The Impact of White Space Ratio of Product Packaging on Consumers' Purchase Intention

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Abstract—In recent years, minimalism has been pursued in design, and more and more product packaging has used a lot of white space, but there is still no accurate guide for white space in different categories of products. The purpose of this study is to explore the influence of white space ratio in packaging design on consumers' purchase intention of high-end products and low-end products, and the preferences of different income groups on white space ratio. Respondents are 405 people in China, and the study is quantitative, using independent sample tests and one-way ANOVA tests to answer research questions. This study shows that for low-end products, the lower the white space ratio, the greater the consumer's willingness to buy, while for high-end products, the higher the white space rate, the lower the consumer's purchase intention. In addition, for both low-end and high-end products, high-income groups prefer packaging designs with higher white space ratio.

Index Terms—White space ratio, packaging, purchase intention, income

I. INTRODUCTION

The influence of white space in advertising stems from the historical culture and visual rhetoric of North America in the 20th century. It is a kind of money-burning advertisement that affects consumers' brand cognition and plays a role in relieving visual fatigue and effectively highlighting the theme in the visual design of packaging. In recent years, with the pursuit of simplicity and minimalism in design, advertisements or product packaging that use white space are often seen. For example, the American technology company Apple uses a lot of white space in advertisements, websites, and product packaging. However, is the white space ratio really the bigger the better? Therefore, it is important to consider whether the image association of the product attributes matches the color association of the background color. In other words, whether the consistency between the white space ratio of the product packaging design and the image association of product features will affect consumers' intension to purchase is the question to be explored in this study.

Researchers have discovered that the visual characteristics of information can influence how people understand its meaning. For example, yellow dots stand out more easily when surrounded by black dots than when surrounded by grey dots. Likewise, a dot is considered smaller when the circle around it is large. Then white spaces surrounding stimuli may have a similar effect, and when product information is surrounded by white space, product information is more likely to stand out and impress

consumers. At the same time, increases in text size and border width together lead to an increase in perceived urgency (Adams and Edworthy, 1995). While product packaging assumes the primary responsibility for communicating, the function of the package insert is to provide detailed information on how best to obtain the benefits of the product (Bettman *et al.*, 1986). From a semiotic point of view, packaging design is the combination of several signifiers such as colors and fonts in a brand expression plan that convey some specific meaning. To consumers, these symbols convey information related to the brand's personality, values, or promises (Dano, 1996).

In the retail industry, Underwood, 2003 pointed out that product packaging is an important attribute related to products, which can affect the brand and self-identity, and can also strengthen the relationship between consumers and brands. In addition, images in the packaging can attract consumers' attention, and brand managers can enhance the strategic positioning of the brand by adding product images to the packaging (Thomas and Capelli, 2018). Over time and with the rise of minimalism, simple packaging has gradually become popular. The simplicity of the packaging is often presented in the form of white space. The white space here is not exactly the same as the blank space in the concept of traditional Chinese painting art but refers to the blank space in the advertising frame, except for other design elements or objects. Research of Peterson *et al.*, 2010 have shown that the more distracting factors in an ad, the less effective the ad is perceived by customers, as the lack of white space can lead to the perception of visual complexity, making the content look cluttered and difficult to read, thus causing a negative emotional response from the customer. Conversely, images around white space may increase attention, and brands are assigned specific qualities and meanings (Olsen *et al.*, 2012). This may be because white space can make material stand out from the clutter when people are not focused on specific information or specific content (Strong Jr and Loveless, 1926). Furthermore, when information is surrounded by white space, they are more likely to accept the advocated position and have a more pronounced cognitive impact on the recipients of the information (Kwan *et al.*, 2017). Pracejus *et al.*, 2006 found that white space has a strong impact on consumer brand perception and purchase intention, with those who see an advertisement using white space rate the product as higher in quality, prestige, trust, and leadership than those who do no white space. This is because customers associate white spaces in design with traits such as trust, integrity, reliability, quality, fashion, leadership, meritocracy, modernity, and luxury (Olsen *et al.*, 2012). Brands with simple packaging designs are perceived to be more expensive, more reliable, and more successful than brands with complex designs, where simple designs manifest as more white space

around their logos (Favier *et al.*, 2019). This is because consumers attribute the characteristics of trust, integrity, reliability, quality, fashion, leadership, meritocracy, modernity to the white space in design (Li *et al.,* 2022). Brands with white space packaging designs are perceived to be more expensive, more reliable, and more successful than those with complex designs (Margariti, 2021).

