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Product Effects of Shape Risk Perception on Hand Sanitizer Packaging

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ABSTRACT

This study examined curved and angular shapes to explore the risk perception of shapes in product design. Risk perception and product effect were analyzed based on three types of hand sanitizer logos and three packaging shapes. The results in Experiment 1 showed that circular and triangular logos were more effective than square logos in increasing consumers' risk perception. In Experiment 2, no difference in risk perception was observed among the curved, curved/angular, and angular package shapes. In Experiment 3, the circular logo had a better product effect than square and triangle logos. Moreover, curved and curved/angular packaging shapes had a better product effect than angular, suggesting that the curved shape did have a better effect. Therefore, when consumers judge hand sanitizer products, curved shapes representing warmth and friendliness were more likely to increase risk perception and product effect than angular shapes that exhibited a sense of power or threat. The results demonstrate people's innate preference for curved shapes, as well as the impression of curved shapes exhibiting a sensation of bubbles or flowing water when scrubbing lotion using hand sanitizer. The findings suggest that the design of a hand sanitizer logo and package should contain non-threatening curved shapes that could convey positive feelings through warm and friendly imagery.

Keywords: shape, logo, packaging, risk perception, product effect

INTRODUCTION

Visual forms are essential in marketing communications and products, evoking consumers' judgment of product perception while triggering their interest in processing product information. By facilitating information interpretation and clarifying data, images can enhance consumers' understanding of information and

facilitate cross-language communication (Hidayah, 2023). Among various images, curved and angular shapes are most often discussed due to visual cognitive processes that are natural and automatic (Tawil et al., 2024). Research suggests that compared to curves, sharp angles tend to evoke greater alertness and attention, as their angular forms can convey a sense of threat. This threat heightens one's awareness of danger, thus increasing attention and triggering negative emotional responses (Biswas et al., 2024). Brain science analysis also confirmed when people view angular straight shapes, their amygdala may be activated bilaterally, as they perceived a threat. When people view curved shapes, their anterior cingulate cortex is activated, as if seeing beautiful things (Larson et al., 2009). Therefore, humans prefer curved forms (Wang et al., 2022). Notably, curved and angular product shapes can evoke differing feelings in consumers. For instance, sharp angular shapes are more likely to produce a sense of insecurity than curved shapes, which can elicit consumers' alertness and attention (Biswas et al., 2024). Angular-shaped packaging can make consumers feel salty and strong taste. In contrast, circular packaging can make consumers think about sweet and mild taste (Kovač et al., 2019; Dolić et al., 2022). Therefore, curved and angular shapes affect consumers' perspectives and judgments about products. Risk perception is seldom considered in product design. However, when buying products, consumers judge risk at differing levels, particularly for risk prevention products, such as insurance and health food products (Lin & Chen, 2019); (Pelaez et al., 2019). Therefore, visually strengthening risk perception can influence consumers' attitudes toward products.

This study examined the risk perception of hand sanitizer logos and packaging shapes to explore the risk perception and product effects through curved and angular shapes. The findings can provide an insight into the influence of curved and angular shapes in hand sanitizer products on consumers while improving the effectiveness of applying visual forms in risk perception.

LITERATURE REVIEW

In shape design, curved and angular shapes are typically used for categorization. Angular shapes appear to be more threatening than curved shapes, but they also contain a variety of symbolic meanings or feelings. For instance, circular shapes are associated with warmth, friendliness, and harmony, while angular shapes evoke resilience, toughness, and capability (Chen et al., 2024). Shapes have been widely used in marketing in recent years. For example, (Sun et al., 2024) explored the relationship between a busy mindset and preferences for brand logos with angular versus curved shapes. Their findings indicate that individuals with a busy mindset exhibit a heightened preference for angular shapes over curved ones, as the former align with their psychological state. Similarly, Chen, Ma, Xiao and Qingg (2024) suggested that curved (as opposed to angular) designs in new products reduce learning costs, thereby increasing consumer acceptance. However, when consumers perceive no need for learning and prioritize product functionality alone, the positive influence of curved designs diminishes. The characteristic of shapes is also prevalent in brand design based on gender and country. Angular straight lines and thick edges have been found more suitable in brands for men, while circular and elongated logos are more suitable in brands for women (Stroessner, et al., 2020). Furthermore, in individualistic countries with independent self-construal, angular logo designs are more common and represent high effectiveness and skilfulness. In collective countries with interdependence and harmony, circular logo designs are more common to present warmth, friendliness, trustworthiness, and care (Zhang, Feick & Price, 2006). This effect is mediated by emotional appraisal, as pointed illustrations of flames are perceived as more aggressive than rounded flame icons, thereby enhancing the perception of spiciness. (Poslon, Kovačević and Brozović, 2021) found that cylindrical and angular packages had lower flavor intensity than hexahedral and polyhedral packages for coffee products and that package complexity was related to flavor intensity. Therefore, curved and angular shapes evoke various consumer experiences and responses to brands and products (Poslon, Kovačević & Brozović, 2021).

