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Investigating the Aesthetic Appraisal of Computers Based on the Unified Model of Aesthetics (UMA)

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Abstract

This study aims to explore the relationship between consumer preferences and shape typicality cognition through the Unified Model of Aesthetic (UMA), with the goal of addressing the gaps in current research on computer products in terms of cognition, perception, social aspects, and aesthetic responses. The preferences of 100 participants for 10 computer images will be measured on a 7-point Likert scale using four sets of two-way adjectives (typical-novel, unified-variety, social belonging-individuality, and like-dislike). The data will undergo several statistical analyses via the IBM SPSS Statistics software. The findings shall demonstrate the role and significance of typicality, novelty, and other independent variables in influencing aesthetic preferences. The objectives of this study are: (1) To investigate whether the principles of unity and variety contribute to the aesthetic appreciation of computers at the perceptual level; (2) To identify the role of typicality and novelty in consumers' aesthetic preferences for computers; and (3) To explore how social connectedness and autonomy affect the aesthetic pleasure of computers. A thorough review of past studies on Project UMA revealed several gaps that must be addressed. Primarily, not many studies have looked on the relationship between typicality and preference at the cognitive level of computers. Secondly, limited research has explored the perceptual and social levels. This includes testing the relationship between the uniform appearance of computers and popularity at the perceptual level and whether computers can foster a sense of group belonging among the participants at the social level. Previous research demonstrated that people prefer typicality or familiarity and often associate familiarity with safety (Hekkert et al., 2003). Additionally, security stands as an important factor in this study where the research objective shall prove the relationship between security and aesthetic preference, which has great significance for computer appearance design and development.

Keywords: Unified Model of Aesthetic, Computer, Aesthetic Preference, Shape, Safety

Introduction

The Theory of Aesthetic Preferences (TAP) refers to the ability to infer and reason about other people's aesthetic preferences(Miller & Hübner, 2020). Preferences are often measured as the judgment of beauty based on the Positive Attraction dimension (Reber et al., 2004). Previous research has validated people's relationship to aesthetic preferences through numerous aesthetic and psychological theoretical frameworks, such as the Arousal Theory, Categorical-Motivation Model, Collative-Motivation Model, Preference-For-Prototype Model, and the Unified Model of Aesthetics. This study aims to evaluate the visual design or aesthetics of computers by referring to the Unified Model of Aesthetic, in hope of addressing the research gaps related to the cognitive, perceptual, social level, and aesthetic response of the current products. The findings will demonstrate how the shift in the marketability value of a product can be achieved using empirically valid measures and statistical analyses, ultimately offering potential contributions to experimental design and aesthetics. The relationship between safety and aesthetic preferences will also be apparent, particularly as security has been found to be associated with unity, typicality, and connectedness (Damasio, 1994; Thurgood et al., 2014; Tyagi et al., 2013.). Such gap is also addressed in this study by investigating the role and significance of typicality, novelty, and other independent variables in aesthetic preference.

Literature Review

The past few decades have witnessed the extensive growth of research regarding the beauty of aesthetics. This field of study was pioneered by Fechner (1876) and is considered one of the oldest topics in psychology (Palmer et al., 2013). Prior to Fechner's work, Weber (1846) repeatedly experimented with weight comparisons in pairs and visually-presented line segments. It led to the proposal of Weber's law, which states that the size of the just noticeable difference varies depending on its relation to the strength of the original stimulus (Weber, 1846). According to Weber's law, such threshold difference is a constant proportion of the original threshold size. It subsequently stands as the earliest psychological work to discover that sensations are interdependent on external stimuli, leading to the establishment of psychophysics.