Although there are many studies on packaging design, there are only a few related studies that use the ratio of white space in packaging and different categories of goods as the research objects in the experiment. At the same time, the effects of subject demographics have rarely been considered in experiments in past studies. In fact, different consumers automatically assign different characteristics to different class of goods based on their previous life experiences (Prahalad and Ramaswamy, 2004). When certain types of goods are given characteristics that are inconsistent with the perceptions of the white space, the white space may not lead to a positive perception of the product by consumers. In addition, the different social classes of consumers, especially the income classes, may also have different influences on product brand perception caused by white space. Based on previous research, this study will further investigate the influence of different ratio of white space in product packaging and income class on purchase intention to help producers to design and produce product packaging more effectively and stimulate consumers' purchase intention. Therefore, the objectives of this study are: 1) For different class of products, understand the impact of white space in packaging on consumers' purchase intention; 2) Measure the preference of white space in packaging for different income groups. According to the research objective, four hypothesis of this research is formulated as follows:

H1: For low-end products, the ratio of white space negatively influences impact on consumers' purchase intentions.

H2: For high-end products, the ratio of white space positively influences impact on consumers' purchase intentions.

H3: For low-end products, there is a meaningful correlation between customer income level and preference for the ratio of white space.

H4: For high-end products, there is a meaningful correlation between customer income level and preference for the ratio of white space.

II. MATERIALS AND METHODS

A. Materials

In this study, potato chip is selected as the low-end product and chocolate as the high-end product, and the packaging with different white spaces is designed. As shown in Fig. 1, each product has two packaging designs, with a white space ratio of 1/5 and 1/3 respectively. The two packaging designs of the same product are completely consistent in dimensions such as brand, packaging size, color, and style, and the information (text and pictures) on the packaging are the same. The only difference between the two pictures is that the area of the information part of the packaging is different, i.e. the proportion of the packaging area occupied by the information

is different.

(a)   (b)

(c)   (d)

Fig. 1. (a) Potato chips packaging with white space ratio of f 1/5; (b) Potato chips packaging with white space ratio of f 1/3; (c) Chocolate packaging with white space ratio of f 1/5; (d) Chocolate packaging with white space ratio of f 1/3.

B. Design and Variable Measurement

In this study, respondents were told that a potato chips company and a chocolate company are preparing to promote their new products and want to investigate consumers' purchase intentions. They are required to observe the packaging designs of two different groups of products with different white space, and then answer the questions about purchase intention in the questionnaire to help the two companies choose the best design. To effectively assess the purchase intention, a 5-point Likert scale (1 = 'strongly disagree' to 5 = 'strongly agree') and 5 items are created:

1) It is very likely that I will buy this product.

2) I would purchase this product next time.

3) I think about this product of chocolate/potato chips as a choice when buying chocolate/potato chips.

4) I would make a special effort to buy this brand of chocolate/potato chips.

5) I will recommend my friends and relatives to buy this product.

To avoid experimental error due to practice effects or fatigue effects, respondents are given a 15-minute break between two product ratings. Finally, the respondents fill in personal information such as gender, age, education, occupation, income, etc., and receive the corresponding experimental remuneration.

C. Data Collection and Data Analysis

The Wenjuanxing platform is used to make an online questionnaire to evaluate the impact of different white space

ratios in packaging design on consumers' purchase intention. Respondents are recruited through WeChat groups using convenience sampling, and a total of 500 people agree to complete the questionnaire and 405 final valid samples are formed.