While shapes affect consumer decisions, consumers' purchase decisions involve uncertainties, such as price, brand, or product categories. This poses a potential risk of hesitation, such as in investment and wealth management or pharmaceuticals. This psychological instability affects purchase intention (Lin & Chen, 2019). Therefore, to reduce purchase uncertainty, particular messages can be reinforced in marketing campaigns to reduce feelings of uncertainty (Pelaez et al., 2019). In contrast, some uncertainties are deliberately emphasized to stimulate consumers' vigilance or attention. For example, Rahinel and Nelson(2016) studied products categorized as low-risk maintenance products (e.g., home insurance) and high-risk protection products (e.g., smoke detectors). They found that consumers preferred asymmetrical diamond or inverted triangle logo designs for high-risk products, believing that these shapes can increase risk perception. This suggests that unsafe conditions can be inferred and help people to become more vigilant. Li, Liu and Zhou (2020) found that diagonal logo design led to a higher perception of food risk. Moreover, differences were found in terms of preferences among consumer groups. For example, consumers with promotion focus had more favorable attitudes toward asymmetrical design, while consumers with prevention focus preferred vertical design forms. (Bansal-Travers, Hammond, Smith, and Cummings (2011) suggested different warning label styles (text content, image type, size, message, etc.) with varying features of design (package color and product description) to elicit risk perception, motivation to cease, and purchase intention. A larger image area and irregular warning label can increase risk perception and encourage cessation, whereas a lighter color or lighter weight could make participants think that tar content is lower, taste is smooth, and the impact on health is lower, reducing risk perception. Therefore, exploring whether product shapes can be designed to increase risk perception to stimulate consumers' attention or to reduce it to obtain better attitudes needs to be further explored.

Based on the above, we posit that the preference for unstable or angular shapes should be more effective in evoking risk perception than curved shapes. This study investigated the risk perception of a common virus-preventive hand sanitizer using curved and angular shapes in logo and packaging design to determine their effects on the product.

H-1: An angular shape (triangle shape, square shape) is more effective than a curved shape (circular) in logo design to increase consumers' risk perception.

H-2: An angular shape (triangle shape, square shape) is more effective than a curved shape (circular) in improving consumers' risk perception in package design.

H-3: For hand sanitizer, an angular (triangle, square) logo in an angular packaging shape can better improve product effect than a curved (circular) logo in a curved packaging shape.

RESEARCH METHODS

Logos and packaging are essential design forms that influence consumers' judgment. This study used three logos and three package shapes to examine curved and angular shapes. An experimental method was employed. We investigated the risk response of curved and angular shapes in hand sanitizer logos and packaging shapes and their effects on the product. The subjects were college students. Experiment 1 focused on risk perceptions of the logo. Basic shapes of a circle, square, and triangle were used as the logo design to evaluate risk perception. Experiment 2 focused on risk perceptions of the packaging design. Curved and angular shapes of commercially available hand sanitizer were categorized to select representative package designs and evaluate their associated risk perception. Experiment 3 focused on the product effect of hand sanitizer design. Based on the results of experiments 1 and 2, the logo and package shape with high-risk perception were selected for the hand sanitizer design to understand the product effect of curved and angular shapes (Figure 1).

