

# Research on Product Design of Face Pareidolia

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**Abstract**—Pareidolia means that the brain sees a meaningful shape in a meaningless thing when it receives a blurred picture from the outside world. Face Pareidolia has become an effective design method in the field of design to enhance product interest, attract attention, and convey emotional characteristics. This study's purpose is to explore whether there are differences in product design with pareidolia in different categories, and how the appearance of emotional faces affects product perception. Shopee, MOMO, and PChome 24h are the top three shopping websites in Taiwan. Used as the search platform for the number of product samples. Products with facial pareidolia (Face Pareidolia) are classified into three main categories: household appliances, 3C audio-visual, and home decoration accessories. From each category, select 8 photos of products with fantasy facial features. Scored by the Product Semantic Difference Scale. After collecting 93 valid questionnaires. Among the three product types with application illusions, the 3C audio-visual category presents a more technological sense of product tonality. And there are obvious differences with the other two types of products. Emotional appearance design can have an impact on the semantics of the product, and strengthen the perception of 「seriousness, toughness, coldness, and sense of technology」, while its 「interestingness and delicacy」 are less affected by emotional appearance.

**Keywords**—pareidolia, product design, product semantics

## I. INTRODUCTION

Pareidolia is a term in psychology that refers to the phenomenon of “parallel vision”. It occurs when our brain receives unclear images or sounds from the outside world and recognizes meaningful patterns from them. These patterns are not present in the stimuli, but our brain automatically perceives them as something meaningful and familiar to aid our cognition. For instance, it is common to see faces in random objects (Fig. 1), and this type of pareidolia is known as face pareidolia [1]. This study aims to investigate whether the phenomenon of facial fantasy pareidolia also applies to product design and how the characteristics of fantasy products are reflected in the modeling construction. Additionally, we explore how facial fantasy products are perceived in terms of product semantics.

To achieve the research objectives, we selected Shopee Shopping, MOMO Shopping, and PChome 24h Shopping, as they are the top three shopping websites in Taiwan. Using the Sample Number search platform, we collected image data of facial pareidolia that are currently available on these websites. We analyzed and compiled the data to identify the categories of products with more pareidolia. We also conducted semantic analyses of the products by the subjects to understand whether there are differences in various types of facial pareidolia and whether there are emotional differences between facial pareidolia and product styling design. Based

on the research attributes, the research period aims to achieve the following three purposes:

- 1) Summarize the common product categories with facial pareidolia found in popular items on Taiwan's shopping websites.
- 2) Determine whether the application of facial pareidolia has differences in the styling of different categories of products.
- 3) Investigate whether facial pareidolia has an emotional impact on product modeling design.



Fig. 1. Appearances of objects with facial pareidolia [1].

## II. LITERATURE REVIEW

### A. Pareidolia and Visual Cognition

Facial pareidolia is a common but complex phenomenon. Whether a stimulus is judged as a face is not only affected by the clarity of the stimulus, whether it is symmetrical, whether there is an eye-like structure, and how similar it is to a real face but also depends on whether there is a “face template” in the subject's memory that can match the current stimulus, which in turn will be regulated by long-term and temporary experience. When there is no, or only small, face information in the stimulus, the expectation and imagination of the face will affect the extraction of visual information in a top-down manner, allowing the individual to find useful information from the limited visual information. are integrated as features of faces; as the face information contained in the stimulus continues to accumulate, individuals make face judgments when a certain threshold is reached, and this threshold is regulated by top-down processing. Studying this phenomenon can provide a deeper understanding of face processing and the integration of top-down information and bottom-up processing information.

The phenomenon of “face pareidolia” and its neural mechanisms are influenced by a combination of bottom-up processing, which involves processing sensory information from the stimulus itself, and top-down processing, which involves the influence of expectations and the presence of face-related contextual information. This reflects the high sensitivity of the visual system to facial structures. Research has found that judgments of stimuli as faces are influenced by the features of the stimuli themselves [2], a process referred to as bottom-up processing. Additionally, they are influenced by expectations of faces and the presence of face-related backgrounds [3–6], which is referred to as top-down modulation. Recent studies have also found that face pareidolia is influenced by individual factors such as gender. By studying face pareidolia, we can gain insights into how the brain recognizes faces and the psychological and neural mechanisms involved in integrating both bottom-up and top-down information for decision-making [7].

