are interactions between people and between people and products, and on a social level, we can use product design not only to make us belong to a group (connectedness) but also to help us distinguish ourselves as individuals (autonomy)[13]. However, the majority of earlier research employed product categories involving long-term use, including telephones, teapots, cars[12], furniture[14], toothbrushes and computers[7], apparel products[15], industrial boilers[10] and wearable devices[16].

Modern consumers demand higher quality and more aesthetically pleasing products to meet their lifestyles, and packaging design has become an essential feature in marketing various objects, especially food[17,18]. Packaging is considered part of the product, as it has a favorable influence on the product. Many researchers believe that elements such as shape, color, materials, image, and information on the packaging are crucial to people's first

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impression. Packaging design has functional benefits and can convey persuasiveness, thereby enhancing brand image[19–21]. From a sales perspective, the appearance of packaging design is one of the critical factors influencing consumers' purchasing decisions about a product[22]. Soft drinks are products that are frequently consumed in daily life, and they constitute a category that consumers choose on a hedonic basis[23,24]. The visual design of the packaging of soft drink products with hedonic value strongly influences consumer response. Today, the soft drink industry is rapidly expanding and becoming a significant part of people's lives. Although some studies have investigated food packaging design[17,25–30], research specifically focusing on the aesthetics of soft drink packaging remains limited. Therefore, an essential topic of this research is the role and effect of design aesthetics in the fast-moving consumer goods (FMCG) category.

Although the importance and impact of aesthetic preferences have been well-established in previous studies, and many researchers have explored the influence of the perceptual (e.g., unity, variety)[2,6,31,32] and cognitive aspects (e.g., typicality, novelty)[7,10,12,15,33,34], relatively few studies have examined the social dimension of aesthetics, such as connectedness and autonomy[13,35]. Most previous studies were conducted at a separate level. However, aesthetic preferences are complex, and people's aesthetic evaluation of objects is made based on the influence of perceptual, cognitive, and social factors. The UMA model allows numerous aspects, which may be understood as diverse representations of the underlying balance of safety and achievement[5]. Therefore, considering perceptual, cognitive, and social levels together will provide a more comprehensive case for aesthetics than considering only one or two levels. In addition, most researchers previously focused on the aesthetics of products involving long-term use. Hence, there is a need for a more thorough and systematic investigation of how FMCG categories of items affect consumers' aesthetic preferences, such as their aesthetic preferences for packaging. The main goal of this study is to explore consumers' aesthetic preferences for soft drink packaging design by integrating the UMA, which covers perceptual, cognitive, and social dimensions, for empirical research and filling the gap in the field of packaging aesthetics. This multidimensional approach ensures a deeper understanding of aesthetic response, goes beyond isolated design attributes, and addresses the interaction between sensory impressions, cognitive evaluations, and social meanings. It provides researchers, designers, and marketers with information about consumers' aesthetic preferences for soft drink packaging designs.

## Literature review

### Aesthetic preferences

Aesthetics are becoming increasingly essential in product design, and consumers can enjoy an excellent aesthetic experience and pleasure from attractive products. Aesthetic preference describes an individual's aesthetic assessment of recognizing product characteristics, and it can also be integrated through previous experience. For example, by understanding aesthetic principles, we can enhance the appeal of our design and enhance aesthetic pleasure[4]. According to Hekkert and Leder[4], aesthetics may pleasure the viewer or user, and all product attributes can promote and evoke sensory pleasure. In modern interactionism, aesthetic pleasure arises from the interaction between perceivers and objects, evoking enjoyment and positivity[36,37].

Blijlevens et al.[38] created a scale to measure people's pleasantness evaluations of product design objects, and they discovered that aesthetic enjoyment might be determined by the following attributes: "beautiful," "attractive," "pleasing to see," "nice to see," and "like to look at." Tangible and intangible facets affect user appreciation; thus, understanding the factors that influence product preference is a direction we have explored. The contributions made can help designers reference product preferences, potentially creating better products and presenting a pleasant product experience.

### Unified model of aesthetics

The UMA model is a comprehensive framework designed to explain aesthetic preferences by integrating multiple dimensions of human experience[5]. Drawing from design, philosophy, perceptual psychology, cognitive psychology, and sociology, the UMA model addresses the complexity of aesthetic appreciation by emphasizing the interplay between perceptual input, cognitive processing, and social meaning. This framework reflects a balance between human drives for safety (unity, typicality, and connectedness) and achievement (variety, novelty, and autonomy). This unified model integrates three distinct yet interdependent levels: perceptual (unity and variety), cognitive (typicality and novelty), and social (connectedness and autonomy) to explain the multifaceted nature of aesthetic preferences. Although each level has independent functions and characteristics, they interact dynamically to shape the overall aesthetic experience. Perceptual input forms the foundation, providing initial impressions, which are then interpreted and refined through cognitive and social evaluations based on individual needs and context. By emphasizing the balance and interaction between these levels, the UMA model provides a comprehensive understanding of the principles governing aesthetic responses.

The empirical aesthetics discipline of psychology initially focused on perceptual characteristics[39]. Perception is a direct response to sensory input, and perceptual principles are generally basic and universal. We need to incorporate structural and perceptual features into our experiences[40]. At the perceptual level, unity and variety can somewhat organize our impressions by providing immediate sensory feedback[6]. For example, unity allows for harmony and coherence in visual stimuli, whereas variety introduces diversity and complexity, both of which are quickly and unconsciously processed. However, these impressions lack deeper meaning without further cognitive engagement.

The cognitive level involves more deliberate and sophisticated psychological processing, including memory, association, understanding, and the evaluation of complex information. Cognitive processing allows individuals to interpret and categorize perceptual inputs meaningfully[5]. This level plays a crucial role in evaluating aesthetic attributes such as typicality[8,41,42] (the degree to which an object aligns with category prototypes) and novelty, which reflects an object's deviation from familiarity. Unlike unity and

variety, which can be perceived almost instantaneously, typicality and novelty require comparisons against mental prototypes and involve recognizing familiarity or innovation. People may have more experience with specific products and may have more knowledge about typical products, which affects their aesthetic preferences for novel products[5]. As demonstrated by studies such as Hekkert et al.[12] and Berghman and Hekkert[5], typicality provides comfort and predictability, whereas novelty evokes interest and excitement; however, both are essential for aesthetic appreciation. Moreover, the interplay between typicality and novelty often aligns with the "most advanced yet acceptable" (MAYA) principle, where moderate novelty is preferred owing to its ability to balance familiarity and innovation.