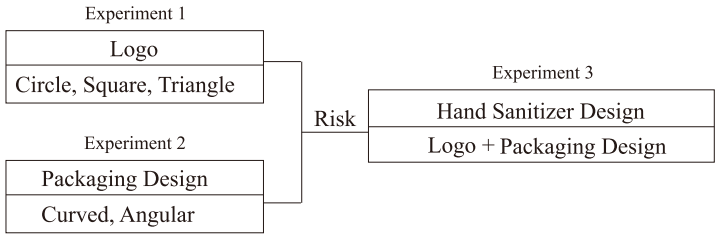


Figure 1. Research structure
source: research data

1. Experiment 1: Risk perception of the logo

(1) Sample design

Logo samples were shaped as a basic circle, square, triangle, and a curved-shaped and angular-shaped design form. The color design was blue. For the material design, symmetrical and asymmetrical forms and three types of water ripples were used to symbolize the meaning of washing hands with cleanser. The text design used sans-serif font, and Arial font for “HAND SOAP”. There were a total of 18 samples, as shown in Figure 2.

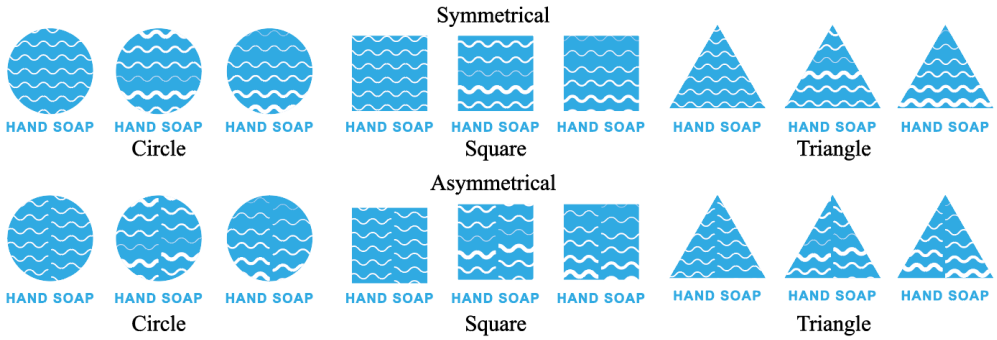


Figure 2. Logo sample design
source: research data

(2) Questionnaire design

First, the logo design was evaluated for visual appearance mainly to remove the logo with too big of a gap in visual appearance. The visual appearance questions surrounded visual complexity, informativeness, familiarity, and novelty, which were evaluated on a 5-point Likert scale. We modified risk perception based on Lin and Chen (2019) and Li et al., (2020) to "What is your risk perception of this hand sanitizer logo?" and "How much risk do you think this hand sanitizer logo avoids?" evaluated on a 5-point Likert scale.

(3) Subjects

Subjects were recruited on a voluntary basis, including 30 college students who were over 20 years old. Each subject answered the questions in paper form. It took about 10–15 minutes to complete the questionnaire. A small gift was provided to each participant at the end of the survey.

2.Experiment 2: Risk perception of package shape

(1) Sample design

The shape design of hand sanitizer packaging was based on the 250–300 ml capacity of PChome and momo, which ranked among the top three online e-commerce platforms in Taiwan in 2020, as the collection scope. The collection time was from October to November 2020, and there were 94 samples. The package outline was redrawn, as shown in Figure 3. Based on the subjects' perceptions, packaging shapes were categorized into visually strong/weak and curved/angular shapes. The data were grouped into two categories using K-mean clusters. The first category with 57 samples favoring curved shapes was named the “curved package shape.” The second category with 37 samples favoring angular shapes was named “angular package shape,” as shown in Figure 3. The results indicate that the intermediate samples in the second group had curved and angular characteristics. To align with the market design, the intermediate curved and angular package shapes were classified as curved and angular packages and were discussed in tandem with the curved and angular shapes. Finally, the 15 package shapes with the highest mean values were selected from each of the three categories for risk perception assessment.

(2) Questionnaire design

The questionnaire design for the package shape perception was "strong vs. weak" and "curved and angular, “using a 7-point Likert scale (1 = weak, 7 = strong; 1 = curved, 7 = angular) as the scale. Risk perception questions were designed in the same manner as in Experiment 1.