### *B. Pareidolia and Mental Activities*

In our visual senses, we tend to look for patterns and contexts, and then give them a seemingly reasonable meaning. In psychology, because of this phenomenon, a series of so-called fantasies through projection has also developed. Psychological activities are caused by sexual pareidolia to understand an individual’s psychological or emotional state. Therefore, from this psychological phenomenon, we can think about it from two angles. The first angle is what exactly do we project to the world? However, regardless of whether what we project is true or not, it does have a real impact on how we view the world [8].

In the process of judging an object with a similar face to be a face, the “expression” of the object will also affect the judgment. Some studies have found that the subject’s rating of how much the face-like object resembles a face is positively correlated with the rating of the intensity of the object’s expression [9]. Some studies have found that the emotional state of the test subjects will lead the test subjects to make more face judgments [10]. In this study, the fear-primed subjects made more judgments about abstract lines. In multi-face judgment, researchers believe that fear regulates the subject’s internal response preference. This may be because the cost of underreporting in a fearful situation is much higher than the cost of false reporting. Considering the difference between faces and general objects, it remains to be verified whether the influence of fear affects only the face illusion. Another study using a signal detection paradigm found that anxious emotional states enhanced subjects’ detection sensitivity to faces but did not change response tendencies [11]. And found that this effect only affected faces, not non-social stimuli (such as houses). Therefore, it is suspected that the emotional state of fear only affects threatening or social stimuli, such as faces, and may have different effects from anxiety. However, whether emotional states motivate trying to discover faces is still controversial. How the extraction of emotional information from stimuli affects the face judgment process and the neural mechanisms of this influence also need to be explored.

### *C. Pareidolia and Product Design*

The phenomenon of pareidolia not only occurs in human beings’ behavior of identifying objects in daily life but many designers and artists are also good at using elements with faces or biological characteristics to add interest and aesthetic value to their works. Similar to most visual pareidolia phenomena, aesthetic perception is a phenomenon in which the brain interacts with multiple stimuli [12]. The use of illusions that imitate faces or creatures in the design field is an extension of bionic design. Through the characteristics of biological appearance, combined with concepts such as imagery and adjective vocabulary, it can be objectively and effectively used as the basis for product modeling design and development [13]. Due to differences in aesthetic preferences and usage scenarios among customer groups, products with similar functionalities can exhibit significant stylistic variations, allowing for diverse changes in product appearance based on different contexts. By understanding how the human brain seeks and recognizes familiar patterns and shapes, designers can consciously incorporate elements that leverage this natural tendency, eliciting positive emotional responses and establishing stronger connections with users. There is an extensive literature on the effects of anthropomorphism on product perception and buyer behavior [14–16].

Previous research [17] has indicated that, in comparison to regular products, products featuring face pareidolia illusions exhibit stronger semantic perceptions of being fun, rounded, exquisite, cute, and gentle in appearance. When excluding price and functionality factors, consumers are more likely to pay attention to products with face pareidolia illusions in their design. These products can even convey a wide range of emotional features such as joy, melancholy, fierceness, and, consequently, contribute to the market positioning and appeal of the product [1].

In summary, the phenomenon of face pareidolia is important for designers to understand how to use it to enhance design configurations. Product design is increasingly concerned with how we can make products more pleasant to use, more durable, and perform better by responding to implicit emotional needs [19]. Thus, anthropomorphism plays a role in product aesthetics, improving human responses and thus product performance [20]. Our tendency to look for shapes and patterns in the human body [21] points to a deep-seated preference for pareidolia [4].

## III. RESEARCH METHODS

This study attempts to explore the categories of products with facial illusion pareidolia that are popular on Taiwanese shopping websites, as well as the differences in the application of facial illusion in different categories of product shapes, and analyze the differences in product appearance, emotion, and semantics. It also provides a reference basis for product styling design and then puts forward specific suggestions. To achieve the purpose of this study, the research structure, research scope and objects, and research methods are explained below (Fig. 2).

### A. Research Structure

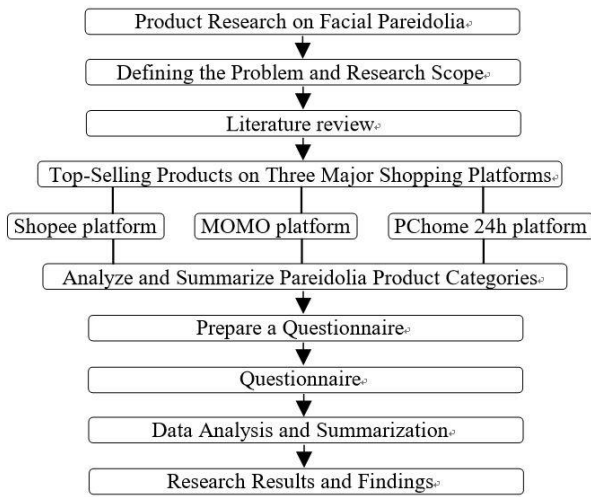


Fig. 2. Product design research structure for facial pareidolia.