Furthermore, aesthetic preferences are socially significant, according to research in social psychology and sociology[43]. On a social level, interpersonal differences are more prominently reflected, incorporating factors such as connectedness (a sense of belonging to a group) and autonomy (the expression of individuality)[7]. Aesthetic preferences are influenced by social culture, social background, group norms, collective consciousness, and popular trends at the social level. Blijlevens and Hekkert[13,35] demonstrated that product aesthetics often reflect social trends, where consumers seek designs that resonate with their cultural background or social identity. For example, minimalist designs might appeal to groups valuing simplicity and sophistication, whereas bold, unconventional designs might align with individuals seeking to stand out. Therefore, we should now pay more attention to the multidimensionality of aesthetic experience. We can gain more from object aesthetics based on a complete and more basic theoretical basis.

The interaction between the perceptual, cognitive, and social levels is significant. The perceptual level offers raw sensory impressions that serve as inputs for cognitive-level evaluations. While perceptual attributes such as unity and variety are foundational, cognitive attributes such as typicality and novelty deepen aesthetic experiences by assigning meaning. Finally, the social level contextualizes these evaluations within cultural and interpersonal frameworks. In addition, the cognitive and social levels can retroactively influence perceptual processing. For example, cultural exposure (social level) may alter how unity or variety is perceived at the sensory level. This dynamic reflects the UMA's distinction between the three levels while acknowledging their interdependence.

In summary, the three levels, i.e., the perceptual, cognitive, and social levels, are inherently distinct yet interdependent. Each level uniquely contributes to aesthetic evaluations, with the perceptual level forming the foundation, the cognitive level adding depth, and the social level providing broader context. Together, they create a holistic framework that captures the complexity and dynamism of aesthetic preferences. This integrated perspective offers valuable insights for both theoretical research and practical applications in design, marketing, and beyond.

*Safety and accomplishment*

The underlying theory of the UMA model of product design is Darwinian, viewing aesthetics as an advanced modern embodiment of primal instincts: an equilibrium between risk and safety[7,44,45]. That is, a desire for safety and achievement guides people's behavior. When these countervailing forces are balanced, we experience aesthetic pleasure. There is safety in familiarity—typicality, unity, and connectedness. Risks involve unfamiliarity, which refers to novelty, variety, and autonomy. While people seek safety, we also take some risks to gain new knowledge. The relationship between these opposite variables and how they function is an important focus of our research. Griskevicius and Kenrick[46] reported that people's needs for security and achievement are basic evolutionary needs that guide their behavior today. People seek safety and pursue achievement with a feeling of pleasure to have a better life. Therefore, beautiful products are based on safety and accomplishment.

*Perceptual-level unity and variety*

Past studies have confirmed that perception is one of the factors determining aesthetic pleasure. The "unity-in-variety" (UiV) is an ancient principle, and the first person to incorporate the UiV concept directly into empirical aesthetics was Fechner (1876/1978). Post et al.[6] discovered that unity, the primary factor influencing the aesthetic preference for balanced product design, contributes to the appreciation of variety. However, if objects lack sufficient variety, people will become bored, making the objects unattractive[47]. Therefore, it has been suggested that there is a greater aesthetic pleasure if a design strikes a balance between variety and unity[31,44]. As Boselie[48] puts it, applying the principle means "preserving unity while almost allowing chaos." Loos et al.[31] have shown that achieving an aesthetic balance in a product requires greater unity. Designs are manually post-processed to increase unity, and the modified design is more visually appealing. Additionally, a desire for aesthetics is inversely correlated with variety and favorably correlated with unity. Thus, previous studies have shown that both unity and variety have important influences on product aesthetic preferences.

*Cognitive-level typicality and novelty*

Cognition can explore art, people's senses, and thinking, and it can help collect and analyze aesthetic experiences so that aesthetic ability can be developed[49]. We rely on previous experience, where more studies in design have examined the cognitive factors that influence aesthetic enjoyment, with particular attention paid to the relationship between typicality and novelty. Defining typicality as the core of familiarity or belonging to a group is where safety resides. At the same time, risk lies in unfamiliarity, representing novelty[7]. Song et al.[9] explored whether people prefer familiar or novel paintings. The results revealed that novel paintings were more pleasurable, which is consistent with previous research[50]. Some scholars have argued that, among cognitive factors, individuals often choose conventional designs because of their ease of recognition and meaningfulness[4,51,52]. Prototypicality is an essential predictor of aesthetic preferences[53]. Hekkert et al.[12] proposed that owing to our biological evolution, we prefer easy-to-classify or typical products because this process conforms to a preference for archetypes. The flip side is the opposite process in which we seek out novel or atypical stimuli around us. Researchers have also reported that individuals favor new designs only when the novelty has little impact on the

prototype. Theoretically, typicality and novelty are two opposite variables[4,54]. The MAYA design principle suggests people should balance typicality and novelty when creating products[12]. Researchers have reported that product designs are most attractive and positively impact aesthetic pleasure when they maximize typicality and novelty simultaneously[12]. Therefore, typicality and novelty are essential factors in product design. It is unclear whether people prefer typical soft drink packaging designs or novel soft drink packaging designs. Further analysis of the impact of typicality and novelty at the cognitive level on soft drink packaging design could contribute to the field.

*Social-level connectedness and autonomy*

With social cues, people communicate and judge their relationships with others and with products. Bloch[55] reported that social issues may affect consumers' aesthetic appreciation of product design, which holds significance for explaining aesthetic pleasure. People use product design to communicate with group members, creating a need for connection, which is also recognized as a fundamental social requirement. Product design creates a desire to connect with other people[56], which is something individuals cannot do on their own. The level of safety achieved can give people a sense of safety and comfort. Thus, connectedness can gain aesthetic appreciation. However, humans also have an innate urge to feel autonomy[57]. From a sociological perspective, this urge helps us protect autonomy. Therefore, uniqueness should be valued aesthetically as well. Previous studies by Blijlevens and Hekkert[13,35] reported that connectedness and autonomy positively influence the aesthetic preference for a product. Blijlevens and Hekkert[35] discovered that autonomy significantly impacts aesthetic judgment when people are in a safe state rather than when they are in a dangerous state when sufficient security is present and will be motivated to seek achievement. Blijlevens and Hekkert[35] presented an aesthetic principle, "Autonomous, yet connected," and showed that it also positively influences aesthetic evaluation. Furthermore, product design receives the most aesthetic praise if it finds the perfect balance between promoting the two contradictory desires for connectedness and autonomy. The current study also investigates whether security and achievement affect the relationship between connectedness, autonomy, and aesthetic preferences. In summary, on a social level, connectedness and autonomy also determine our aesthetic experience of objects. However, past research on the social aspects of aesthetics has been ignored; thus, the current study explores these aspects.