(3) Subjects

The subjects for package shape perception were recruited on a voluntary basis, including 30 college students who were over 20 years old. Each subject answered the questions in paper form, within about 10–15 minutes to complete the questionnaire. A small gift was provided at the end of the survey. The subjects for risk perception were voluntarily recruited, including 30 college students over 20 years of age. Each subject answered the questions in paper form, which took about 10-15 minutes to complete. A small gift was given at the end of the survey.

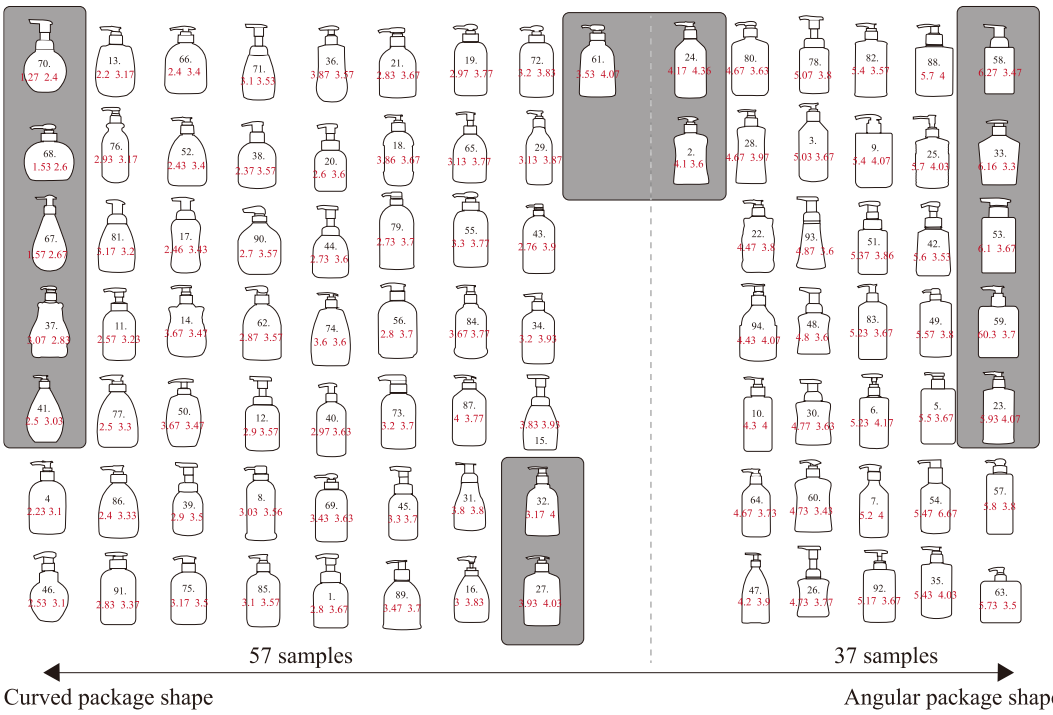


Figure 3. Sample selection after cluster analysis
source: research data

3. Experiment 3: Product effect of hand sanitizer design

(1) Sample design

Based on the results from experiments 1 and 2, we selected the logos and package shapes with a mean value of 2.8 or higher for the hand sanitizer design. For the logo design, two logos were randomly selected from circular shapes, square shapes, and triangle shapes. Six logos were selected after excluding samples with significant differences in visual appearance. For the package shape design, two package shapes were randomly selected from the curved, curved/angular, and angular shapes, encompassing a total of 6 packaging shapes. The product message design was based on the messages on the 94 sample bottles from the market survey conducted in Experiment 2. The most frequently occurring product messages were regarding cleanliness and antibacterial properties. The sample design for hand sanitizer was a logo on the top of the bottle and a text message on the bottom. The design consisted of six logo samples and six packaging shapes, with 36 samples in total (Figure 4).