### B. Research Scope and Objects

This study chose Shopee Shopping, MOMO Shopping, and PChome 24h Shopping, the top three shopping websites in Taiwan, as search engines. The scope of data collection was limited to the top 100 best-selling products on the current shopping platform as the number of product samples. The screening method was used to find the top 100 fantasy products on the three shopping websites, and the data were analyzed and summarized to become the sample number for the subsequent questionnaire survey.

In recent years, people's shopping methods have gradually become completely different from those in the past. The research subjects are not limited to specific ethnic groups because the topic of this study is an issue that the general public can discuss and judge. Secondly, education level does not affect cognitive discriminability. There was a total of 93 valid subjects in this study. There are 51 women, accounting for 54.8%, and 42 men, accounting for 45.1%. The average number is 46.77, and its age distribution is shown in Fig. 3.

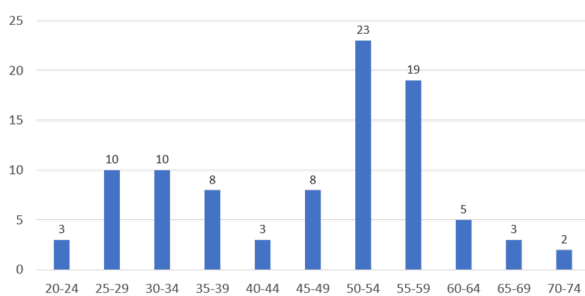


Fig. 3. Age distribution of subjects.

### C. Research Design and Process

The topics discussed in this study are issues that concern the general public and are suitable for online questionnaire surveys. Therefore, this study mainly uses online questionnaires with high message transferability to be delivered to the subjects for filling in the questionnaires. Although the validity of the Internet survey method has been questioned, the Internet survey method is still a traditional random sampling method [22].

#### 1) Sampling method

This study carried out semantic extraction based on the

product semantic extraction mentioned by Wang, Xing, and Zhang [17]. In this literature, adjective-like product semantic terms were extracted using word frequency analysis software, ultimately forming 7 pairs of product semantic dimensions that describe product styling. After collecting these 7 pairs of product semantic dimensions, a semantic differential scale questionnaire can be designed to observe whether respondents perceive differences in product styling across different categories. The semantic differential scale was developed by American psychologists Osgood, Suci, and Tannenbaum and is used to interpret experiences, skills, and other implicit knowledge that are not easily expressed [23]. It is commonly used in sensory engineering methods. Semantic differential scales have been widely used in design and other related fields. Specifically, subjects rate concepts or matters based on their subjective feelings based on a given semantic differential scale. The final data will be converted into whether there are differences in product styling and emotion among different categories and will be converted into a reference source for product styling.

#### 2) Survey design

First of all, the questionnaire design of this study classified the categories of fantasy products and finally summarized the facial fantasy products, which are household appliances, 3C and audio-visual categories, and home decoration and life accessories. After excluding samples with repetitive functions and unclear features, 8 photos of products with facial fantasy shapes were selected from each category and scored through a semantic difference scale between positive and negative meanings of the products. When this study provides subjects with ratings, the concept of Pareidolia and the way to fill in the positive and negative product semantic difference scales are first mentioned to ensure that each subject can understand the purpose of this study. Questionnaire design and subsequent filling in and answering.

## IV. RESEARCH RESULTS AND ANALYSIS

Product styling is the focus of designers, and it is also the first impression given to consumers of the product. To this end, this study establishes 7 pairs of vocabulary semantics from two different perspectives based on the appearance, shape, or color of products with facial illusions and features, as well as the emotional vocabulary generated by the use experience, to explore the semantic space of product styling.

### A. Classification of Products with Facial Pareidolia

This study collected Taiwan's major online shopping websites and ranked the top 100 products with facial pareidolia. After summary and sorting, the samples were converted into three product categories: 1) Household appliances, 2) 3C audio-visual, 3) Home decoration accessories.