Expanding from Weber’s work, research by Fechner in psychophysics has had a major impact on aesthetics. It includes the proposal of the Psychophysical Methods, which comprise refined experimental techniques to study the connection between physical stimuli and psychological experiences. These scientific methods laid the foundation for the emergence of experimental aesthetics. Fechner further established his theories on experimental aesthetics through his work "*Vorschule der sthetik*", also known as "Elementary Aesthetics" (Härtel et al., 1876). Such empirical approach is highly dependent on the generation of quantitative data for output validation through the utilization of surveys, observations, participants, experiments, and fixed analysis (Yahaya, 2017). Furthermore, Fechner was reported to be in favor of using scientific approaches to explore aesthetics by suggesting that rather than relying on subjective opinions and personal preferences, aesthetics should be handled as an empirical science, just like physics or psychology (Berlyne, 1970; Gibson, 1962). Fechner's principle of unitary connection of the manifold (Härtel et al., 1876) was supported by Berlyne (1971). According to this theory, an appealing stimulus—in this case, one that can elicit the greatest amount of pleasure—must provide a proper balance between the complexity of a multiplicity of points of attack and the orderliness of unitary connection (CUPCHIK & BERLYNE, 1979). It later imposed a prominent influence over Berlyne's Aesthetic Theory.

The focus of Berlyne's Arousal Theory is the motivation behind people's behaviors. Berlyne (1960) discovered that the preference of arousal level plays a significant role in influencing each person's behavior. The highest preference can be attained at a medium arousal level while the level is influenced by a variety of conditions, including the participants' own experience (Berlyne, 1970). However, this hypothesis gradually lost its predominance in subsequent developments; nevertheless, current researchers have been investing efforts to improve the theory. For example, Bhandari et al (2019) adopted the subcomponents of emotion (e.g., pleasure and arousal) from the Arousal Theory to explore the impact of visual aesthetics on user ratings (Bhandari et al., 2019). Similarly, Bornioli et al (2019) explored the relationship between sensory stimulation and walking experience based on the psychological theory of environmental emotion (Bornioli et al., 2019).

Berlyne also proposed the Categorical-Motivation Model, which is a theory of aesthetic preference that examines the relationship between the complexity or novelty of stimuli and people's perceptual reactions. It assumes that moderate arousal is the most aesthetically pleasing and aims to explain how people process and react to aesthetic stimuli. The model also describes stimuli's novelty, complexity, and incongruity as "control variables" following their impact on arousal Berlyne (1970), suggesting that the contribution of each salience could affect the categorical status or meaningfulness of the stimuli (Whitfield, 2000).

Another psychological framework by Berlyne is the Collative-Motivation Model, which is heavily linked to his works on Motivation Theory (Berlyne, 1970). The model explores how the motivation and drive in humans can affect their judgment and response toward a stimulus (Suhaimi, 2021). Berlyne conducted several tests and discovered that people are motivated to look for stimuli that share the same collaborative properties as their own motivational characteristics. He also found that people favor moderately complicated and uncertain stimuli over those that are either too simple or too complex (Berlyne, 1971). In his book "Aesthetics and Psychobiology", Berlyne regarded novelty as an important variable and linked individual variability in personality traits to the complexity or novelty of stimuli (Berlyne, 1970). Such notion has profound implications across various fields, such as psychology, design, and marketing.

However, Berlyne's original model received criticisms from Whitfield who conducted an in-depth investigation into the relationship between furniture and aesthetic preferences. The findings revealed that a subset of participants exhibited a preference for stimuli that were novel, complex, and ambiguous while others exhibited a preference for more familiar, simple, and clear stimuli. Berlyne's model was also criticized for overemphasizing the role of complexity in aesthetic preference; a comprehensive model of aesthetic preference should consider additional dimensions, such as novelty and typicality (Whitfield, 2008). Moreover, Berlyne's Categorical-Motivational Model was argued by Eysenck and Iwawaki (2010) to be overly simplistic. The authors believed that cultural and social factors influencing aesthetic experience should also be considered in addition to examining aesthetic preferences in terms of perception and cognition(Eysenck & Iwawaki, 2010).

The propounded arguments, therefore, demonstrated that although Berlyne's model offered a useful framework for understanding how individuals process and respond to aesthetic stimuli, it is far from perfect. This prompted Rosch to propose the principles of categorization(Rosch, 1978)to illustrate the close relationship between prototypes and aesthetic preferences. People prefer objects that look more like actual prototypes of products. For example, typical car designs may be perceived as more aesthetically pleasing than less typical car designs. The findings by Whitfield and Slatter (1979) showed that the

extent to which a stimulus is typical — or prototypic — of the category accessed by the subjects often determines the effect, also termed as "preference-for-prototypes"(Whitfield & Slatter, 1979). Such concept connects typicality to human liking and claims that the processing of information adopts a cognitive interpretation that is subject to categorical mediation (Whitfield, 2008). This ultimately provides theoretical support for the further development of aesthetic preference research.