Of all respondents, 51% are women and 49% are men. About 51% of respondents are in the 20-29 age group, 37% are in the 30-39 age group and 12% are in 40-49 age group. Overall, 16% hold a high school diploma or lower, 60% have a bachelor's degree and 24% have a master's degree or higher. Among them, about 62% have income levels below 10,000 CNY per month, 20% have incomes between 10,000CNY and 20,000CNY per month, 12% have incomes between 20,000CNY and 30,000CNY per month, and 6% have income level higher than 30,000CNY per month.

For data analysis and interpretation, this study uses SPSS v.18 software for analysis. In order to test hypotheses, independent sample test, correlation, reliability and other analysis methods are used.

D. Reliability and Validity Analysis

Cronbach's alpha coefficient is used in this study to assess the questionnaire's reliability. That is, the item's degree of consistency is related to the measurement content. The greater the value of Cronbach's alpha, the greater the internal consistency. The results show that the questionnaire's Cronbach's alpha value is 0.853, which is above 0.8, indicating good consistency and high reliability.

As for the validity of the survey, some constraints are set in the questionnaire. This study can exclude those who never buy snacks by filtering the questions at the start of the survey. In addition, questionnaires were distributed to various locations to improve validity. Invalid questionnaires where people choose a single option or left blank answers are eliminated.

III. RESULTS

There may be some differences in people's preference for the white space rate of different class of products. In order to determine whether the white space rate has a significant impact on the product purchase intention, the independent sample T test method should be used to verify H1 and H2.

H1: For low-end products, the ratio of white space negatively influences impact on consumers' purchase intentions.

Table I and Table II show that in terms of the purchase intention of potato chips, the respondents' purchase intention for product packaging with low white space rate (4.1812 ± 0.48097) is higher than that of product packaging with high white space rate (2.9254 ± 0.51442), and the difference is statistically significant, $t(404) = 46.99$, $P<0.000$, $d=2.335$. There is a strong relationship between the ratio of white space in packaging design and purchase intention in low-end products, which is significant. Therefore, Hypothesis 1 is accepted, and it is believed that for low-end products, the ratio of white space will negatively affect consumers' purchase intention.

TABLE I: PAIRED SAMPLES STATISTICS OF PACKAGING DESIGN OF CHIPS

	Mean	N	Std. Deviation	Std. Error Mean
chipsmallwhite	4.1812	405	0.48097	0.0239
chiplargewhite	2.9254	405	0.51442	0.02556

TABLE II: PAIRED SAMPLES TEST OF PACKAGING DESIGN OF CHIP

	Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference				
				Lower	Upper			
chipsmallwhite – chiplargewhite	1.2558	0.53782	0.02672	1.20327	1.30834	46.99	404	0.000

H2: For high-end products, the ratio of white space positively influences impact on consumers' purchase intentions.

TABLE III: PAIRED SAMPLES STATISTICS OF PACKAGING DESIGN OF CHOCOLATE

	Mean	N	Std. Deviation	Std. Error Mean
chosmallwhite	3.5032	405	0.44468	0.0221
cholargewhite	3.9654	405	0.51703	0.02569

Table III and Table IV below show that there is a strong relationship between white space ratio in packaging design and purchase intention in high-end product, and the difference is statistically significant, that is, $t(404) =-14.215$, $P<0.000$, $d=-0.706$). In terms of the purchase intention of high-end chocolate, the respondents' purchase intention for product packaging with high space rate (3.9654 ± 0.51703) is

higher than that for product packaging with low white space rate (3.5032 ± 0.44468). Therefore, Hypothesis 2 is accepted. Therefore, it can be considered that for high-end products, the proportion of white space will have a positive impact on consumers' purchase intention.

Since people's preferences for things will continue to change with the growth of income, people at different income levels may have certain differences in the preference for white space ratio in packaging design. When verifying H3 and H4, SPSS is first used to group the income variables, which were: 1) Less than 10,000 CNY/Month, 2) 10,000CNY/Month-20,000CNY/Month, 3) 10,000CNY/Month-20,000CNY/Month and 4) More than 30,000CNY/Month. Since there are more than three grouping variables of income level, the One-Way ANOVA method can be used for analysis of variance.

