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The Influence Mechanism of Visual Cues on Sustainable Consumption: An Experimental Analysis of Color, Eco-Label Type, and Salience

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Abstract. Against the backdrop of increasingly severe global environmental challenges,sustainable consumption has become an important component of global environmental protection.Visual cues have an important impact on sustainable consumption behavior.This study explores the influence of color,ecological label type and ecological label significance on consumers' environmental perception and purchase intention through experiments.The experiment design covers three product—potato chips,shampoo,and garbage bags.The results show that environmentally friendly color can enhance consumers' perception of environmental protection,but the impact on purchase behavior is different between different product categories.Third-party certified eco-labels is not significantly superior to the enterprise self-declaration label in terms of environmental perception and purchase intention.The influence of label salience (size) on environmental perception and purchase intention is moderated by product category.These findings suggest that product categories and consumption situations should be considered when designing visual cues, which provides a theoretical basis for the effective formulation of visual strategies for sustainable marketing.

Keywords: visual cues,sustainable consumption, environmental perception, purchase intention

1. Introduction

Global environmental pressures have pushed sustainable consumption to the forefront of the development agenda.Although consumers' awareness of environmental protection is increasing, the market share of green products is still not high, which reveals the complexity of the process of transforming environmental protection willingness into actual purchase behavior.As a direct and efficient external stimulus,visual cues play a huge role in it.Visual elements such as color and label can not only effectively convey environmental information and reduce consumers' cognitive load,but also guide consumers to make more sustainable purchase decisions by stimulating consumers' emotional resonance and value identity.Visual cues have become an important tool for enterprises to convey sustainable value and influence consumers' choices.

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At present,the research on the influencing factors of sustainable consumption behavior mainly focuses on individual difference factors,social situation factors and marketing communication factors [1].As an important factor affecting consumers' decision-making,visual cues are less studied, more dispersed or mainly concentrated in a specific field,and no one has made clear the various visual elements and the logic behind them.This study wanted to see how the visual cues of color and label affect green consumption.We focus specifically on how these cues function and where their influence ends.Our goal is to clarify the consumer decision-making process and help brands design more effective green marketing strategies.

2. Literature review

As the most intuitive information carrier,visual cues can affect consumers' attention,emotion and judgment in the initial stage of product contact, and are widely used in green marketing, advertising and packaging design [2].Visual cues cover visual elements such as colors,symbols,labels,images, and fonts.These elements affect consumers' perception and purchase decisions through emotional connections or rational cues.Previous studies have shown that visual cues can not only enhance environmental awareness,but also enhance the credibility and quality association of products,thus promoting sustainable consumption behavior [3].Therefore,it is of theoretical and practical value to explore the mechanism of consumer behavior from the perspective of visual cues.

2.1. Color

As one of the most influential visual cues, color can largely attract consumers' attention and affect their perception.According to personal experience, specific colors can remind people of the corresponding items,information or perception [4],so green is often associated with environmental protection and sustainability,and is more effective in generating positive advertising attitudes and purchase intentions [5].However,green is not always the best choice to convey environmental protection.For hand sanitizer and canned tuna,blue is the most attractive color and the best choice to convey corporate social responsibility(CSR)information,while improving product credibility and willingness to pay premium levels [6].In addition,cold tones generally make snack products look more healthy or natural, reflecting the complex role of color in different commodity categories [7].

However,some studies have found that the use of green as an environmentally friendly color may be suspected of 'green cleaning'. When consumers suspect that enterprises use green appearance for surface environmental marketing,the positive impact of green packaging may be weakened.There are also differences in people's understanding and values of environmental protection in different cultural backgrounds.Only when the product color is consistent with the consumer's cultural values and their expectations for environmental protection,green is more likely to enhance the consumer's perception of the brand's environmental protection [8].

From the perspective of behavioral psychology,color affects purchase intention through emotional response,processing fluency and symbolic meaning.Green or low saturation colors can usually produce positive emotions such as calmness and reliability,and improve brand attitude and product attractiveness [9].In addition, color can also be used as a heuristic cue to allow consumers to judge whether the product is environmentally friendly at a lower cognitive cost,thereby increasing the probability of selection [10].