#### 1) Household appliances

The classification basis generally refers to household appliances driven by electric energy, such as sweeping robots, lighting, coffee machines, etc. It can be seen from the home appliances category that there are many products on the market that are used to create illusions in lighting fixtures. In addition, from the buttons, concave holes, or the shape of the



product, you can think of products with facial pareidolia (Fig. 4).



Fig. 4. Household appliances \_ products with facial pareidolia.

2) 3C audio-visual

In terms of classification, the abbreviation of the three English words Computer, Communication, and Consumer-electronics is used as the definition. This is the basis for this study to classify audio and video products here. It can be seen from 3C and audio-visual products that many image lenses can cause illusions and illusions. The main reason is that the “lens shape” makes people easily associate with faces. It was also found from the case that the concave hole design of the flash drive often gives people a fantasy illusion. The audio and video speaker products, all have concave hole or convex designs, and the appearance of the speaker products is very confusing. It is easy to have the facial feeling of hallucinatory pareidolia (Fig. 5).



Fig. 5. 3C audio-visual \_ products with facial pareidolia.

3) Home decoration accessories

Mainly depends on the product shape or the style of the product with holes, such as clothing products such as shoes or hats, and daily necessities such as socket holes, pen holders, facial tissue boxes, and other accessories that are used in daily life. Summarized in this category (Fig. 6). Products in this category are more diversified in color applications and are more lively and youthful in color.



Fig. 6. Home decoration accessories \_ products with facial pareidolia.

B. Research Analysis of Products for Three Main Categories

Using the product semantic scale for analysis, it was found that the subjects’ feelings about home appliances home decoration, and life accessories tended to be consistent (Table 1). Except for “exquisite”, the semantic meanings of 3C audio-visual products are lower than those of the other two categories of products; in the “natural sense/technological sense” item, the difference is most significant. The product appearance design shows that the face is a fantasy illusion, and the 3C audio-visual products appear more “solemn, tough, mature, cold, and technological” (Fig. 7).

Table 1. The average of semantic scale in three main categories

Question	Household Appliances	3C Audio-Visual	Home Decoration Accessories
Solemn ↔ Interesting	3.65	3.41	3.75
Tough ↔ Mellow	3.43	3.01	3.36
Rough ↔ Exquisite	3.33	3.16	3.08
Mature ↔ Cute	3.69	3.34	3.61
Cold ↔ Gentle	3.55	3.01	3.46
Technical ↔ Natural	3.15	2.43	3.46
Angry ↔ Happy	3.60	3.18	3.50

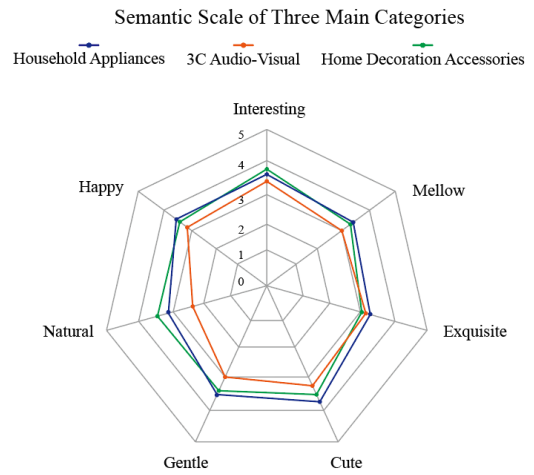


Fig. 7. Radar chart of semantic scale for three types of products.

C. Using Emotional Characteristics to Explore Product Semantic Perception

All product samples were divided into groups based on angry or happy expressions (divided by 3 points on the scale). There were 21 products with a happy expression and 3 with an unhappy expression, all of which appeared in 3C audio-video products. It shows that the vast majority of products that use facial pareidolia mainly based on the emotional appearance of pleasure, as shown in the semantic analysis table of happy and anger products in Table 2 and radar chart of semantic scale for three types of products in Fig. 8. Only in the category of technology products such as 3C audio-visual, some products adopt serious or angry facial features to present a more “technological, cold, mature and tough” product tone. Among the various semantic indicators, “interesting and exquisite” is less affected by emotional appearance.