Hekkert et al. (2006) proposed the Unified Model of Aesthetics as a theoretical framework for understanding the mental processes involved in aesthetic experience. Its basic ideas are Darwinian in nature, which view aesthetics as a modern evolutionary expression of a primal instinct that balances risk and safety (Hekkert, 2006; Whitfield & de Destefani, 2011). The unified model structured in Project UMA predicts that the balance of opposing forces, such as unity and variety as well as connectedness and autonomy, influences the human's aesthetic pleasure for designed products (Project UMA, n.d.). These opposing forces represent three levels of research, namely perceptual, cognitive, and social (Yahaya, 2017). Hekkert et al (2014) also found that people prefer typicality or familiarity and often associate familiarity with safety. These findings, while posing great significance to Project UMA, remained questionable. For example, their assessment on the social aspects of sneakers and backpacks was done by recruiting people with design backgrounds as the participants (Thurgood et al., 2014), which could have an impact on aesthetic preferences. Similarly, the testing of car keys and car interiors also involved participants with design backgrounds at the perceptual level (Thurgood et al., 2014). It was argued that the participants' social background and cultural differences could have imparted a prominent effect over the research results.

Furthermore, previous research in related fields had recruited participants from Australia, the United States, the Netherlands, and Malaysia, with the exception of (Safia, 2021). As the largest economy in Asia, any research conducted in the context of China will have important implications and significance for the design and product industries. Exploring people's aesthetic preferences for computers will also reveal the relationship between security and aesthetic preferences, particularly as previous studies reported the strong association between security with unity, typicality, and connectedness(Damasio, 1994; Thurgood et al., 2014; Tyagi et al., 2013). Furthermore, past findings demonstrated that high typicality refers to people's preferences for safe or familiar items while high novelty reflects how exposure to novel objects helps people to develop cognitive abilities (Allan Whitfield, 2005; Paul Hekkert, 2012). From an evolutionary point of view, the two opposing results described above stem from the desire for safety and the urge to explore the unknown (Yahaya, 2017), with the former being the primary consideration of aesthetic preferences (Whitfield, 1983).

In conclusion, people's cognition of aesthetic preference corresponds to Weber's law, Psychophysics, Arousal Theory, Categorical-Motivational Model, Collative-Motivation Model, Preference-For-Prototypes Theory, and Unified Model of Aesthetics at different stages. Although these models and theories have been tested in various ways, the results can reflect people's pursuit of safety and the unknown. Additionally, the previous Unified Model of Aesthetic failed to test the aesthetic preference of computers and the three levels at the same time. Therefore, this paper aims to predict and further study the aesthetic preferences of computers.

Theoretical Framework

The purpose of this study is to investigate the aesthetic preference of design products. This will be achieved by varying the shape of the stimulus to obtain diverse aesthetic judgment

responses from the participants. Unity, variety, typicality, novelty, connectedness, and autonomy have been identified as the independent variables while aesthetic preference stands as the dependent variable. The thorough literature review has introduced the model and theoretical framework for determining aesthetic preferences and safety has been found to play an important role in aesthetic preferences. Next, UMA will be used to test whether safety is pursued at the cognitive, perceptual, and social levels. The results will verify the three corresponding hypotheses that are proposed according to the three levels. Figure 3.0 shows the theoretical framework of this study.