Because consumers' interpretation of green information is regulated by factors such as experience,green cleaning suspicion,and product type,the influence of different colors on consumers' environmental perception and purchase intention is conditional,and the effect is different in different

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situations.Moreover,the current research lacks research on comparing the effects of environmentally friendly colors and non-environmentally friendly colors under multiple product categories.So it is necessary to further test the effects of color cues in different product categories and different situations.Based on this discussion,the following hypotheses are proposed:Eco-friendly colors enhance consumers' environmental perceptions more than non-eco-friendly colors(H1).Eco-friendly colors increase consumers' purchase intentions more than non-eco-friendly colors(H2).

2.2. Ecological label type

Ecological labels are also often used as visual cues to provide consumers with environmental information about products or services and promote consumers to make more sustainable choices (ISO 14024).The types of eco-labels include declarations,written descriptions,visual labels,etc. Different forms of eco-labels have different effects on transmitting information [11].

In recent years,there have been more and more studies on the impact of eco-labeling on sustainable consumption.The most extensive research is on how sustainability labels affect consumers' perception of products,behavioral intentions and actual purchase behavior.Compared with other product attributes,the impact of environmental labels on consumers' purchase intention is relatively significant.Environmental labels have a significant positive impact on consumers' sustainable behavior [12].Consumers are more willing to pay a premium for labeled products and show higher purchase intentions [13].

Compared with corporate self-declaration labels,consumers trust third-party authoritative certification labels more,because they are more credible and can reduce the suspicion of green cleaning.In the field of sustainable consumption,for products with third-party authoritative certification labels,consumers tend to have higher environmental awareness,stronger willingness to purchase and higher willingness to pay premiums,while self-declared eco-labels have little impact on sustainable consumption [14].

However,some people believe that eco-labeling will be regarded as a kind of moral pressure,resulting in consumers' rebellious psychology and choosing products without eco-labeling [15].The effectiveness of eco-labels also varies due to factors such as differences in personal environmental concerns [16].In addition,a variety of label categories will lead to consumer confusion,increase consumer confusion,but reduce the efficiency of consumer judgment and affect purchase behavior [17].Therefore,it is of great significance to study the difference effect of label form. In this regard,we propose a hypothesis:Under the premise that consumers can identify the authority of third-party institutions,third-party authoritative certification labels can better enhance consumers' perception of product environmental protection than corporate self-declaration labels (H3).On the premise that consumers can identify the authority of third-party institutions,third-party authoritative certification labels can enhance consumers' willingness to purchase products more than corporate self-declaration labels(H4).

2.3. Ecological label salience

Visual saliency is a key factor that affects whether consumers notice information.Saliency usually involves features such as size,location,and color contrast.Among them,label size is one of the most direct and stable influencing factors in visual attention.

Research shows that sustainability labels with larger size and more visual impact are more likely to be noticed by consumers.When the label size is large and prominent,consumers need less time and cognitive effort to view sustainability labels.When consumers can quickly identify

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environmental labels,it is more likely to form a positive environmental perception and increase purchase intention [18].Therefore, label salience is an important condition that affects sustainable consumption decisions,and the research on label salience is relatively neglected in the existing literature. In this regard, we propose a hypothesis:Large-size labels are more effective than small-size labels in improving consumers' environmental perception of products(H5).Large-size labels are more effective than small-size labels in improving consumers' willingness to purchase products. (H6)

2.4. Mechanisms through which visual cues influence consumer behavior

2.4.1. Perception and emotional responses to visual cues

Consumers' response to visual cues is first at the perceptual level.Color,image,brand logo and other elements directly affect consumers' first impression of the product.Visual cues first affect consumers' attention, then make consumers perceive product attributes,and finally affect evaluation and selection.In semiotic research, semiotic elements affect consumers' cognition,sensory experience and emotional attitude through systematic,reliable and cultural signals,thus affecting consumers' attitudes and behaviors towards green products [19].Positive sensory interaction with green products can enhance satisfaction and help maintain consumers' green behavior over time.Koenig-Lewis et al.found that emotion is a key driver of sustainable purchasing behavior relative to rationality.Both positive and negative emotions will affect the purchase intention,and the impact of positive emotions on environmentally friendly packaging is stronger than that of negative emotions [20].Visual elements related to environmental protection can arouse consumers' association with the concepts of environmental protection,green and health,arouse consumers' emotional resonance,make them more supportive of environmental protection,and thus promote consumers to make more sustainable behavioral decisions [21].