## Visual aesthetics and packaging design

Focusing on fundamental visual perception and visual aesthetic perception or appreciation is crucial in human aesthetics[58]. Therefore, product aesthetic preferences are influenced primarily by a product's visual characteristics or appearance[59,60]. The power of first impressions and the impact of visual appeal play essential roles in determining preferences[10].

Wu et al.[61] discovered that the aesthetic appeal of a product may lead to a consuming pleasure and might prevent actual consumption. Wu et al.[61] focused on very differentiated types of products (nondurable products, such as toilet paper and napkins), which are inevitably destroyed during consumption and may be too beautiful to use. Therefore, various product categories may impact product aesthetics and consumer behavior differently.

A study by Wang[27] investigated the effects of visual packaging on perceptions of food quality and food value as well as brand preference. However, the study did not explore some packaging characteristics (e.g., color, shape) that affect value perception. Spence[17] investigated various sensory aspects of packaging: color, shape, sound, texture, and smell. The results suggested that the visual characteristics of packaging might be the most significant sensory cues influencing a product's success or failure. However, the study did not have specific quantitative data to evaluate how each attribute affects the aesthetic preference for packaging design.

He and Lv[26] researched and analyzed the related practices of color composition and color psychology in the product packaging of soft drinks and spirits. Kovačević et al.[28] investigated the critical role of packaging visual elements (typefaces) in flavored food packaging. Garaus and Halkias[29] also focused on color studies in packaging product categories. The literature suggests that other elements of product packaging, such as shape, may also influence product and category perceptions and consumer preferences. Therefore, a crucial part of the visual identity of a package is the form factor. The shape of packaging plays a vital role in communication[22]. According to Vladić et al.[30], the shape is a crucial instrument for marketing and differentiated products and is an essential factor affecting price. However, the effect of shape on consumer perceptions is the least examined of package design factors.

On the basis of previous research, this study proposes the following hypotheses:

*Hypothesis 1*

The various principles of the UMA have unique effects on the aesthetic appreciation of soft drink packaging designs.

*Hypothesis 2*

The combined model at the three levels explains more variance in aesthetic appreciation than does a model containing only single-level variable pairs.

*Hypothesis 3*

Different situational conditions will affect the tendency of UMA to the safety and accomplishment of soft drink packaging designs.

## Study 1

Study 1 explored how the perceptual, cognitive, and social levels influence aesthetic preferences for packaged designs. We exposed participants to various soft drink packaging stimuli covering unity, variety, typicality,

novelty, connectedness, and autonomy. The participants rated different designs on the basis of these variables and aesthetic pleasure.

## Methods

The research was approved by the ethics committee of Universiti Putra Malaysia (UPM.TNCPI.800-2/1/7), and all methods were employed in accordance with relevant guidelines and regulations. Informed consent was obtained from all participants.

*Stimuli selection*

Soft drink bottles were chosen to develop a targeted stimulus design because they are well known among respondents and have a well-defined archetype. Sixteen new concepts were handled and designed by professional designers. Image processing technology processes all bottle images into a uniform color. Labels were removed to reduce brand recognition and give products a unified vision. The stimulus was characterized by varying degrees of unity, variety, typicality, novelty, connectedness, and autonomy. The selection of stimuli was based on a series of preliminary studies to determine the extent to which these variables differed. Experts and judges were asked to evaluate the stimuli based on the strengths of their experience and knowledge. The ten most representative pictures were selected as the final stimuli based on responses to the pretest.

*Participants*

A total of 214 participants from the Chinese population, including students, staff, and public users, were included in the experiment. Participants under 18 years of age and those with design background knowledge were excluded. Previous work by Whitfield[62] showed that participants with a background in design research tended to give specific responses because their appreciation of stimuli was based primarily on design principles rather than on the required input. Therefore, to avoid professional bias in the test results, this study chose to invite people without a design background as participants. The participants were recruited by Qualtrics©, an experienced management platform that recruits participants according to criteria tailored to client requirements. After the elimination of invalid questionnaires, 200 questionnaires remained. The age range of the participants was as follows: 57% ($n=113$) were 18–25 years old, 36% ($n=71$) were 26–35 years old, 6% ($n=11$) were 36–45 years old, and 3% ($n=5$) were 46 years old and above. Among the respondents, 110 were female (55%), and 90 were male (45%).

*Procedure*

The study conducted a visual assessment, and an online questionnaire with web and mobile versions was used. The study received ethical approval from Universiti Putra Malaysia. A consent form was the initial step of the online survey, which included two sections; the first part included the participants' demographics, age, and gender for data identification and analysis. Next, the participants were asked to use a Likert scale to rank how pleased they felt toward the stimulus. The participants were subsequently shown ten images of soft drink packaging products one at a time. The stimuli were presented in random order. A series of questions accompanied each picture, and the participants were asked to use a 7-point Likert scale to indicate how much they agreed with the statement (ranging from "not agree at all" to "completely agree"). Individuals were requested to rank their evaluation of aesthetics based on their first impression of the product's appearance in the picture, with the survey expected to take less than 30 min to complete. Based on the validated scales of Blijlevens et al.[38], aesthetic pleasure ("this design is pleasing to see"), unity ("this is a unified design"), variety ("this design conveys variety"), typicality ("this is a typical design"), and novelty ("this is a novel design"). Another scale was developed by Blijlevens and Hekkert[35] to evaluate how well a product's design communicates connectedness ("this design makes me feel connected"), and autonomy ("this design emphasizes my individuality"). Therefore, the aesthetic scale of the current study covers essential scales at the perceptual ("unity" and "variety"), cognitive ("typicality" and "novelty"), and social ("connectedness" and "autonomy") levels as well as "aesthetic pleasure."

*Data analysis*

This study used Statistical Product and Service Solutions (IBM SPSS Statistics version 26.0, https://www.ibm.com/products/spss-statistics) for data analysis. Pearson correlation analysis was used to conduct preliminary correlation tests. Multiple regression analysis was conducted to assess the overall goodness of fit of the model, which measures the amount of variance explained. It is possible to identify the perceptual, cognitive, and social levels and the "relative contribution" of each level in explaining product aesthetic preferences. Repeated-measures analysis of variance (ANOVA) was used to analyze the differences between means to examine the differences in the participants' responses to stimuli. In generalized estimating equations (GEEs), it is possible to examine the strength of influence of each independent variable (perceptual: unity and variety; cognitive: typicality and novelty; social: connectedness and autonomy) in explaining the dependent variable (aesthetic pleasure). The resulting GEE β coefficients can confirm and verify how the independent variables affect the dependent variable (aesthetic pleasure), thus enabling comparison of the strength of the effects between different variables.