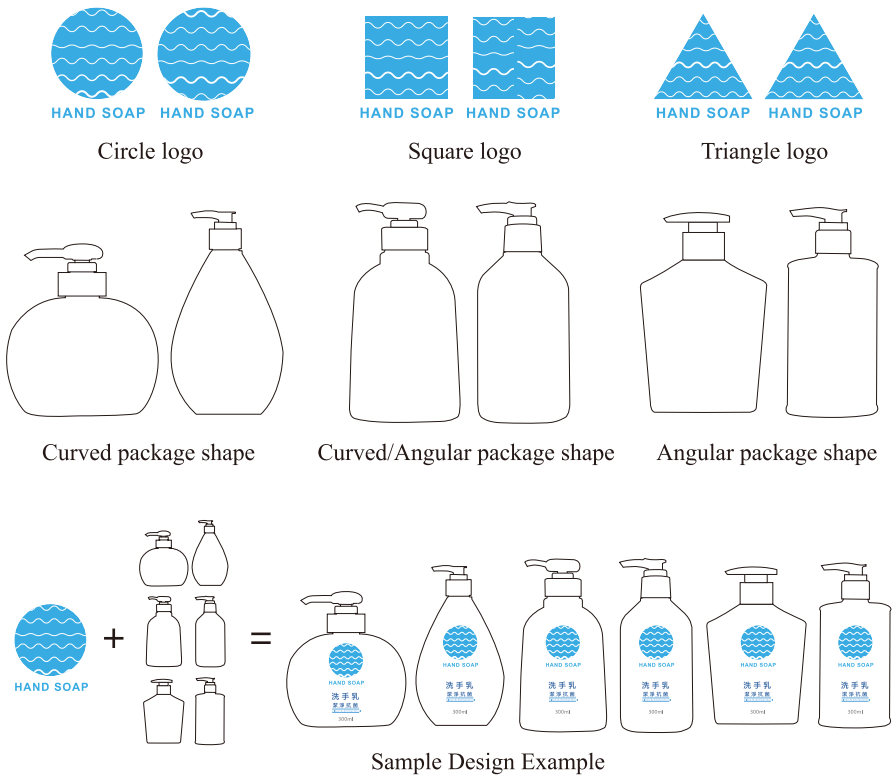


Figure 4. Sample design
source: research data

(2) Questionnaire design

Product effect was measured by attitude, use need, and purchase intention. Preference was based on Gubalane and Ha (2023); the items were modified to "After seeing this hand sanitizer, what is your overall evaluation of the product?" This was measured using a 7-point Likert scale (1 = I dislike it very much; 7=I like it very much). The use needs questionnaire design was developed based on (Rahinel and Nelson (2016) and Lin and Chen (2019); the items were modified to "Would you use this hand sanitizer?" (1 = I wouldn't use it at all; 7 = I would really like to use it) and "Would you try this hand sanitizer?" (1 = I wouldn't try it at all; 7 = I would really like to try it). The purchase intention question design was based on Wibowo et al., (2020); Wibowo the items were modified to "Likelihood of purchasing the advertised product," "Odds that I would consider purchasing the advertised product," and "Intention to purchase the advertised product." These

were evaluated using a 7-point Likert scale (1 = very low; 7 = very high). The questionnaire was conducted online. Subjects were asked to complete the questionnaire based on their feelings, with a total of 36 items.

(3) Subjects

The subjects were recruited voluntarily, including 30 college students who were over 20 years old. Each subject answered the questions in paper form. It took about 20 minutes to complete the questionnaire. NTD 100 was gifted at the end of the survey.

RESEARCH RESULTS

1. Experiment 1: Risk perception of the logo

(1) Risk perception analysis of three logo designs

Among the 18 samples of logo designs, the visual appearance evaluation revealed two logos below the average of 2.5 for each of the circle, square, and triangle-shaped designs. These were deleted, leaving a total of 12 samples of three types of logos to be evaluated. Among the risk perception means of the circular logos, circular logo B (M:3.13) had the highest mean, followed by A (M:3.00). The square logo C (M:2.8) had the highest mean, followed by B (M:2.75) and D (M:2.75). Triangle logo A (M:3.09) had the highest mean, followed by B (M:2.97) (Table 1). This indicates that circular logos may increase attention and evoke a heightened sense of risk.