2.4.2. Cognitive load and visual simplicity

Consumers' decision-making process is usually affected by cognitive load.When the information is too complex,consumers' choices may be troubled.Therefore,simple and intuitive visual design helps to reduce the cognitive burden and make it easier for consumers to make decisions.When the sustainability information of environmentally friendly products is simpler,clearer and more easily noticed,consumers are more likely to perceive their sustainability and make sustainable behavioral decisions [22].And when consumers face judgment barriers and information overload when assessing the authenticity and impact of green products,it will lead to consumer confusion and hinder their choice of green products and more sustainable consumption behavior [23].

2.4.3. Alignment with values and self-concept

Behavioral Reasoning Theory(BRT) shows that consumers' beliefs and values can drive consumer behavior [24].Consumers tend to choose products that are consistent with their values.Visual cues can emphasize values such as environmental protection and social responsibility in brand communication,help consumers establish emotional connections with brands,and thus promote sustainable consumption.Consumers with strong green self-identity believe that environmental behavior is consistent with their positive self-image,and they regard environmental protection as a moral responsibility to society [25].These consumers are more inclined to choose brands that reflect

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their personal identity and social responsibility.When visual cues are consistent with consumers' self-image, purchase behavior is more likely to occur.

3. Methodology and research design

3.1. Procedure and experimental design

This study used a 2 (color: eco-friendly vs. non-eco-friendly) × 2 (label type: third-party certified label vs. self-declared environmental claims)×2(label salience: highvs.low)×3(product category:potato chips,shampoo,garbage bags)between-subjects design.The selected products represent food,daily chemicals, and household goods,covering diverse consumption contexts.All products are displayed under fictitious brand names to eliminate brand bias.Packaging pictures are made using Adobe Photoshop,and the design elements are consistent to control irrelevant variables.

3.2. Sample description

A total of 280 valid questionnaire data were collected in this survey.The participants were between 18 and 51 years old,of which 85.7% were 18-29 years old,5% were 30-39 years old,7.5% were 40-49 years old,and 1.8% were over 50 years old. In terms of gender,men account for 20% and women account for 80%.In terms of education level,respondents are mainly concentrated in the undergraduate level and above,among which undergraduate students account for 77.5%,graduate students and above account for 10.4%, and junior college and below account for 12.1%.

4. Results

4.1. Effects of color type on environmental perception and purchase intention

At the level of Environmental perception,products in the eco-friendly color condition (green) received higher environmental perception ratings than in the non-eco-friendly condition (red), supporting H1. Overall, the mean score was 4.82 (green) vs. 4.08 (red).Potato chips scored 4.65 vs. 4.16, shampoo 4.58 vs. 4.10, and garbage bags 5.24 vs. 3.97. The color effect varied by category, largest for garbage bags (Δ=1.27), followed by potato chips (Δ= 0.49) and shampoo (Δ= 0.48).

At the level of purchase intention,color effects were category-specific. H2 was supported only for garbage bags, where purchase intention was 5.23 (green) vs. 4.45 (red), and WTP premium ¥1.77 vs. ¥1.12. For potato chips and shampoo, differences were negligible: potato chips purchase intention 4.69 vs. 4.83, WTP ¥1.46 vs. ¥1.27; shampoo purchase intention 4.48 vs. 4.45, WTP ¥4.26 vs. ¥4.80.

Table 1. Effect of color type on environmental perception across different product categories

Product Category	Environmental Perception (7-point)		
	Green Group Mean	Red Group Mean	Difference (Green − Red)
Potato Chips	4.65	4.16	0.49
Shampoo	4.58	4.10	0.48
Garbage Bags	5.24	3.97	1.27
Overall	4.82	4.08	0.75

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Table 2. Effect of color type on purchase intention across different product categories

Product Category	Purchase Intention (7-point)		
	Green Group Mean	Red Group Mean	Difference(Green − Red)
Potato Chips	4.69	4.83	-0.14
Shampoo	4.48	4.45	0.03
Garbage Bags	5.23	4.45	0.78
Overall	4.80	4.58	0.22