## Results

The results of the participants' ratings of the scales for ten soft drink designs were summarized, including the participants' preferences for the ten samples, as shown in (Fig. 1), and the average of the seven influencing factors for each product was calculated for further analysis, as shown in (Table 1). For example, stimulus 2 received the highest score on the aesthetic pleasure scale, with a mean aesthetic pleasure value of 4.91 and a standard deviation (SD) of 1.42.


**Fig. 1**. The line graph of estimated marginal means for aesthetic pleasure.

Pearson correlation analysis was used as a preliminary test to explore the relationships among the various influencing factors. The results show that all variables significantly affect the participants' aesthetic pleasure in soft drink packaging and that the two variables at each level are significantly negatively correlated. Multiple regression analyses were performed on different levels to gain additional insights into these findings. At the perceptual level, unity and variety positively impact the aesthetic rating of packaging design ($\beta$unity = 0.437, t = 21.10, $p < 0.001$; $\beta$variety = 0.183, t = 8.81, $p < 0.001$). We also found that the $R^2$ value of the model is 0.19, which means that the unity and variety of fixed effects explain 19% of the variance in aesthetic preferences. At the cognitive level, we found an $R^2$ of 0.21, and both typicality and novelty significantly and positively contribute to aesthetic preferences ($\beta$typicality = 0.525, t = 23.13, $p < 0.001$; $\beta$novelty = 0.316, t = 13.94, $p < 0.001$). Multiple regression analyses revealed that connectedness and autonomy positively impact aesthetics ($\beta$connectedness = 0.545, t = 28.57, $p < 0.001$; $\beta$autonomy = 0.215, t = 11.26, $p < 0.001$). At the social level, the $R^2$ of 0.30 suggests that 30% of the variation in aesthetic preferences can be explained.

To assess the combined effects of the UMA, multiple regression analysis was used to verify the causal relationships between all the independent variables and aesthetic preferences. A significant regression model was found, F (6, 1993) = 187.98, $p < 0.001$, $R^2$ of 0.36. These results imply that the model explains 36% of the variance in aesthetic preferences. Therefore, a model that combines the three levels will have a proportionally more significant variance than a model that includes only one level. Surprisingly, as other variables were considered, the effect of variety decreased and was no longer critical. This result is due to the impact of novelty or autonomy on variety, especially novelty, which accounts for nearly half of the impact of variety. We find that variety becomes meaningful for aesthetic preferences when controlling for connectedness. Based on the study provided above, the outcomes are very evident. The social level impacts aesthetic preference the most, with the cognitive and perceptual levels closely behind. The results diverge significantly from those of the study conducted by Berghman and Hekkert[57], who showed that the perceptual level is the most crucial determinant. This difference suggests that the model requires further elaboration.

Repeated-measures analysis of variance (ANOVA) was employed in this study to examine potential variations in reactions to the ten stimuli for each scale. The results show that each scale is statistically significant, as shown in Table 3 below. However, regarding gender and age, the results were not substantial, and the effects were negligible. For this reason, they were not included in the ANOVA and GEEs.

This study used GEEs to further examine the degree to which the independent variables may explain the dependent variable. The dependent variable was aesthetic preference, whereas the independent variables were the other scales. The results show that connectedness, typicality, and unity have the highest loadings on aesthetic pleasure. Tables 2 and 3 present the findings.

| Soft Drink Packaging Design | | Factors | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | **Aesthetic Pleasure** | **Unity** | **Variety** | **Typicality** | **Novelty** | **Connectedness** | **Autonomy** |
| 1 |  | 4.17 (1.68) | 5.76 (1.27) | 3.18 (1.69) | 6.10 (1.05) | 2.30 (1.22) | 4.88 (1.62) | 2.55 (1.49) |
| **2** |  | **4.91 (1.42)** | **6.06 (1.01)** | **3.11 (1.62)** | **5.87 (1.20)** | **2.84 (1.30)** | **5.15 (1.31)** | **2.43 (1.21)** |
| 3 |  | 3.92 (1.59) | 3.75 (1.98) | 4.13 (1.75) | 4.58 (1.73) | 3.58 (1.55) | 3.95 (1.68) | 3.82 (1.75) |
| 4 |  | 4.37 (1.71) | 4.67 (1.87) | 4.54 (1.76) | 3.88 (1.91) | 4.80 (1.66) | 3.64 (1.70) | 4.62 (1.69) |
| 5 |  | 4.28 (1.61) | 5.54 (1.49) | 3.81 (1.78) | 5.17 (1.41) | 3.33 (1.51) | 4.19 (1.62) | 3.29 (1.50) |
| 6 |  | 3.58 (1.82) | 2.85 (1.74) | 5.08 (1.78) | 2.99 (1.68) | 5.47 (1.49) | 3.19 (1.70) | 4.83 (1.75) |
| 7 |  | 2.85 (1.76) | 2.90 (1.88) | 4.96 (1.89) | 2.62 (1.70) | 5.15 (1.60) | 2.72 (1.62) | 4.84 (1.93) |
| 8 |  | 4.09 (1.97) | 3.47 (2.01) | 5.59 (1.56) | 2.84 (1.65) | 5.76 (1.44) | 3.36 (1.73) | 5.32 (1.69) |
| 9 |  | 4.47 (1.96) | 3.12 (1.90) | 5.73 (1.59) | 2.88 (1.74) | 5.62 (1.33) | 3.15 (1.73) | 4.94 (1.58) |
| 10 |  | 3.24 (1.83) | 2.78 (1.84) | 5.19 (1.91) | 2.42 (1.65) | 5.63 (1.72) | 2.72 (1.55) | 5.29 (1.78) |

**Table 1**. The Participants' evaluation results: stimulates–mean value (standard deviation).

## Study 2

In Study 2, we aimed to investigate whether product preference trends are affected in different contexts, as people are motivated to maximize their achievements and safety needs. In this study, we let participants evaluate designs aesthetically in different mindsets through two scenarios. That is, we investigate how aesthetic preferences play a role at the perceptual, cognitive, and social levels in specific situations.

