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## ABSTRACT

This research aims to assess how eye-tracking technology can be applied to identify which graphic design elements on vitamin water packaging most effectively capture consumer attention and influence their visual behavior. The study simulated a shopping scenario in a laboratory setting. Six different packaging styles (AOI1-6), each featuring a variety of elements such as styles, images, and logos, were tested. The participants were 30 male and female consumers aged between 20 and 30 years old, selected using purposive sampling. Viewing behavior was recorded using Tobii Pro Glasses 3, focusing on the number of fixations and duration of fixation. The results indicated that AOI 1 -featuring a vertical logo and a realistic image-received the highest attention in terms of both the number of fixations and the duration of fixation, with averages of 22 and 21.786 seconds, respectively. ANOVA results showed that the six styles were significantly different ( $p < .001$ ). Additionally, the heatmap test results showed that the center position on the simulated shelf received the most attention, with dark red representing the longest viewing duration. While the left side could still attract a considerable amount of attention, the right side received the least. These findings can be used as a guide to design vitamin water packaging graphics that more effectively capture consumer attention and support purchasing decisions.

**Keywords:** Vitamin water, Graphics on packaging, Packaging design,  
Eye-tracking technology



## I. INTRODUCTION

The vitamin water market is growing rapidly today due to health-oriented consumer interest and a preference for nutritious products. In the aftermath of the COVID-19 pandemic, Thai people have become more health-conscious. Therefore, vitamin water has emerged as a popular option that aligns well with current health trends. It is classified as a functional drink with high growth potential in the Thai market, supported by economic expansion and a continuous increase in consumer demand. Entrepreneurs need to differentiate their products, especially by making the packaging stand out and look credible, which is an important strategy for success in the market (Pringplerd, 2022, pp. 1-2).

Packaging is one of the key factors influencing consumers' purchasing decisions. This is especially true for health-related products such as vitamin water, where consumers pay close attention to nutritional information on the label, as well as graphic elements on the packaging. Features such as color, imagery, and logos help create brand recognition (Vijitsombat, 2021, p. 34). Packaging design needs to take into account both utility and aesthetics in order that the product stands out, differentiates itself from the competition, and meets the needs of the target audience.

Eye-tracking technology has been increasingly used in packaging design research as it enables researchers to accurately identify consumer points of interest, such as the number of fixations and fixation duration. These metrics provide more in-depth behavioral data than conventional questionnaires. Research by Varela et al. (2014, pp. 701-710) shows that the branding area on packaging is the most visually appealing for consumers. Eye-tracking data can help designers place art elements more purposefully and efficiently. However, there is a lack of studies that link eye-tracking data to deeper insights into purchasing decisions, which is necessary to comprehensively understand consumer behavior.

In light of these considerations, the researcher employed eye-tracking technology as a tool to examine and quantify consumer visual interest in the graphic designs of vitamin water packaging. Conducted in a simulated experimental environment, the study focuses on identifying the graphic elements on vitamin water packaging that are most visually appealing and analyzing the relationship between visual behavior and purchasing decisions. The findings aim to provide insights into vitamin water packaging design strategies that can enhance consumer appeal. Additionally, they also serve as a practical guide for entrepreneurs seeking to develop vitamin water packaging styles that are both competitive and sustainable in an increasingly dynamic market.

## II. LITERATURE REVIEW

The use of eye-tracking technology continues to gain attention in the study of consumer behavior and packaging design. Nemergut and Mokrý (2020, pp. 371-378) found that the use of realistic fruit images on juice packaging can stimulate greater consumer interest than the use of drawings. Mehta et al. (2023, pp. 8845-8860) applied eye-tracking technology together with facial expression analysis via a high-resolution webcam to assess consumers' interest in orange juice packaging. It was found that nutritional information received the most visual attention and was significantly linked to the emotional reactions of consumers. Meanwhile, Tonkin et al. (2011, pp. 1-8) compared consumers' visual behavior in real and simulated environments, concluding that simulated experiments closely replicate real consumer behavior while also effectively reducing research costs. Similarly, Szocs and Lefebvre (2016, pp. 152-159) pointed out that imagery is the most important element influencing both attention and purchase decisions. Supporting this, Kattibut (2022, p. 87) found that branding and product descriptions are important elements that help build credibility and motivate purchase decisions in the context of vitamin water products.