(2) Risk perception of three logo designs

This study performed a one-way dependent sample analysis of variance of the risk perception of the three logos. The results are presented in Table 2. In the test of sphericity, the Mauchly's W coefficient is .99 ($\chi 2$=.586, p=.75), and an F=8.64, p=.00<.05. This finding indicates a difference between the three logo design forms. Further post hoc comparisons also showed that circular shapes and triangle shapes were larger than square shapes. This indicates that circular and triangular logos evoke a significantly higher sense of risk compared to square logos.

A		**B**		**C**		**D**	
							
M	**SD**	**M**	**SD**	**M**	**SD**	**M**	**SD**
3.00	.43	3.13	.56	2.83	.54	2.78	.54
							
M	**SD**	**M**	**SD**	**M**	**SD**	**M**	**SD**
2.66	.51	2.75	.46	2.80	.45	2.75	.45
							
M	**SD**	**M**	**SD**	**M**	**SD**	**M**	**SD**
3.09	.61	2.97	.50	2.92	.55	2.76	.60

Table 1 Three logos risk analysis
source: research data

Circular		**Square**		**Triangle**	
M	**SD**	**M**	**SD**	**M**	**SD**
2.94	0.35	2.74	0.33	2.93	0.37
	SS	**DF**	**MS**	**F**	**LSD**
Between Groups	11.38	57	0.20	8.64	Circular = Triangle > Square
Within Groups	10.97	116			
Total	22.35	173			

Table 2 Analysis of variance (anova) of three types of logos
source: research data

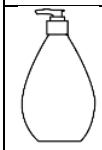
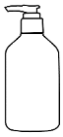
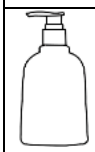
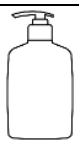
2. Experiment 2: Risk perception of packaging shape

(1) Analysis of three packaging shape types

Among the risk perception means for the three packaging shapes, the curved package shape C-C (M: 2.97) had the highest mean, followed by C-E (M: 2.85). The highest mean was found for curved/angular package shape CA-B (M: 3.03), followed by CA-E (M: 3.02). Angular package shape A-B (M: 3.1) had the highest mean, followed by A-E (M: 3.02) (Table 3). This indicates that curved package shapes may enhance attention and evoke a heightened sense of risk.

(2) Risk perception of three package shapes

We analyzed the risk perception of the three packaging shapes using a one-way dependent sample analysis of variance. Table 4 shows that in the spherical test, Mauchly's W coefficient is .837 ($\chi 2=4.967$, p=.08), and F=2.592, p=.08>.05, indicating that there was no difference in the risk perception of these three packaging shapes.

C-A		**C-B**		**C-C**		**C-D**	
							
M	**SD**	**M**	**SD**	**M**	**SD**	**M**	**SD**
2.77	.54	2.83	.67	2.97	.52	2.73	.74
C-E		**CA-A**		**CA-B**		**CA-C**	
							
M	**SD**	**M**	**SD**	**M**	**SD**	**M**	**SD**
2.85	.53	2.88	.45	3.03	.45	2.9	.44
CA-D		**CA-E**		**A-A**		**A-B**	
							

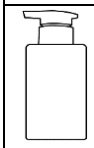
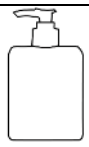
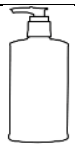
M	**SD**	**M**	**SD**	**M**	**SD**	**M**	**SD**
2.93	.52	3.02	.44	2.98	.48	3.1	.44
A-C		**A-D**		**A-E**			
							
M	**SD**	**M**	**SD**	**M**	**SD**		
2.92	.54	2.88	.54	3.02	.45		

Table 3 Three packaging's risk analysis
C= Curved package shape; CA= Curved/Angular package shapes; A= Angular package shapes
source: research data

Curved		**Curved/Angular**		**Angular**	
M	**SD**	**M**	**SD**	**M**	**SD**
2.83	.40	2.95	.29	2.98	.28
	SS	**DF**	**MS**	**F**	**LSD**
Between Groups	5.217	29	.180	2.592	
Within Groups	4.607	60			
Total	9.824				