Table 2. Semantic analysis table of happy and angry products

Bias	Average	Interesting	Mellow	Exquisite	Cute	Gentle	Natural	Happy
Happy	3.56	3.64	3.35	3.22	3.62	3.47	3.12	3.75
Angry	2.47	3.37	2.67	2.97	3.00	2.47	2.27	2.50

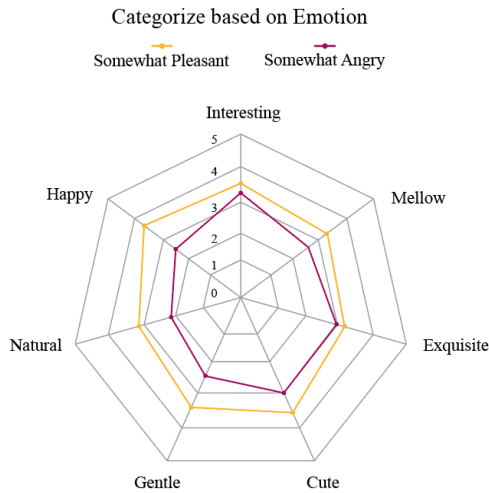





Fig. 8. Radar chart of semantic scale for three types of products.

The general perception of emotional feelings can be perceived by the “expression” of the face or the “movement” of the body as well as the “color” of the shape. Therefore, this study specifically extracted the questionnaire statistics table (such as Table 3) of the 3C audio-visual category in Category B. The items with an average value of semantic intention of “angry expression  $\longleftrightarrow$  happy expression” are less than 3.0: B03, B07, and B08 are discussed in (Table 4).

Table 3. Average semantic value of B 3C audio-visual category

Semantic NO.	Interesting	Mellow	Exquisite	Cute	Gentle	Natural	Happy
B01	3.8	3.9	3.6	3.9	3.6	2.5	3.7
B02	3.5	2.2	3.3	3.4	3.0	2.2	3.6
<b>B03</b>	3.4	2.7	2.9	3.1	2.5	2.4	<b>2.2</b>
B04	3.2	3.6	3.2	3.5	3.3	2.4	3.4
B05	3.2	3.0	2.9	3.2	3.1	2.6	3.4
B06	3.5	3.4	3.4	3.7	3.7	2.9	3.9
<b>B07</b>	3.7	3.2	3.1	3.5	2.8	2.3	<b>2.8</b>
<b>B08</b>	3.0	2.1	2.9	2.4	2.1	2.1	<b>2.4</b>
Average Value	3.41	3.01	3.16	3.34	3.01	2.42	3.18

Table 4. 3C audio-visual products with semantic intent less than 3.0

Product shape and number	The “Expression” of the face	The “Movements” of the body	The “Color” of styling
 No.: B03	Wrinkling and staring eyes	2 horns on the head (microphones)	Black head with orange eyes
 No.: B07	Eyes connected and gazing as one	Alien-like attitude	Bright red body with deep blue eyes
 No.: B08	Tall and fierce eye expression	Wide cheekbones and sunken cheeks	black face with orange eyes

The analysis in Table 3 shows that people’s emotional perception is the product of interaction with objective facts, and its content mainly includes the comprehensive unity of facial expressions, body movements, physiological responses

to visual colors, and emotional expression. In other words, emotions are the most direct emotional expression of human psychology and physiology for objectively existing things and embody the relationship between human subjective needs and objective facts.

D. Discuss Product Semantic Perception Based on Age Groups

There are slight differences in the definition of age groups according to different research organizations or analysis subject needs. This study refers to the Oxford English Dictionary definition: “Middle Age is the stage between 45 and 65 years old, between young adults and old age”. The tested samples were divided into 45 years old and 45 years old. Analyzes were conducted into two age groups. Those aged 20 to 44 are defined as young adults, and those aged 45 and above are defined as middle-aged and elderly (the minimum value in the sample is 21 years old, and the maximum value is 72 years old).

As shown in Fig. 9, middle-aged and elderly people generally have a more vivid and open feeling about facial pareidolia, and their semantic feelings tend to be “interesting, mellow, exquisite, cute, gentle, natural, happy” and other characteristics. The semantic analysis of these three product categories (Figs. 10 and 11) shows that young and middle-aged people feel a strong sense of technology rather than a sense of nature for 3C audio-visual products with facial pareidolia.