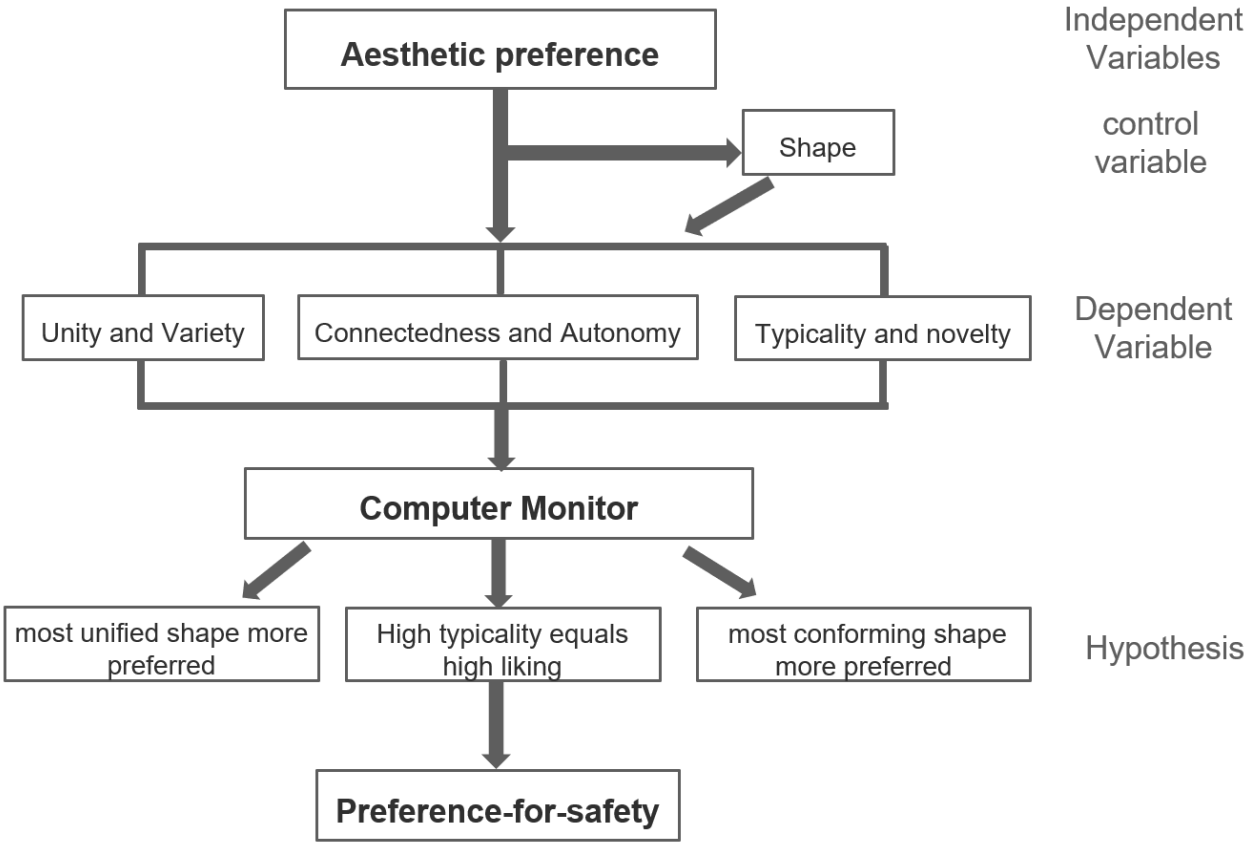

Figure 3.0: Theoretical Framework

Hekkert (2014) introduced the Unified Model of Aesthetics, which states that our aesthetic preferences depend upon a constant conflict between three drives: evolutionary, complementary, and motivational. One of these drives prompts people to seek acquisition through exploration and learning, while the other motivates people to seek safe, familiar objects, and safe situations that are easy to handle. This indicates that humans prefer both security and success (Higgins et al., 1997). In UMA, the perceptual level is where both unity and variety originate. Variety satisfies people's need for achievement because it involves taking chances and trying new things, whereas unity fosters perceptual knowledge, satisfying people's need for safety (Thurgood et al., 2014). If Hekkert's theory is accurate, the previously intended balance between unity and variation may change due to the need for success or safety. The preference for security will lead people to prefer unity, while the preference for risk will lead people to prefer variety. This does not imply that unity and variety are mutually exclusive, but rather that in divisions — those who value unity have comparatively lower demands for variety (Thurgood et al., 2014). To determine people’s various demands for unity

and variety, this study shall examine the aesthetic preferences of computers using UMA. Therefore, the following hypothesis is put forth: At the perceptual level, unity is a significant factor affecting people's aesthetic appraisal of computer product design.