TABLE IV: PAIRED SAMPLES TEST OF PACKAGING DESIGN OF CHOCOLATE

	Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference				
				Lower	Upper			
chosmallwhite - cholargewhite	-0.46222	0.65437	0.03252	-0.52614	-0.3983	-14.215	404	0.000

H3: For low-end products, there is a meaningful correlation between customer income level and preference for the ratio of white space.

First, the variance homogeneity test is carried out. Table V shows that the corresponding *p* value >0.05 under the current degree of freedom, indicating that the variance is homogeneous. It can be seen from Table VI that there are significant differences between different groups (*p*= 0.000).

TABLE V: TEST OF HOMOGENEITY OF VARIANCES OF PACKAGING DESIGN OF CHIPS

	Levene Statistic	df1	df2	Sig.
chipsmallwhite	0.235	3	401	0.872
chiplargewhite	1.369	3	401	0.252

TABLE VI: ANOVA OF PACKAGING DESIGN OF CHIPS

		Sum of Squares	df	Mean Square	F	Sig.
chipsmallwhite	Between Groups	18.63	3	6.21	33.28	0.000
	Within Groups	74.827	401	0.187		
chiplargewhite	Between Groups	6.191	3	2.064	8.217	0.000
	Within Groups	100.717	401	0.251		

In order to further explore the influence of income on white space preference, further analysis have been done by comparing the mean distribution of product purchase intentions of different income groups. As can be seen from Table VII, for the packaging design with low white space ratio, people with higher income have lower the purchase intention. On the contrary, for the packaging design with high white space ratio, the higher the income, the higher the score, which means they have a stronger purchase intention and preference for products with white space design.

TABLE VII: DESCRIPTIVE RESULT OF PACKAGING DESIGN OF CHIPS

		N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum
						Lower Bound	Upper Bound		
chipsmallwhite	1	250	4.3112	0.41993	0.02656	4.2589	4.3635	3.2	5
	2	81	4.1728	0.46233	0.05137	4.0706	4.2751	3	5
	3	50	3.82	0.46467	0.06571	3.6879	3.9521	2.6	5
	4	24	3.6083	0.37523	0.07659	3.4499	3.7668	2.8	4
chiplargewhite	1	250	2.8472	0.50968	0.03223	2.7837	2.9107	2	4
	2	81	2.9605	0.53143	0.05905	2.843	3.078	2	4
	3	50	3.08	0.42185	0.05966	2.9601	3.1999	2.4	4
	4	24	3.3	0.45301	0.09247	3.1087	3.4913	2.4	4
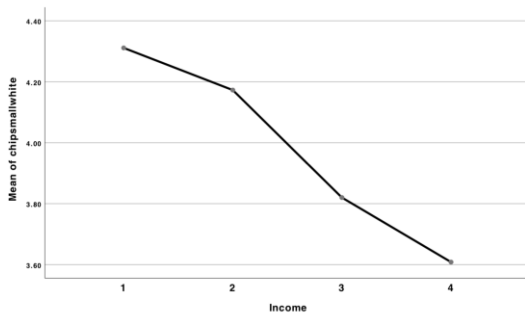
(a)
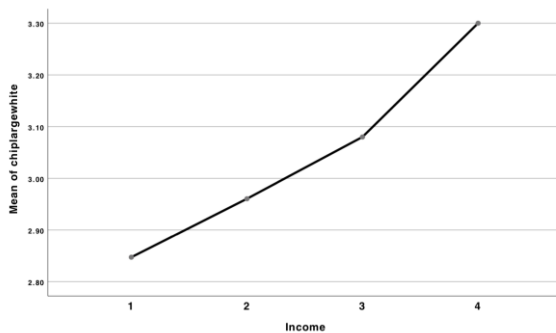
(b)

Fig. 2. (a) Packaging with low white space ratio of potato chips, the relationship between income group and purchase intention; (b) Packaging with large white space ratio of potato chips, the relationship between income group and purchase intention.