Table 4 Analysis of variance (anova) of three types of packaging's
source: research data

3. Experiment 3: Product effect of hand sanitizer design

In the reliability analysis of the product effect questionnaire, Cronbach's alpha = .92, >.90 for attitude toward the product, number of times using the product, and purchase intention reached a high level of reliability. Table 6-7 and Figure 5 present the results of the two-way dependent sample analysis of variance of the product effect for the three logos and three packaging shapes. In the test of sphericity, Mauchly's W coefficients are .912 ($\chi 2$=2.755, p=.252), .989 ($\chi 2$=.346, p=.841), and .989 ($\chi 2$=10.559, p=.308). The interaction F=.540, p=.707>.05, was not significant, and no significant cross or non-parallel segments were observed from profiles 2 and 3. Therefore, there was no interaction effect between the three types of logos and the three packaging shapes. In addition, the combination of logo and packaging shape did not influence product effectiveness. As the interaction

effect was not significant, the main effects of packaging shape and logo design were compared separately. Packaging shape was significant at F=8.256, p=.00<.05. Post-hoc comparisons also showed that curved/angular and curved products were more effective than angular products. Logo design was significant at F=6.301, p=.00<.05. Post-hoc comparisons also showed that circular logos were more effective than square and triangle logos.

	III SS	DF	MS	F	Sig	LSD
Between Groups	12.64	8	6.268			
Logo (A)	2.51	2	1.26	6.30	.00**	C>S=T
Package Shapes (B)	9.90	2	4.95	8.26	.00**	CA=C>A
Within Groups	180.51	279	4.703			
Total	193.15	287				

Table 5 Analysis of variance (anova) of logos and packaging
source: research data

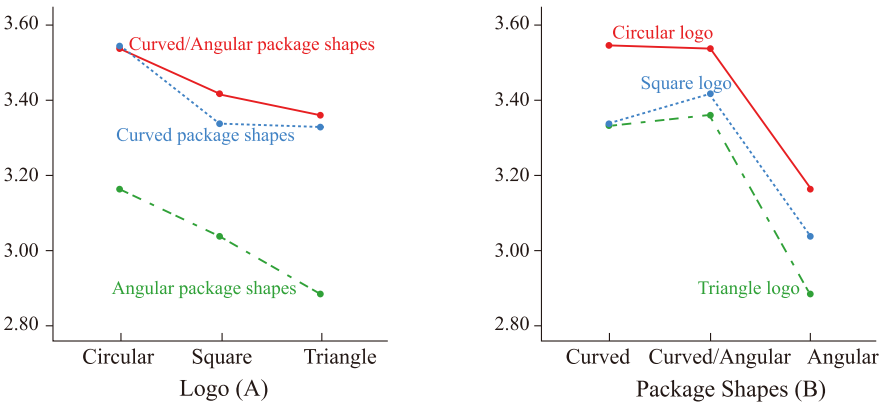


Figure 5. Product effect profile of logos and packaging
source: research data

Logo					
Circular		**Square**		**Triangle**	
M	**SD**	**M**	**M**	**SD**	**M**
3.41	.11	3.26	.13	3.19	.12
Package shapes					
Curved		**Curved/Angular**		**Angular**	
M	**SD**	**M**	**SD**	**M**	**SD**
3.40	.133	3.437	.116	3.028	.145

Table 6 Average of packaging shape
source: research data

CONCLUSION

This study used curved and angular shapes to explore the risk perception of shapes and product effects. In terms of product effect, the three packaging shapes of the circular logo, curved shape, and curved/angular shape were more effective in increasing the product's utilization rate and purchasing effect.