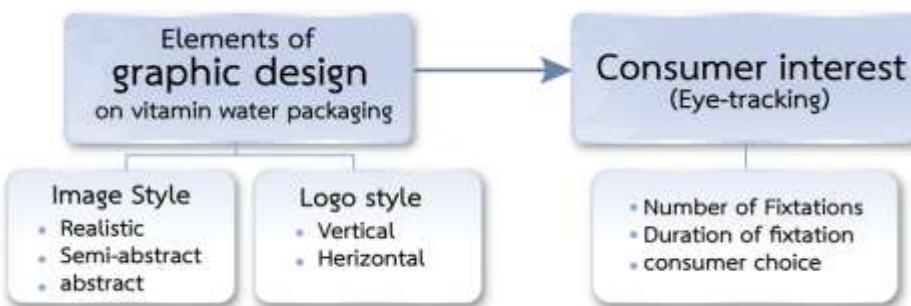


Previous studies have demonstrated that graphic elements on packaging, including logos and product information, significantly influence customer interest. Moreover, the utilization of eye-tracking technology can yield insights into viewing behaviors associated with purchasing decisions. Building on this knowledge, the present study aims to establish a framework for identifying Areas of Interest (AOI) on vitamin water packaging to comprehensively examine the correlation between viewing behavior and purchasing decisions. The number of fixations, duration of fixation, and the graphic styles that garner the most attention will be analyzed. The findings are expected to result in the development of packaging design guidelines that effectively align with the expectations and behaviors of the target audience, thereby enhancing appeal in a competitive market.

### III. RESEARCH METHODOLOGY

#### Conceptual Framework

This research is an experimental investigation aimed at evaluating consumer interest in graphic styles on vitamin water packaging, using eye-tracking technology. The conceptual framework guiding this research is outlined below, as illustrated in Figure 1.



**Figure 1:** Conceptual framework

#### Population and Sample Groups

The age range of 20-30 years was selected based on prior research by Thienthong (2021, p. 36), which found that this group exhibited significantly higher intentions to repurchase and increase future consumption of vitamin water compared to other age groups, as confirmed by Bonferroni pairwise comparisons. Additionally, participants in this age range are known to have more stable eye movement behavior than older individuals, which aligns with the experimental requirement for participants with normal visual function in eye-tracking studies. Therefore, this age group represents both a relevant consumer segment and a methodologically appropriate sample for the study.

The sample consisted of male and female vitamin water drinkers aged 20-30 years. Purposive sampling was used to select 30 participants. The inclusion criteria required that all participants had previously purchased or drunk vitamin water, regardless of the brand. The sample size was calculated through power analysis, using a power level of 0.80, an effect size of 0.5 (Cohen, 1988, pp. 77-83), and a significance level of 0.05, calculated using G\*Power software. The analysis indicated a required sample size of 27 participants. To account for potential loss of participants during the experiment, three more participants were added, resulting in a final sample size of 30 participants.

## Experiment

1) The researcher designed six different graphic styles for vitamin water packaging (AOI1-6) to test participant interest. These designs were displayed against a white background with a refrigerator backdrop to simulate a realistic shelf-viewing environment within a laboratory setting. The placement of the packaging designs was rotated among left, center, and right positions so that the placement position of the simulated vitamin water bottle on the screen did not influence the attention of the participants. Each image was presented for 3 seconds.

2) Before the experiment was performed, the participants in the experimental group completed a color blindness test by looking at an Ishihara test strip on a monitor with a web browser simulator, provided by the researcher. Test takers had to achieve a 100% score to proceed to the next step. The test took about 30 seconds to complete.

3) After being tested for color blindness in step 2, the participants were instructed to wear the Tobii Pro Glasses 3 eye-tracking device. To prevent the device and its connecting cable from becoming entangled with the participant's face or hair around the ears, participants were asked to hold the recording unit-connected to the end of the glasses' leg-in one hand and rest it on their lap for the duration of the experiment. The researcher then performed a one-point calibration by holding a calibration card at a distance of 50-100 centimeters from the participant. After that, participants were asked to look at the screen to begin the eye-tracking evaluation.