| Variable | B | SE B | 95% CI for B | *p* |
|---|---|---|---|---|
| Unity | 0.169 | 0.025 | [1.128, 1.243] | 0.000 |
| Variety | 0.049 | 0.031 | [0.989, 1.116] | 0.109 |
| Typicality | 0.172 | 0.031 | [1.118, 1.261] | 0.000 |
| Novelty | 0.167 | 0.030 | [1.115, 1.254] | 0.000 |
| Connectedness | 0.338 | 0.034 | [1.312, 1.499] | 0.000 |
| Autonomy | 0.129 | 0.028 | [1.076, 1.202] | 0.000 |

**Table 2**. Summary of generalized estimating equation analysis for variables predicting 'aesthetic pleasure'. B indicates the unstandardized beta, SE B indicates the standard error for the unstandardized beta, and CI indicates the confidence interval. ($N = 2000$).

| Variable | $df_{NUM}$ | $df_{DEM}$ | Epsilon | F | *p* | $\eta^2_p$ |
|---|---|---|---|---|---|---|
| Aesthetic pleasure | 7.23 | 1438.37 | 0.836 | 33.51 | 0.000 | 0.144 |
| Unity | 6.29 | 1251.08 | 0.724 | 148.86 | 0.000 | 0.428 |
| Variety | 5.93 | 1179.53 | 0.681 | 75.29 | 0.000 | 0.274 |
| Typicality | 5.63 | 1119.71 | 0.645 | 196.56 | 0.000 | 0.497 |
| Novelty | 6.42 | 1276.68 | 0.739 | 183.06 | 0.000 | 0.479 |
| Connectedness | 6.26 | 1245.88 | 0.721 | 75.30 | 0.000 | 0.275 |
| Autonomy | 6.72 | 1336.80 | 0.775 | 115.87 | 0.000 | 0.368 |

**Table 3**. Analysis of variance (ANOVA) results for all scales. $df_{NUM}$ indicates the degrees of freedom numerator. $df_{DEM}$ indicates the degrees of freedom denominator. $\eta^2_p$ indicates the partial eta-squared.

## Methods

The research was approved by the ethics committee of Universiti Putra Malaysia (UPM.TNCPI.800-2/1/7), and all methods were employed in accordance with relevant guidelines and regulations. Informed consent was obtained from all participants.

*Stimuli*

As in Study 1, the same ten pictures of soft drink packaging designs were used to ensure that the same stimuli would influence participants to make different choices under different situational conditions.

*Participants*

The recruitment procedure was the same as that in Study 1. A total of 170 participants were invited to participate and were randomly assigned to two different experimental conditions. After the elimination of invalid questionnaires, 159 questionnaires remained. The age range of the participants was as follows: 46% ($n = 73$) were 18–25 years old, 33% ($n = 53$) were 26–35 years old, 14% ($n = 22$) were 36–45 years old, and 7% ($n = 11$) were 46 years old and above. Among the respondents, 72 were female (45%), and 87 were male (55%).

*Procedure*

The testing phase was the same as that in Study 1. The participants were informed that they were about to undergo a visual evaluation of ten soft drink packages. However, unlike those in Study 1, the subjects were asked to imagine themselves in one of two different situations: "going to a very formal meeting" or "going to a good friend's rave party." The participants were instructed to think about whether the visual appearance of the soft drink bottle design was appropriate for the scenario and to rate the packaging design for "unity," "variety," "typicality," "novelty," "connectedness," "autonomy," and "aesthetic pleasure." Stimulus images were presented randomly, and the form of all rating questions and the procedures were consistent with those of Study 1.

## Results

We summarized the results of the two groups of participants on the ten soft drink design scales, including the participants' aesthetic preferences for the ten samples under different scenarios. Table 4 shows the visual data comparison chart of the two groups. Comparing the average ratings of the two groups, we observe that there were significant differences in the aesthetic preferences for soft drinks packaging between the two groups of participants. The mean ratings of the two groups revealed significant differences in the participants' aesthetic preferences for soft drinks packaging. For "going to a very formal meeting," stimuli 2 was rated high on the "aesthetic pleasure" scale; for "going to a good friend's rave party," stimuli 9 was the most liked.

*Scenario 1: "going to a very formal meeting"*

As in the analysis method of Study 1, Pearson correlation analysis was used to explore the relationships among various influencing factors. Surprisingly, autonomy is significantly negatively correlated with the aesthetic pleasure of soft drink packaging. We continued with multiple regression analyses to gain additional insights into