Table 3. Effect of color type on WTP premium across different product categories

Product Category	WTP Premium (RMB)		
	Green Group Mean	Red Group Mean	Difference (Green − Red)
Potato Chips	1.46	1.27	0.19
Shampoo	4.26	4.80	-0.54
Garbage Bags	1.77	1.12	0.65
Overall	2.50	2.40	0.10

4.2. Effects of label type on environmental perception and purchase intention

At the level of environmental perception,when consumers' ability to recognize third-party authority was not considered,H3 was not supported. Label type had no significant positive effect, and in some categories,self-declared labels outperformed third-party certified labels.Overall,environmental perception was lower for third-party certified labels (M = 4.41) than for self-declared environmental claims (M = 4.60, Δ = −0.19). By category, scores were: potato chips 4.33 vs. 4.81,shampoo 4.24 vs. 4.45, garbage bags 4.66 vs. 4.55.

At the level of purchase intention,H4 was not supported without distinguishing consumers' recognition of third-party authority. Overall purchase intention was lower for third-party certified labels (M = 4.64) than self-declared environmental claims (M = 4.74). By category: potato chips 4.67 vs. 4.85, shampoo 4.36 vs. 4.57, garbage bags 4.88 vs. 4.80. WTP premium followed a similar pattern: potato chips ¥1.21 vs. ¥1.51, shampoo ¥4.49 vs. ¥4.57, garbage bags ¥1.29 vs. ¥1.60.

Table 4. Effect of label type on environmental perception across different product categories

Product Category	Environmental Perception (7-point)		
	Certified Label Mean	Declarative Label Mean	Difference (Certified−Declarative)
Potato Chips	4.33	4.81	-0.48
Shampoo	4.24	4.45	-0.21
Garbage Bags	4.66	4.55	0.11
Overall	4.41	4.60	-0.19

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Table 5. Effect of label type on purchase intention across different product categories

Product Category	Purchase Intention (7-point)		
	Certified Label Mean	Declarative Label Mean	Difference (Certified − Declarative)
Potato Chips	4.67	4.85	-0.18
Shampoo	4.36	4.57	-0.21
Garbage Bags	4.88	4.80	0.08
Overall	4.64	4.74	-0.10

Table 6. Effect of label type on WTP premium across different product categories

Product Category	WTP Premium (RMB)		
	Certified Label Mean	Declarative Label Mean	Difference (Certified − Declarative)
Potato Chips	1.21	1.51	-0.3
Shampoo	4.49	4.57	-0.08
Garbage Bags	1.29	1.60	-0.31
Overall	2.33	2.56	-0.23

4.3. Effects of label salience on environmental perception and purchase intention

At the level of Environmental perception,label salience had an overall positive effect, providing general support for H5, though no effect was observed for garbage bags. Across products, mean environmental perception was 4.58 vs. 4.33. By category: potato chips 4.53 vs. 4.29, shampoo 4.60 vs. 4.08, garbage bags 4.60 vs. 4.61.

At the level of purchase intention, effects of label salience varied by product, providing partial support for H6. The positive effect was strongest for shampoo, weak or reversed for garbage bags.For purchase intention: chips 4.82 vs. 4.70, shampoo 4.62 vs. 4.31, garbage bags 4.76 vs. 4.92. For WTP premium: chips ¥1.50 vs. ¥1.22, shampoo ¥5.25 vs. ¥3.80, garbage bags ¥1.40 vs. ¥1.50.

Table 7. Effect of label salience on environmental perception across different product categories

Product Category	Environmental Perception (7-point)		
	Large Label Mean	Small Label Mean	Large − Small Difference
Potato Chips	4.53	4.29	0.24
Shampoo	4.60	4.08	0.52
Garbage Bags	4.60	4.61	-0.01
Overall	4.58	4.33	0.18

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Table 8. Effect of label salience on purchase intention across different product categories

Product Category	Purchase Intention (7-point)		
	Large Label Mean	Small Label Mean	Large − Small Difference
Potato Chips	4.82	4.70	0.12
Shampoo	4.62	4.31	0.31
Garbage Bags	4.76	4.92	-0.16
Overall	4.73	4.64	0.09

Table 9. Effect of label salience on WTP premium across different product categories