4) Once all the images had been viewed, participants were instructed to remove the eye-tracking glasses and complete the interest assessment form. This assessment form focused on their interest in the graphic styles presented on the vitamin water packaging.

5) The collected data were analyzed to evaluate consumer interest in each graphic style. The results were then summarized and discussed based on a comparison of two key eye-tracking metrics: the average number of fixations and the average fixation duration (measured in milliseconds).

## Research Tools

1) The research tools comprised the Tobii Pro Glasses 3 eye-tracking device, and a screen used to display the vitamin water packaging models. The screen was a 27-inch LG UHD 4K monitor (model 27UP600-W) with a 16:9 aspect ratio and a display resolution of 1920 x 1080 pixels. The Tobii Pro Glasses 3 eye-tracking device is shown in Figure 2.



**Figure2 :** Tobii Pro Glasses 3 eye- tracking device (a) and data recording device (b)

2) The survey consisted of both multiple-choice questions and open-ended questions, allowing respondents to express their opinions in detail. Instrument quality inspection was performed by qualified experts in measurement and evaluation. The item validity analysis yielded a score of 0.90, which exceeded the minimum threshold of 0.50, indicating that the instrument had a "valid" level of accuracy.



## Data analysis

1) Consumer interest data on vitamin water packaging were analyzed to identify which graphic styles were most frequently viewed, based on the number of fixations. Each of the six packaging styles (AOI1-6) were presented in different positions on the monitor, resulting in 12 images viewed by each participant. The total number of fixations for each AOI across all 30 participants was recorded. These values were then averaged to determine the overall number of fixations for each of the six packaging styles.

2) Consumer interest data were also analyzed to determine which graphic styles on vitamin water packaging received the longest viewing time, measured by duration of fixation in milliseconds. The duration of fixation was recorded for each area of interest (AOI1-6) displayed on the monitor. The average fixation duration for each AOI was calculated to summarize the overall viewing time for each packaging style. The first and second analyses employed one-way analysis of variance (ANOVA) to test for significant differences in means. The independent variable was the graphic style of the vitamin drinking water packaging, classified into six styles (AOI1-6), while the dependent variables were the number of fixations and the duration of fixation.

3) To analyze whether graphic styles on vitamin water packaging influence consumer purchasing decisions, frequency distribution analysis was used. This analysis examined the consistency between the duration of visual attention on each graphic style and purchasing decisions. Specifically, the study investigated whether the packaging style that received the longest viewing time corresponded with the participants' self-reported choice in the post-experiment assessment. Based on the consistency between participants' visual attention and their questionnaire responses, the analysis aimed to determine whether the area of interest (AOI1-6) that received the most attention—on the most visually distinct packaging style—also influenced purchasing decisions. The proportion of participants who chose a specific graphic style as their preferred choice was compared to the eye-tracking data to assess its influence on purchase decisions. To support this analysis, dummy variables were created using binary values (0 and 1), allowing the data to be interpreted on a nominal or ordinal scale, as follows:

3.1 If a participant chose a graphic style on the vitamin water packaging as the one that most influenced their purchasing decision, and that selection was consistent with the packaging style they viewed for the longest duration, a value of 1 was assigned.

3.2 If a participant selected a graphic style on the vitamin water packaging as the one that most influenced their purchasing decision, but this selection was inconsistent with the style they viewed for the longest duration, a value of 0 was assigned. The results were analyzed using a one-proportion Z-test, which assessed whether the proportion of participants whose purchase decisions aligned with the graphic style they viewed the longest differed significantly from chance. Specifically, the test compared participants who selected the graphic style that corresponded with the one they looked at the longest (consistent, coded as 1), and participants whose chosen style did not correspond with their longest viewing time (inconsistent, coded as 0). The hypotheses for the test were defined as follows: Null hypothesis ( $H_0$ ):  $p \leq 0.5$ . The proportion of consistent responses is 50% or less (no effect); Alternative hypothesis ( $H_1$ ):  $p > 50\%$ . The proportion of consistent responses is greater than 50% (indicating an effect). The test was conducted at a significance level of  $\alpha = 0.05$ .