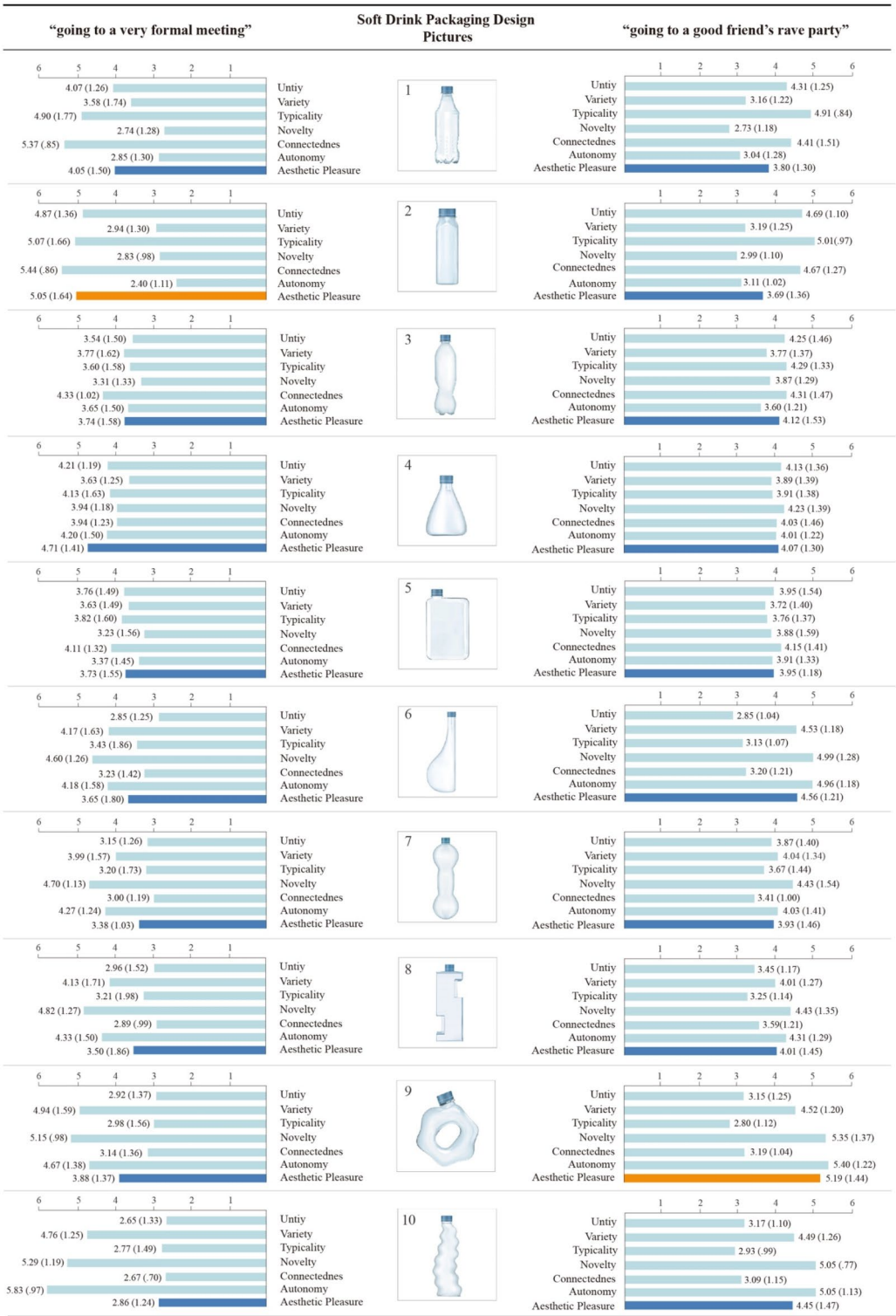


**Table 4**. The participants' evaluation results (two groups): stimuli–mean value (standard deviation).

the perceptual, cognitive, and social levels. At the perceptual level, unity and variety positively impact the aesthetic rating of packaging design ($\beta$unity = 0.642, t = 24.54, $p < 0.001$; $\beta$variety = 0.129, t = 4.94, $p < 0.001$). The $R^2$ value of the model is 0.43, which means that the unity and variety of fixed effects explain 43% of the variance in aesthetic preferences. At the cognitive level, we found an $R^2$ of 0.30, and both typicality and novelty significantly and positively contribute to aesthetic preferences ($\beta$typicality = 0.548, t = 18.74, $p < 0.001$; $\beta$novelty = 0.154, t = 5.26, $p < 0.001$). Multiple regression analyses revealed that connectedness and autonomy significantly positively impact aesthetics preferences ($\beta$connectedness = 0.380, t = 11.24, $p < 0.001$; $\beta$autonomy = 0.086, t = 2.53, $p < 0.05$).

| Variable | B | SE B | 95% CI for B | *p* |
|---|---|---|---|---|
| Unity | 0.511 | 0.033 | [1.563, 1.777] | 0.000 |
| Variety | 0.098 | 0.024 | [1.052, 1.156] | 0.000 |
| Typicality | 0.245 | 0.027 | [1.211, 1.348] | 0.000 |
| Novelty | 0.166 | 0.033 | [1.106, 1.260] | 0.000 |
| Connectedness | 0.131 | 0.034 | [1.067, 1.218] | 0.000 |
| Autonomy | −0.027 | 0.028 | [0.922, 1.029] | 0.339 |

**Table 5**. Summary of generalized estimating equation analysis for variables predicting "aesthetic pleasure". B indicates the unstandardized beta, SE B indicates the standard error for the unstandardized beta, and CI indicates the confidence interval. ($N = 840$).

| Variable | $df_{NUM}$ | $df_{DEM}$ | Epsilon | F | *p* | $\eta^2_p$ |
|---|---|---|---|---|---|---|
| Aesthetic pleasure | 6.39 | 530.08 | 0.775 | 14.61 | 0.000 | 0.150 |
| Unity | 6.77 | 561.93 | 0.826 | 25.12 | 0.000 | 0.232 |
| Variety | 7.07 | 587.02 | 0.866 | 12.86 | 0.000 | 0.134 |
| Typicality | 6.95 | 576.78 | 0.850 | 17.66 | 0.000 | 0.175 |
| Novelty | 7.01 | 581.54 | 0.858 | 54.95 | 0.000 | 0.398 |
| Connectedness | 6.95 | 577.07 | 0.850 | 67.35 | 0.000 | 0.448 |
| Autonomy | 7.82 | 649.37 | 0.968 | 43.02 | 0.000 | 0.341 |

**Table 6**. Analysis of variance (ANOVA) results for all scales. $df_{NUM}$ indicates the degrees of freedom numerator. $df_{DEM}$ indicates the degrees of freedom denominator. $\eta^2_p$ indicates the partial eta-squared.

At the social level, the $R^2$ of 0.13 suggests that 13% of the variation in aesthetic preferences can be explained. However, given that the Pearson correlation analysis showed that connectedness and autonomy were strongly negatively correlated, the effect now becomes significant and positive, which seems to be an instance of statistical suppression. This means that part of the positive effect of connectedness on aesthetic pleasure is transformed into a negative effect through autonomy. Since the aesthetic pleasure effect of connectedness is stronger than that of autonomy, the correlation between autonomy and aesthetic ratings becomes negative. However, when controlling for connectedness, the correlation between autonomy and aesthetic pleasure becomes positive. We continue to use multiple regression analysis to evaluate the combined effect of the UMA, $F(6, 833) = 148.49$, $p < 0.001$, $R^2$ of 0.51, and the results show that the regression model is significant. This means that the model explains 51% of the variance in aesthetic preferences. After accounting for variables at other levels of the UMA, autonomy still has a negative and nonsignificant effect on aesthetic pleasure. This result is due to the inclusion of variety at the perceptual level and novelty at the cognitive level, both of which have a corresponding effect on autonomy at the social level. The perceptual level influences aesthetic pleasure the most, followed closely by the cognitive and social levels.

As in Study 1, repeated-measures analysis of variance (ANOVA) was used to examine potential changes in responses to the ten stimuli for each scale. GEEs further reveal how much the independent variables can explain the dependent variable. The beta results show that unity, typicality, novelty, and connectedness most impact aesthetic pleasure. Tables 5 and 6 present the survey results.