We observed a significant difference in Experiment 1 regarding risk perception among the three types of logos: circular, square, and triangle. The risk perception of both circular and triangle logos was higher than that of square logos. While triangular logos are perceived as conveying higher risk, both triangular and square logos evoke lower perceptions of risk compared to circular logos. Therefore, H-1 supports that an angular shape (triangle, square) is more effective than a curved shape (circular shape) in improving consumers' risk perception in logo design. Triangular logos can increase the perception of risk, but this effect is only partially supported overall. According to the research findings, the circular shape had the highest mean of risk perception. Although it is softer and warmer than a curved shape, a circular shape has the characteristic of visual focus, making it easy to attract attention. Hence, consumers may temporarily ignore the psychological feeling of the circle. The characteristic of focus increases the response to risk perception. The triangle is an angular shape with direction, sharpness, and strength, and it should be successful in triggering consumers' responses to risk

perception. Meanwhile, the square shape had the lowest risk perception. It is angular but stable on all sides, with a sense of stability and seriousness that reduces risk perception. Furthermore, the logo's colour was blue, which may reinforce the calmness and stability of the square shape. In addition to shape considerations, color elements in packaging play a pivotal role in human object recognition Chitturi et al., 2022; Devi, et al., 2024. Regarding symmetrical and asymmetrical texture forms, no significant difference was observed in risk perception. In this study, the asymmetrical differences were not sufficiently presented, and the blue color scheme also reduced unstable tension. This contrasts with the findings of Rahinel, and Nelson (2016), who suggested that asymmetrical and angular logos are more likely to increase usability. Their study indicated that context leads consumers to make different judgments regarding product use. This study used a single product presentation, not a simulation of a washstand situation. Therefore, context is a factor influencing consumers' judgment. Hence, we suggest increasing the use of context for future analysis of the differences in risk perception of design forms in varying contexts of changes in logo shape, texture, and color.

Experiment 2 investigated the risk perception of curved, curved/angular, and angular packaging shapes; no significant difference was observed among the three packaging shapes. Therefore, H-2 suggests that an angular shape is more likely to increase consumers' risk perception than a curved shape. This may be because consumers have an established image of hand sanitizer as a clean product; the packaging shape and clean/antibacterial message might intuitively increase their risk perception. Therefore, when designing the packaging shape of hand sanitizer, the 15 package shapes in this study provide reference values. In a follow-up study, we expanded the sample scope to explore the strengths and weaknesses of different shapes of hand sanitizers for various product claims, such as “moisturizing” and “smoothness.” This provides insight into the differences in the application of varying claims regarding the packaging shapes of hand sanitizer.

We analyzed the product effects of three logos and three packaging shapes with high-risk perception in Experiment 3. No interaction was observed between the logos and packaging shapes, only their main effects. Analysis on the three logos

showed that the product effect of the circular logo was higher than that of the square and triangle logos. Among the three packaging shapes, the product effect of the curved/angular shaped and curved shape logos were higher than the angular shaped logo. Therefore, H-3， which suggests that angular (triangle/square) logos with angular packaging shapes are more effective than curved (circular) logos with curved packaging shapes for hand sanitizer products, is not valid. The findings indicate that curved-shaped packaging had better product effects than angular shapes. This is because people prefer curved shapes, which could be related to the experience and impression of using hand sanitizers. As smooth lotions produce bubbles after scrubbing, the impression of a watery feeling is also associated with curved shapes. Therefore, while angular shapes are more threatening, curved shapes that Favor warmth and harmony can motivate consumers to use and buy the product. This finding aligns with previous research where curved products and packaging are more preferable (Simmonds et al., 2019). Consumer preference for shapes may be an essential factor influencing purchase intention (Zhou et al., 2021). Curved package design is considered more product attitude, use need, and purchase intention more effectively than angular shapes. Therefore, when designing the logo for hand sanitizer, a circular logo can be used. Furthermore, curved and curved/angular shapes can be used for the packaging shape, which should have a greater effect on the product (see Figure 6). Our subsequent study will explore different shapes, colors, and materials for logo and packaging shapes.

Figure 6. Hand sanitizer packaging
source: research data

It is evident that differences in shape can affect consumers' judgment of risk, and that curved and angular shapes can lead to different product effects. However, the need for warm, non-threatening curved shapes or powerful, threatening angular shapes needs to be further explored as consumer attitudes toward different products change. This is because consumers may have varying

judgments depending on the product category, product appeal, or context. Therefore, several questions should be explored in future research. The results of this study indicate the importance of understanding consumers' risk perceptions of products before design, to create a visual design form that can increase the purchase intentions for products.

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