Both typicality and novelty originate at the cognitive level in UMA. The Categorization Theory Rosch (1978) was the first to identify typicality. Meanwhile, the Preference-for-Prototype Model connects typicality to human preferences based on the context of Rosch's prototype-based categorization (Whitfield, 2008). The Collative-Motivation Model developed by Berlyne serves as the foundation for novelty as a predictor of aesthetic preference (Suhaimi, 2021). Furthermore, Berlyne's Collative Motivation Model views novelty as a predictor of aesthetic preference where it is used as a collative variable to measure aesthetic preferences and assumes that these variables have arousal potential (Berlyne, 1970). Because typicality and novelty have their own strengths in predicting and determining aesthetic preferences, Whitfield (2000) proposed the Categorical-Motivational Model, which is a theoretical reconciliation of the previous attempts by (Whitfield, 1983). According to Whitfield's theory, both familiarity and novelty are capable of accurately predicting aesthetic preferences (Suhaimi, 2021). As an extension of the Categorical Motivational Model and the Preference Prototype Model, this study will test aesthetic preference and motivational functions by observing computers of different shapes. Therefore, the following hypothesis is put forth at the cognitive level: high typicality equals to the high liking for computers.

There has been a scarcity of theories or studies on principles that can be used to explain aesthetic enjoyment based on social concerns. Blijlevens et al (2014) proposed a new aesthetic standard known as "Autonomous, yet Connected" and they demonstrated its applicability to customers' aesthetic experiences by comparing a product's design to a completely different standard. This aimed to determine how well the new aesthetic standard can answer our societal concerns about connectedness and autonomy — this principle separates itself from previous aesthetic principles (e.g., Deci & Ryan, 2009). Previous studies found that people certainly feel connected or autonomous depending on a product's design (Thurgood et al., 2014). Humans develop relationships with one another and preserve a feeling of group identity to satisfy their evolutionary need for safety. They also possess an inherent need to feel autonomous (Lynn & Harris, 1997; Snyder & Fromkin, 1977; Snyder & Lopez, n.d.). Such notion subsequently suggests that both autonomy and connectedness positively influence aesthetic pleasure for product designs (Hekkert et al., 2014). Moreover, Thurgood et al (2014) also found that autonomy will affect aesthetic pleasure more when people are in safe environments as opposed to when they are in threatening situations (Thurgood et al., 2014). When a product category already provides adequate safety, consumers choose to lose autonomy rather than improve connectedness in the dangerous conditions compared to the safe state. These findings seem to support Maslow's Hierarchy of Needs Maslow (1943), which states that adequate connectivity is a requirement for consumers to value a certain level of autonomy in a product design. Therefore, the following hypothesis is put forth at the social level: high connectedness equals to the high liking for computers.

Conceptual Framework

The conceptual framework aims to improve the theoretical system of UMA by emphasizing consumers' needs for product aesthetic preferences. It is of great significance to the sustainable development of experimental aesthetics. Moreover, product design needs to clarify consumers' aesthetic needs in social, cognitive, and perceptual levels. It also must

determine whether consumers prefer typical appearance in the process of purchasing products because it makes them feel more secure.

To ensure the validity of the findings, the study will only test the participants' visual perception. For the purpose of reducing the influence of brand impression on aesthetic cognition, the stimuli displayed in the questionnaire shall remove the brands. Since Tyagi et al (2013) failed to show both color harmony and a common order of color selection, this study will use 2D images to display the product and process the images in black and white. It will also modify the selection of participants based on the deficiencies in previous studies, including to exclude those with a design background. The 7-point Likert scale will be used to collect consumers' aesthetic evaluations. The collected data will be repeatedly analyzed using Inter-Correlation Coefficient (ICC), Analysis of Variance (ANOVA), Multi-Dimensional Scaling (MDS), and Generalized Estimating Equations (GEE) to generate a conclusion that will be beneficial to the active development of computer product design.

Figure 4.0 illustrates the conceptual idea of this study. It suggests that aesthetics is a sensual pleasure, which is defined in this study as the positive response elicited from any of our senses after interacting with any type of object (Cabanac, 1979). By focusing on the cognitive, social, and perceptual aspects of aesthetics, the study aims to identify the relationship between the independent and dependent variables.