#### IV. RESULTS

The graphic design of the vitamin water packaging, developed for consumer interest testing using eye-tracking technology, focused on specific Areas of Interest (AOIs). The researcher created six packaging styles (AOI1-6), each incorporating distinct graphic elements centered around imagery. The central visual component was a background scene featuring mountains, trees, and the sky. These elements were intentionally chosen to reflect key associations: Mountains and trees conveyed naturalness and freshness, which are selling points of vitamin water. The sky conveyed purity, clarity, and relaxation, aiming to resonate with consumers seeking refreshment from daily fatigue. The color scheme for this case study included blue, green, and white tones: Blue represents freshness and safety, green represents naturalness, and white represents the purity of vitamin water. Three distinct image styles were developed: 1) Realistic: A photograph-like image using natural light and shadows to mimic how the human eye perceives the scene; 2) Semi-abstract: Based on the realistic image but with distorted details and sharp mountain lines to create a novel and visually stimulating effect; 3) Abstract: A more stylized version using freeform shapes and simple colors to express the concept artistically. In terms of product information, the label prominently displays the product name- "Vitamin Water" -in both Thai and English. A sans-serif font was selected for the English text to emphasize stability and modernity, with the straight lines instilling confidence in the quality and cleanliness of the water and its vitamins, which are beneficial for the body. The Thai text was styled with a headless font to maintain visual consistency with the English font and ensure suitability for the target audience, enhancing readability from a distance. In this study, the key product descriptor was "Vitamin B", presented in blue to convey the cleanliness of vitamin water products and their vitamins. All six packaging designs (AOI1-6) were based on these design concepts in various combinations, as shown in Table 1.

**Table 1:** Styles of graphic elements on vitamin water packaging (AOI1-6)

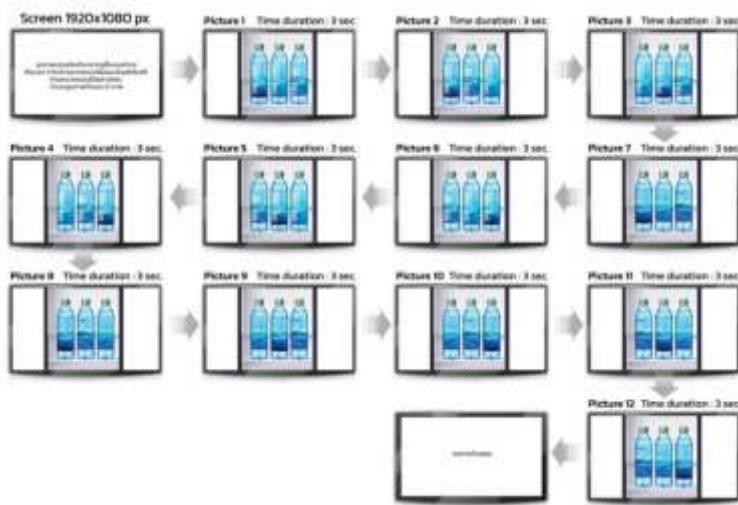
AOI	Elements of vitamin water packaging	Logo style			Image style	
		Mock up	Vertical logo	Horizontal logo	Realistic image	Semi- abstract image
1			✓		✓	
2			✓			✓
3			✓			✓
4				✓	✓	



**Table 1: (continued)** Styles of graphic elements on vitamin water packaging (AOI1-6)

AOI	Elements of vitamin water packaging	Logo style			Image style	
		Mock up	Vertical logo	Horizontal logo	Realistic image	Semi- abstract image
5					✓	✓
6					✓	✓

Based on the results presented in Table 1, the graphic design styles of the vitamin water packaging were displayed on a screen in a simulated environment that closely resembled a real-world setting. Each image of the vitamin water packaging was placed on a virtual mock-up structure, with a screen backdrop designed to resemble the appearance of products on the shelf of a refrigerator in a convenience store. The six packaging styles were arranged for display in sets of three per screen page. The positions of the images (left, center, and right) were rotated across the pages. Participants were given clear on-screen instructions that read: "The image will appear on the screen for 3 seconds. You can look freely at a total of 12 images." The images displayed on the screen automatically changed in sequence until the viewer had seen all 12 images. The sequence and layout of the image presentations used to assess interest in the graphic styles of the vitamin water packaging are shown in Figure 3.