*Scenario 2: "going to a good friend's rave party"*

Pearson correlation analysis revealed that all the variables significantly affected the participants' aesthetic pleasure. We continued with multiple regression analyses to gain additional insights into the perceptual, cognitive, and social levels. At the perceptual level, unity and variety positively impact the aesthetic rating of packaging design ($\beta unity = 0.221$, $t = 6.79$, $p < 0.001$; $\beta variety = 0.401$, $t = 12.31$, $p < 0.001$), and the $R^2$ value of the model is 0.25. At the cognitive level, we found an $R^2$ of 0.27 ($\beta typicality = 0.243$, $t = 7.72$, $p < 0.001$; $\beta novelty = 0.480$, $t = 15.28$, $p < 0.001$). At the social level, the $R^2$ of 0.26 suggests that 26% of the variation in aesthetic preferences can be explained ($\beta connectedness = 0.232$, $t = 7.38$, $p < 0.001$; $\beta autonomy = 0.439$, $t = 13.93$, $p < 0.001$). We continue to use multiple regression analysis to evaluate the combined effect of the UMA, $F(6, 743) = 74.26$, $p < 0.01$, $R^2$ of 0.37, and the results show that the regression model is significant. This means that the model explains 37% of the variance in aesthetic preferences. All the dependent variables were significantly related to the aesthetic preference for soft drink products. The cognitive level influences aesthetic preferences the most, followed closely by the social and perceptual levels.

Repeated-measures analysis of variance (ANOVA) was used to summarize potential changes in responses to the ten stimuli for each scale. The GEE results show that novelty, autonomy, unity, and variety have a more significant impact on aesthetic pleasure. Table 7 and 8 present the survey results.

| Variable | B | SE B | 95% CI for B | *p* |
|---|---|---|---|---|
| Unity | 0.161 | 0.037 | [1.092, 1.263] | 0.000 |
| Variety | 0.137 | 0.041 | [1.058, 1.243] | 0.001 |
| Typicality | 0.081 | 0.037 | [1.008, 1.165] | 0.029 |
| Novelty | 0.248 | 0.035 | [1.196, 1.372] | 0.000 |
| Connectedness | 0.082 | 0.033 | [1.018, 1.158] | 0.012 |
| Autonomy | 0.235 | 0.041 | [1.167, 1.371] | 0.000 |

**Table 7**. Summary of generalized estimating equation analysis for variables predicting "aesthetic pleasure". B indicates the unstandardized beta, SE B indicates the standard error for the unstandardized beta, and CI indicates the confidence interval. (N=750)

| Variable | $df_{NUM}$ | $df_{DEM}$ | Epsilon | F | *p* | $\eta^2_p$ |
|---|---|---|---|---|---|---|
| Aesthetic Pleasure | 7.74 | 573.02 | 0.971 | 8.23 | 0.000 | 0.100 |
| Unity | 7.80 | 577.45 | 0.968 | 17.17 | 0.000 | 0.188 |
| Variety | 7.72 | 571.49 | 0.968 | 12.54 | 0.000 | 0.145 |
| Typicality | 7.72 | 571.58 | 0.988 | 33.93 | 0.000 | 0.314 |
| Novelty | 7.86 | 581.97 | 0.923 | 34.54 | 0.000 | 0.318 |
| Connectedness | 7.40 | 547.89 | 1.000 | 15.32 | 0.000 | 0.172 |
| Autonomy | 7.96 | 588.76 | 0.971 | 32.05 | 0.000 | 0.302 |

**Table 8**. Analysis of variance (ANOVA) results for all scales. $df_{NUM}$ indicates the degrees of freedom numerator. $df_{DEM}$ indicates the degrees of freedom denominator. $\eta^2_p$ indicates the partial eta-squared.

## Discussion

Through two empirical studies, this research investigated how visual appearance influences consumers' aesthetic preferences for soft drink packaging design. The studies showed that the perceptual, cognitive, and social levels positively affect consumers' aesthetic preferences for product design, and H1 was partially supported. Specifically, Study 1 revealed that unity, typicality, novelty, connectedness, and autonomy significantly affected product aesthetic pleasure. When controlling for connectedness, variety also makes sense for aesthetic preferences. A negative correlation exists for each conceptual-level factor, indicating that the two opposing factors conflict. In addition, connectedness had the most significant impact on aesthetic pleasure, followed by unity and typicality. This result is also confirmed in the most pleasing soft drink packaging design (stimuli 2). At the perceptual level, our findings support past research, suggesting that unity is more important than variety (e.g., Post et al.[6]; Loos et al.[31]). At the cognitive level, the participants preferred typical products more than novel products, which is supported by studies by other researchers (e.g., Tyagi[14]; Yahaya[7]). In contrast, some believe that novelty is the main predictor (e.g., Song et al.[9]; Suhaimi et al.[10]). The current study revealed that typicality and novelty are two extremes of the same scale. However, this finding is not supported by the suggestion of Hekkert et al.[12] hat jointly maximizing typicality and novelty predicts high liking. Therefore, in this study, the preference for prototypes better explains product aesthetic preferences than the MAYA principle does. At the social level, Study 1 confirms the findings of Blijlevens and Hekkert[13,35] that both autonomy and connectedness enhance the aesthetic appeal of a product, and we found that connectedness was more important than autonomy in explaining aesthetic appreciation. This result may also be related to soft drink bottles' contact with the human body (hands and mouths); thus, the participants tended toward the safety side. These findings from Study 1 indicate that people prefer safety options over risks in regard to soft drink packaging designs.

In Study 2, we added situational conditions based on Study 1 and proved that product preference is affected under different background scenarios. The results for "going to a very formal meeting" show that all other variables significantly affected the participants' aesthetic pleasure in soft drink packaging except for autonomy. When controlling for connectedness, the correlation between autonomy and aesthetic pleasure becomes positive. The reason may be that, in certain situations, owing to social customs and peer pressure, people prefer safe choices, thereby increasing the desire for connection with others. The desire to establish connectedness with others is an inherent social need. Therefore, people will pursue higher-level needs (such as achievement) only once they feel that they have attained a basic level of safety[56]. For the "going to a very formal meeting" group, the basic level of safety may not be met, leading to a greater need for connectedness, which in turn diminishes the impact of autonomy on aesthetic pleasure. Consistent with the preferred stimulus in Study 1, stimulus 2 was rated high on the aesthetic pleasure, unity, typicality, and connectedness scales. This result tends to favor the safety side of the UMA model. In contrast, for "going to a good friend's rave party," we obtain surprising results. All the independent variables significantly affected the participants' aesthetic preferences for soft drink packaging. The beta indicates that novelty, autonomy, unity, and variety significantly affect aesthetic preferences. Unlike other "going to a very formal meeting" scenarios, stimulus 9 was selected as the most liked and was highly rated on the novelty, autonomy, and variety scales. However, people move toward achievement from the safety side of the UMA. This result suggests that the participants wanted to seek a sense of accomplishment

through novel products. Product-related risks/security may impact the ideal balance between connectedness and autonomy[35]. As suggested by Kaplan et al.[63], the social risk is understood as the extent to which the choice of a product will "affect the way others think of you." In a formal meeting, people may be able to make someone feel connected by using common or familiar products. This may be related to social conventions, peer pressure, or herd mentality. In contrast, if someone belongs to a group of people for whom the social norm is to convey individuality and pleasure, a unique and novel product may make someone feel connected. Thus, we agree with Blijlevens and Hekkert[35] that for one group, typicality (unity, connectedness) may be the norm (e.g., formal meeting). In contrast, for another group, novelty (variety, autonomy) may be the norm (e.g., rave party).