In Addition, it can be seen in Fig. 2 that there is an obvious linear relationship between income and purchase intention of deferent packaging design. Therefore, H3 is accepted, that is, for low-end products, there is a meaningful correlation between customer income level and preference for the ratio of white space, and people with higher incomes prefer packaging designs with high white space ratio.

H4: For high-end products, there is a meaningful correlation between customer income level and preference for the ratio of white space.

Like the test process of H3, the homogeneity of variance test is shown in Table VIII. The corresponding *p* value is >0.05, indicating that the variance is homogeneous, and Table IX shows that there is a significant difference between different groups (*p*=0.000).

TABLE VIII: TEST OF HOMOGENEITY OF VARIANCES OF PACKAGING DESIGN OF CHOCOLATE

	Levene Statistic	df1	df2	Sig.
chosmallwhite	0.091	3	401	0.965
cholargewhite	2.519	3	401	0.058

By comparing the average scores of different income groups for high-end chocolate purchase intentions, it can be seen from Table X that for packaging designs with a higher white space ratio, people with higher incomes have stronger purchase intentions, while for packaging designs with a low white space ratio, people with higher incomes have lower purchase intentions.

TABLE IX: ANOVA OF PACKAGING DESIGN OF CHOCOLATE

		Sum of Squares	df	Mean Square	F	Sig.
chosmallwhite	Between Groups	12.279	3	4.093	24.276	0.000
	Within Groups	67.607	401	0.169		
cholargewhite	Between Groups	12.972	3	4.324	18.248	0.000
	Within Groups	95.024	401	0.237		

TABLE X: DESCRIPTIVE RESULT OF PACKAGING DESIGN OF CHOCOLATE

|		N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum
						Lower Bound	Upper Bound		
chosmallwhite	1	250	3.6264	0.42881	0.02712	3.573	3.6798	2.2	4.8
	2	81	3.4148	0.37653	0.04184	3.3316	3.4981	2.4	4
	3	50	3.228	0.39592	0.05599	3.1155	3.3405	2.2	4
	4	24	3.0917	0.34881	0.0712	2.9444	3.239	2.4	3.6
cholargewhite	1	250	3.8472	0.50968	0.03223	3.7837	3.9107	3	5
	2	81	4.0272	0.48862	0.05429	3.9191	4.1352	3	5
	3	50	4.216	0.40575	0.05738	4.1007	4.3313	3.4	5
	4	24	4.4667	0.37144	0.07582	4.3098	4.6235	3.8	5

(a)

(b)
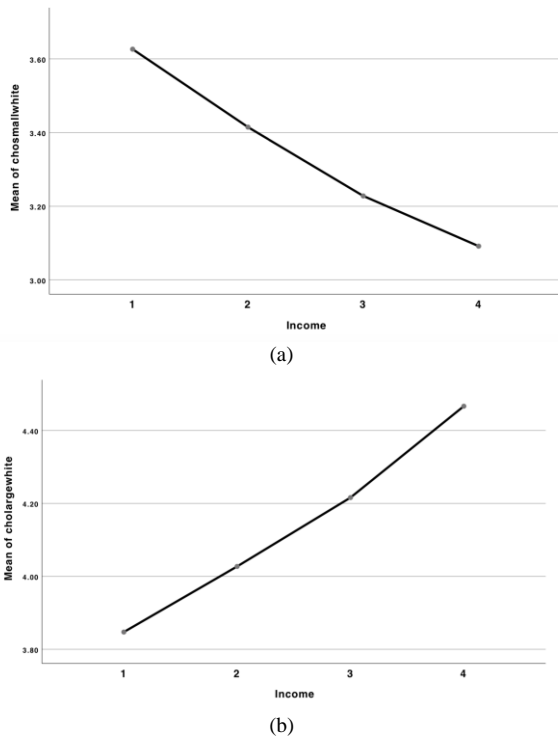
Fig. 3. (a) Packaging with low white space ratio of chocolate, the relationship between income group and purchase intention; (b) Packaging with large white space ratio of chocolate, the relationship between income group and purchase intention.