Product Category	WTP Premium (RMB)		
	Large Label Mean	Small Label Mean	Large − Small Difference
Potato Chips	1.50	1.22	0.28
Shampoo	5.25	3.80	1.45
Garbage Bags	1.40	1.50	-0.10
Overall	2.72	2.17	0.54

4.4. Moderating role of product category

Product category played a moderating role in the effects of both color and label salience on environmental perception and purchase intention.The influence of eco-friendly color was most evident for garbage bags,but appeared negligible for chips and shampoo.In terms of environmental perception,the difference between the green and red conditions was 1.27 for garbage bags,0.49 for potato chips,and 0.38 for shampoo.In terms of purchase intention,the corresponding differences were 0.78 for garbage bags,−0.14 for potato chips,and 0.03 for shampoo.

The effect of label salience on environmental perception and purchase intention in different product categories is also different.Large-size labels have the most obvious improvement in environmental awareness and purchase intention in shampoo,and the effect is not obvious or even reverse in garbage bags.At the level of environmental perception,the difference between the large-size label group and the small-size label group of shampoo was 0.52,the potato chips was 0.24,and the garbage bag was -0.01.At the level of purchase intention,the difference between the large-size label group and the small-size label group of shampoo is 0.31,the potato chips are 0.12, and the garbage bags are -0.16.

5. Conclusion

Compared with non-eco-friendly color (red),eco-friendly color (green) significantly enhanced environmental perception,but its impact on purchase intention and willingness to pay varied by product category,with the strongest effect on garbage bags and weaker on crisps and shampoo.This suggests that green can easily be reminiscent of nature and sustainability,thus affecting consumers' cognitive evaluation,but this change in perception does not necessarily translate into purchasing behavior.For chips,the consideration of taste dominates the decision-making process,exceeding the environmental cues;for shampoo,functional effects are prioritised,and although environmental perception has improved,the effect of color on behavior is not obvious.For label types,third-party

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authoritative certification labels are not superior to corporate self-declaration labels in terms of environmental perception or purchase intention,and in some cases even worse.Through our analysis,we found that only about half of the participants recognized the authority of the fictional certification body,indicating that the effectiveness of third-party authoritative certification labels are related to whether consumers are familiar with the certification label.When the authority of the certification label is not recognized, it not only has no trust advantage, but may weaken the persuasiveness due to the increase of cognitive difficulty;the corporate self-declaration labels are more direct and easier to understand.This finding implies that the credibility advantage of third-party authoritative certification labels assumed in previous studies may be premised on consumer recognition of institutions.The label significance effect is also moderated by product category:larger labels can increase the willingness to buy shampoo and willingness to pay,but have no positive or even negative effects on garbage bags,indicating that although more prominent labels can enhance attention,excessive emphasis on environmental attributes may lead to 'greenwashing' suspicion.Product category is a key moderator of sustainable visual cues,which means that their effects vary in different contexts.For potato chips,the purchase decision is driven by hedonic attributes such as taste.Environmental cues may enhance perception,but have little effect on purchase.For shampoo,functional attributes are dominant,making environmental cues secondary.For garbage bags,product functions are more closely related to the environment,so that environmental cues can significantly affect perception and purchase.When the core function of the product is compatible with environmental protection,simple clues such as color can have a significant impact;in hedonic or function-oriented products,environmental cues only play a supporting role rather than a decisive role.

5.1. Mediation analyses

5.1.1. Emotional response as a mediating pathway

We found that emotional response plays a partial mediating role between visual cues and environmental perception and purchase intention.Consumers' perception of product value and product reliability on green packaging is higher than that on red packaging.Trust in third-party authoritative certification labels is also stronger than corporate self-declaration labels.These positive emotional reactions have a positive impact on consumers' overall perception of the environmental attributes of products,and partially have an indirect impact on purchase intention.This suggests that visual cues can shape consumers' overall environmental evaluation by triggering positive emotional experiences,such as feeling value for money,reliable,and trustworthy,thus driving further consumer behavior intentions.

5.1.2. Cognitive load as a mediating pathway

We found that cognitive load plays a partial mediating role between visual cues and environmental perception and purchase intention.This path is particularly evident in the impact of eco-friendly colors and large-size labels on environmental perception.The simplicity of visual cues and the readability of label information significantly reduce the difficulty of consumer information processing,making consumers less cognitive efforts in evaluating product environmental attributes.This low cognitive load state enables consumers to form an overall judgment on the environmental attributes of products based on intuitive clues,thus significantly improving their environmental perception and purchase intention.