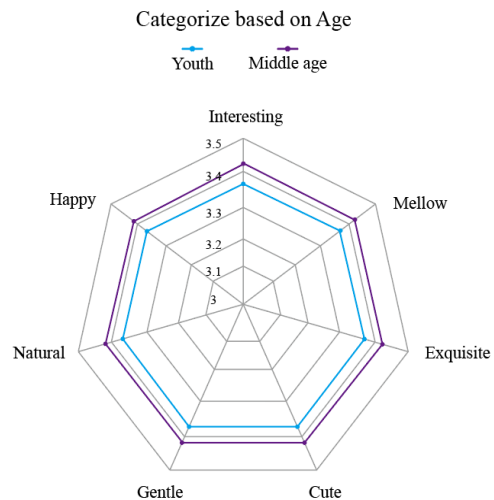


Fig. 9. Radar chart of semantic scale of products for youth and middle aged.

Semantic Scale of Three Main Categories\_Youth

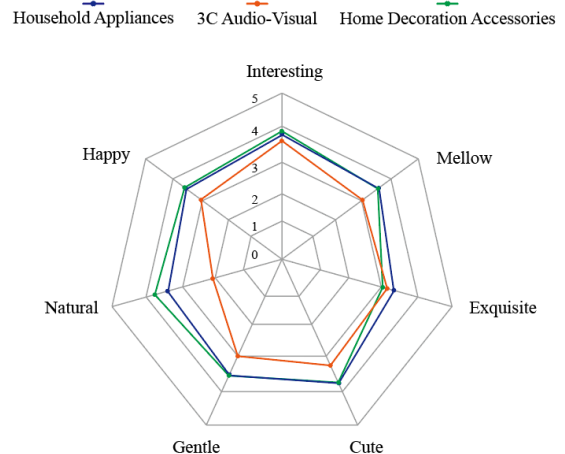


Fig. 10. Radar chart of semantic analysis of products for Youth.

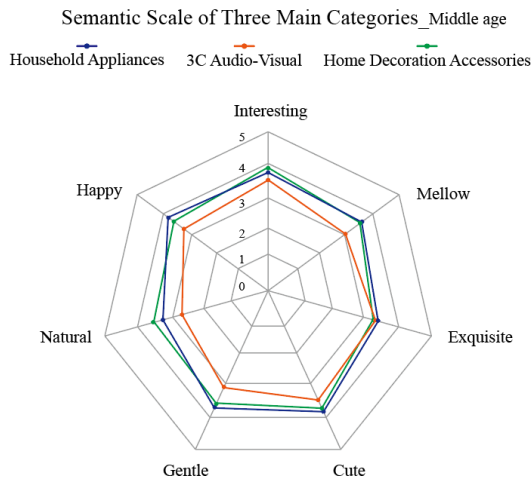


Fig. 11. Radar chart of semantic analysis of products for Youth.

## V. CONCLUSION

Through literature analysis, this study found that product exterior designs that use fantasy illusion have stronger semantic perceptions such as interesting, round, delicate, cute, and gentle than ordinary shapes. There is no significant difference between the sense of technology and the sense of nature in terms of the presence or absence of face pareidolia. Overall, the use of pareidolia product appearance can help shape the market positioning and interest of the product. It is an effective means to enhance product attractiveness and convey the tonality of the product. Among the currently popular products sold on Taiwan's online shopping platforms, the main product types with facial illusions include household appliances, 3C audio-visual products, home decoration accessories, etc. This study used the Semantic Perception Scale combined with emotional perception to analyze and compare the three types of products. It was found that there was no difference in the feelings of technology and nature between products with or without facial pareidolia. Among these three types of products that use facial pareidolia, the 3C audio-visual category clearly presents a more technological product tone, and is more "solemn, tough, mature, cold, and technological". Some 3C audio-visual products adopt serious or angry emotional appearances to further strengthen the aforementioned characteristics. If the age group is used as a distinction, it can be found that young and middle-aged people feel a stronger sense of technology rather than a sense of nature for 3C audio-visual products with facial pareidolia.

Based on the above findings, it is known that the appearance design of products with facial pareidolia has different attributes and semantic features according to different product categories. Among 3C audio-visual technology products, the difference is most obvious. Although the sense of technology is not the main influencing feature of facial pareidolia, it is the main feature of 3C audio-visual products. Emotional appearance design can have an impact on product semantics, strengthening the perception of "seriousness, toughness, coldness, and a sense of technology", while the degree of "interesting and exquisite" is less affected by emotional appearance.

## CONFLICT OF INTEREST

The authors declare no conflict of interest.

## AUTHOR CONTRIBUTIONS

Lai-Fen Yang conducted the research, analyzed the data, and wrote the paper; Yueh-Hsiu Cheng provided academic advice; both authors had approved the final version.

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