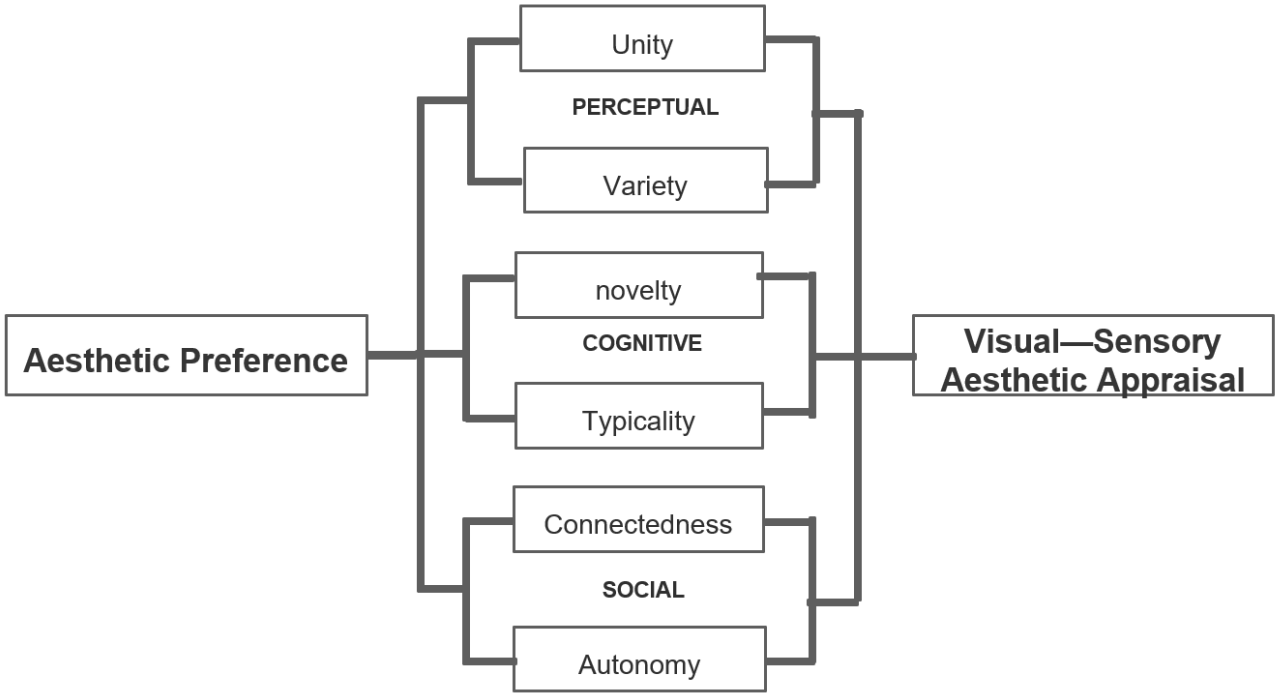

Figure 4.0: Conceptual Framework

Conclusion

The purpose of this research is to investigate the impact of six variables toward the aesthetic preferences for computer products. Before the experiment, the research methods in related fields were reviewed to decide on the use of research methods with high feasibility. The stimuli, participants, language, and questionnaire survey platform used in the experiment are also described in detail. Upon completing the questionnaire, the participants can complete three different levels of aesthetic preference assessment using the 7-point Likert scale. The experiment aims to address the gaps in current investigations related to product perception, social, cognitive, preference, and aesthetic responses. It also seeks to verify the relationship

between the three levels of UMA with aesthetic preferences, particularly as previous research had only tested the cognitive level. Therefore, the present research is of great significance for model testing and aesthetic knowledge expansion to demonstrate how statistical tests and scales that have received empirical validation can be used to transform the marketability values for products. Although the potential impact of this research on the fields of experimental aesthetics and product design will not be mentioned before and during the experiment, such contributions may only be discovered after completing the rest of the chapters. In particular, the research will demonstrate the capability of the six variables (typicality, novelty, autonomous, connected, unity, and variety) in determining and predicting design product preferences.

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