Unlike previous studies that focused on product categories involving long-term use, the current study selected the FMCG product category to fill this gap. This study provides multidimensional insights into the aesthetic preferences for soft drink packaging designs. As mentioned earlier, Berghman and Hekkert[5] claimed that the perceptual, cognitive, and social levels are related to and impact product aesthetics. However, most previous studies focused on examining only one or two separate levels, whereas the current study investigated the three levels simultaneously and made discoveries. This study confirms the findings of Berghman and Hekkert's[5] that, compared with a model containing only a single level of the variable pair, the combined model explains a larger proportion of the variance. Therefore, H2 was positively supported, providing an empirical basis for the UMA.

More importantly, this research highlights the dynamic nature of aesthetic preferences, demonstrating that the balance between safety and achievement, plays a critical role in shaping consumer evaluations of design attributes. Study 2 provides support for H3. People adapt to different situations by reconciling two conflicting impulses. On the one hand, we seek safety and avoid danger. On the other hand, higher-order needs and the need for self-actualization tend toward achievement[5]. Due to people's herd mentality and preference for safety, most individuals favor soft drink packaging designs that exhibit unity, typicality, and connectedness. However, novelty, variety, and autonomy in designs are also desired by people who seek a sense of achievement. By validating this interplay, our study provides empirical support for the UMA model's theoretical foundation and its application in understanding aesthetic preferences within product design.

Interestingly, we found that the perceptual, cognitive, and social levels had different effects on aesthetic preferences in both studies. This can be attributed to differences in situational scenarios, participant goals, and the interaction of variables in the UMA model. In Study 1, without a specific scenario, the participants may rely on existing social cognition and cultural background to evaluate product designs. They may subconsciously judge which design is more mainstream and attractive on the basis of social standards and market trends. For example, the simpler, traditional, and connected bottle (stimulus 2) was rated as the most liked. In Study 2, for the "going to a very formal meeting" scenario, the perceptual level had the greatest effect, meaning that visual features became the main focus. In a formal setting, the participants may choose a design that looks visually uniform and professional (stimulus 2) to convey a serious message. For the "going to a good friend's rave party" scenario, the participants' aesthetic preferences were more influenced by their cognitive level. They needed more cognition to evaluate which designs best conveyed the relaxed, personal, and fun atmosphere of the party. Therefore, bottles with unique shapes and structures (stimulus 9) were considered more in line with the atmosphere of the party. This result reflects that in informal and vibrant scenarios, people pay more attention to the creativity and uniqueness of the design. Furthermore, in social settings such as parties, people may consider which designs can stand out in social interactions or conform to group expectations.

The experiments show that aesthetic preference is not a single-level judgment but a multilevel, dynamic evaluation process. In different contexts, the influence of the perceptual, cognitive, and social levels changes, reflecting people's needs and expectations in different situations. This exploration of dynamic balance extends the depth of existing research and provides a new perspective for understanding the complex interaction of design attributes. In addition, within the soft drink packaging category, our two studies showed that products with greater unity evoked more positive aesthetic preferences among participants than those with variety. This finding is not surprising, given the importance of unity in aesthetics identified in previous research. It may also be explained by simple products' lack of elements, making it more difficult to appreciate variety. This study offers valuable insights into the perceptual, cognitive, and social dimensions of aesthetics, emphasizing the importance of a multidimensional perspective. Future research is encouraged to delve deeper into consumer psychology and aesthetic preferences in product design, further advancing our understanding in this area.

## Conclusions

Overall, integrating the UMA into research on soft drink packaging design offers profound insights into understanding and enhancing aesthetic preferences. By addressing the perceptual, cognitive, and social dimensions, the UMA provides a comprehensive framework for analyzing how different design elements influence consumer preferences and emotional responses. The current study contributes to aesthetic theory and empirically determines the impact of the UMA on aesthetic appreciation. It also helps to identify the determinants of aesthetic preferences between consumers and products. By investigating the interplay between product design attributes, this study offers a nuanced understanding of how conflicting forces shape aesthetic appreciation. Our findings contribute to the theoretical discourse on balancing safety and achievement in design aesthetics. The results provide actionable insights for designers, marketers, and educators. By understanding the unique contributions of perceptual, cognitive, and social attributes, professionals can create designs that are visually appealing, aesthetic, and socially relevant.

While our study revealed new results that advance knowledge about packaging designs, it still has several limitations that may provide additional avenues for future research. First, we considered only the visual dimension, and other senses, such as touch, can also impact aesthetic preferences. In addition, although this study used an innovative beverage packaging design as a stimulus and the shape of the bottle as the primary variable, in addition to shape attributes, visual elements such as color and labels cannot be ignored. Investigating

different product categories or adding more variables can provide more possibilities. The current study aimed to identify predictors of aesthetic preferences; however, consumers' attitudes and behaviors may influence product design. These factors should be addressed in future research to gain a more comprehensive understanding of consumer preferences.

## Data availability

The datasets used and(or) analyzed during the current study are available from the corresponding author upon reasonable request.

Received: 4 June 2024; Accepted: 21 January 2025
Published online: 08 February 2025

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## Acknowledgements

This study is part of the first author's Ph.D. thesis at the Faculty of Design and Architecture, Universiti Putra Malaysia. The authors would like to express Professor Allan Whitfield, Dr. Deirdre Barron, and Dr. Lichen Tai for their help with this study.

## Author contributions

S.D. wrote the draft of the manuscript. M.F.Y manuscript revision, M.F.Y and A.R.A.R supervision, S.D. data collection, and analysis of the results. All authors contributed substantially to the manuscript and approved the submitted version.

## Declarations

## Competing interests

The authors declare no competing interests.

## Additional information

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