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5.2. Moderation analyses

5.2.1. Moderating role of environmental concern

We found that consumers' concern to environmental protection significantly moderated the impact of visual cues on environmental perception and purchase intention.For consumers with high environmental concern,eco-friendly colors,third-party authoritative certification labels,and large-size labels can significantly enhance their perception of the environmental attributes of products and further enhance their purchase intention more effectively.Individuals with high environmental concern are more sensitive to the environmental information transmitted by visual cues,and can produce a higher sense of trust and value recognition,thus having a higher environmental perception and then more smoothly transforming into purchase intention.For consumers with low environmental awareness,visual environmental cues cannot significantly cause environmental perception,and environmental perception cannot be significantly transformed into purchase intention,and their decisions are more dominated by non-environmental factors such as price,taste or instant function.

5.2.2. Moderating role of product–environment relevance

We found that the environmental relevance of the product itself significantly moderated the effect of visual cues on environmental perception and purchase intention.For products with high environmental relevance,consumers are more likely to consider their environmental attributes,so visual cues can more effectively enhance consumers' environmental perception,and the transformation effect of this perception on purchase intention is very significant.For products with low environmental relevance,although visual cues may still enhance the perception of environmental protection to a certain extent,the driving effect of this perception on the final purchase intention is limited.Consumers consider the hedonic attributes or functional performance of the product itself when making consumption decisions, and the role of visual cues in such products.

5.3. Managerial implications

Based on the above conclusions, the following suggestions are proposed to enhance consumers' sustainable consumption behavior through visual cues.

First,differentiate the use of environmentally friendly colors according to product attributes and environmental relevance.In product packaging and communication design,for products with high environmental relevance,environmental color can be used as a core visual element to strengthen the sustainable attributes of products;in products with more hedonic or functional attributes,environmentally friendly colors are more suitable as auxiliary cues,which are distinguished from core information such as taste and efficacy,so as to avoid the dominant position of environmentally friendly visual elements,arouse consumers' suspicion,and play a reverse role in sustainable consumption decisions.

Second,reduce the dependence on authoritative symbols and strengthen the comprehensibility of information.In the context of FMCG products for mass consumers,the content of ecological labels should minimize the threshold of understanding and convey the meaning of environmental protection through clear language.The eco-labeling of products with high environmental relevance should simplify the information and highlight the key environmental attributes,such as 'degradable materials' and 'environmental protection substrate'.Functional-oriented products should adopt the

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fusion expression of core functions and environmental attributes,such as 'chip removal formula,containing 95 % natural ingredients',to reduce the cognitive burden while maintaining credibility.In hedonic-oriented products,certification expression should be weakened,and basic environmental information should be conveyed only with icons or short text,so as to avoid interrupting consumers' decision-making process.

Third,reasonable control of the significance of ecological labels.The size, location and visual weight of eco-labels should be coordinated with product attributes.In the products with high environmental relevance,the label size should be properly controlled and presented close to the product information area,so as to avoid the disgust and doubt of consumers caused by excessive amplification.In function-oriented products,the significance of labels can be appropriately improved as a supplement to functional information.In hedonic-oriented products,ecological labels should be controlled in size and do not occupy the main visual space,so as not to weaken the sensory appeal of the product.

5.4. Limitations and future research directions

There are still some limitations in this study,which need to be improved in future research.First of all,although the experiment set the attention test questions to ensure the validity of the data,due to the use of online questionnaires,the subjects may still have inattention or interference during the filling process,and there are some differences between the experimental state and the real shopping environment.Secondly,the proportion of young people aged 18-29 in the study sample is more than 85%.Although this group is an important participant in green consumption,the conclusion still needs to be cautious when promoting to the middle-aged and elderly groups.Consumers of different ages may have different perception and response patterns to visual cues.In addition,the experiment uses virtual brands to control the interference of brand reputation,but this may also lead consumers to reduce their willingness to pay due to the lack of brand trust and emotional connection,which makes the experimental results different from the real market practice.

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