In addition, as can be seen from Fig. 3, for high-end products, there is also a clear linear relationship between income and purchase intention. Thus, people with high income have more preference on white space. Therefore, H4 is accepted, that is, for high-end products, there is a meaningful correlation between customer income level and preference for white space, and those with higher incomes prefer packaging designs with high white space rate.

IV. DISCUSSION

The purpose of this study is to examine the impact of white space ratio on packaging on consumers' purchase intention. This study builds on previous research by focusing on whether higher white space ratio is better for different class of product. An important finding is that for low-end products, consumers prefer packaging designs with low white space.

This may be because the positioning of low-end products is close and friendly, a large number of attractive graphics with little white space can shorten the distance between products and consumers and is more in line with the characteristics of low-end products. Conversely, for high-end products, as researchers such as Olson have proposed, consumers associate a lot of white space with attributes of luxury and sophistication, and packaging design with large white space can stimulate consumers to buy products (Olsen *et al.*, 2012). In addition, people at different income levels have different preferences for the white space ratio of product packaging. High-income people are more likely to pursue a refined and high-quality life. A high ratio of white space in packaging design makes them feel that the product is more expensive and premium. On the contrary, people with low-income levels prefer to look for products that are cost-effective. When they have perception of expensive on the packaging design, they may be more inclined to choose cheaper alternatives.

Modern markets tend to provide consumers with a lot of marketing incentives, and in this case, the white space ratio of packaging design can be an important marketing dimension. According to our research results, managers of high-end products should leave enough white space and advocate minimalism in the packaging design to make the products look more advanced. If the brand positioning is low-end and friendly, the pictures and texts can be appropriately enlarged to shorten the distance with ordinary consumers. In this way, managers may be able to improve the strategic positioning of the brand by adjusting the white space ratio, thereby attracting more target customers.

V. CONCLUSION

The influence of packaging design on consumers' purchase intention has been generally valued by marketing scholars, cognitive psychologists and aesthetic researchers. Compared with the existing research, the theoretical contributions of this research mainly include the following two aspects. First, this study explores the impact of the white space ratio on the packaging of low-end products and high-end products on consumers' purchase intention, which compensates for the existing research's one-sidedness. That is, for low-end products, people prefer packaging designs with low white space ratio while for high-end products,

people prefer packaging design with high white space ratio. Second, this study focuses on the different purchase intentions of different income groups for different packaging white space. It is found that in the same type of product, high-income groups prefer white space design in products than low-income groups.

By utilizing packaging with more white space, merchants can position their brands as "luxury" or "elegant," while by using packaging with less white space, they can position their products as "friendly" or "close." This study supplements the existing research, has innovative significance for decision-making in marketing, and provides new ideas for the brand positioning strategy of enterprises. Merchants should consider the strategic positioning of the brand in the proportion of white space in the packaging design, as well as the characteristics of their own products. For example, for high-end products aimed at high-income groups, the packaging design can use a simple design with large white space, while for low-end products aimed at mass consumers, the white space on the packaging can be minimized, and pictures and text can be enlarged to attract attention. Through subtle adjustments in packaging design, consumers' associations and expectations on product features can be consistent with the perceptions conveyed by the product packaging to enhance consumers' purchase intention. Therefore, it is necessary for marketing department to pay attention to the standard of white space ratio on packaging design and consider product packaging as a marketing consideration and dimension.

VI. LIMITATIONS

There are some limitations in this study. First, the respondents of the experiment in this study are all Chinese. In the future, if conditions permit, the scope of research can be expanded to people from different countries to expand the reliability of this study. Second, to study the fitness between the perception of white space in packaging and the characteristics of the product itself, two food products, potato chips and chocolate, are selected for this study. Although two kinds of foods with relatively different temperaments are deliberately selected, they are still limited to food. Future research can consider incorporating more product or service categories to conduct more extensive survey research to obtain higher external validity.

CONFLICT OF INTEREST

The author declares no conflict of interest.

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