**Figure3 :** The sequence of the presentation of graphic styles on vitamin water packaging

The experiment in this research was designed to be consistent with the experimental conditions specified by the researchers. It was conducted in a controlled laboratory environment with a fixed experimental duration to reduce the influence of external distractions on the detection of eye movements, as shown in Figure 4. The location and installation characteristics of the data collection equipment, as well as the positioning of the participants, were also carefully considered.





**Figure 4:** Example of the positioning and setup of the data collection device in relation to the participant.

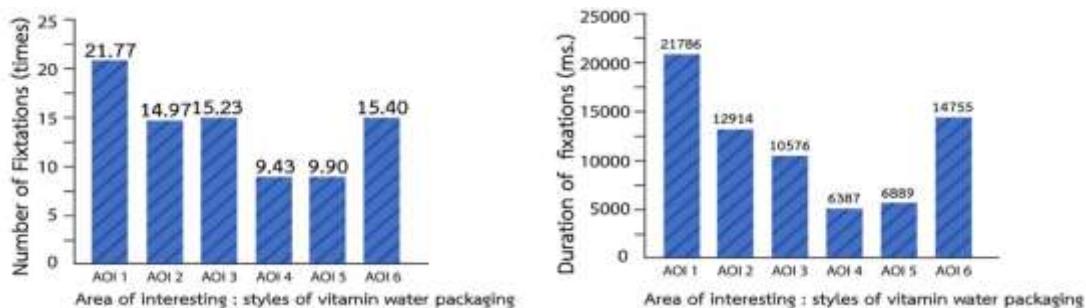
The researcher assessed the results of the experiment to determine consumer interest in the visual design of vitamin water packaging using eye-tracking technology. Figure 5 depicts the interface of the eye-tracking test conducted with testers using the Tobii Pro Glasses 3 Controller program.



**Figure 5:** Interface of the eye-tracking test conducted using the Tobii Pro Glasses 3 Controller program

Figure 5 shows an example of the analytical output for the number of fixations and duration of fixation across six graphic styles of vitamin water packaging (AOI1-6) from 30 participants ( $n = 30$ ). The researcher analyzed the results by inputting relevant data into the Tobii Pro Glasses 3 Controller program, as shown in the figure. (1) Gaze Overlay: This is represented by red circles that show where the participants focused their visual attention. In the image, the gaze overlay appears on one of the vitamin water packages, with the diameter of the red circle covering specific graphic elements, signaling the participant's visual focus on that area. (2) Area of Interest (AOI): The AOIs were pre-defined by the researcher to analyze the eye-tracking test results of each participant. In this research, each graphic style of the simulated vitamin water bottle packaging was assigned to one of the distinct AOIs (AOI1-6), as previously shown in Table 1. (3) Time Interval Selection: The program was set to evaluate visual attention within a 3-second window per image, matching the experimental design. The Tobii Pro Glasses 3 Controller program was then used to calculate and display

eye-tracking metrics, which were then analyzed to assess consumer interest in each packaging style. The results of this data analysis are as follows:



**Figure 6:** Comparative analysis of consumer interest in graphic styles on vitamin water packaging

From Figure 6 (left), the results of the comparative analysis of consumer interest data on vitamin water packaging are presented to identify which graphic styles consumers "looked at the most," based on the number of fixations recorded across six styles (AOI1-6). The analysis of the average number of fixations per person revealed that the averages obtained were decimal fractions rather than whole numbers, or integers. Therefore, the researcher rounded up the decimal fractions with a value of 0.5 or more to 1, and rounded down those below 0.5 to 0. The findings indicate that Style 1 (AOI 1)-featuring a vertical logo with a realistic image style-received the highest average number of fixations, at 22 times per participant. In contrast, Style 4 (AOI 4)-which included a horizontal logo with a realistic image style-received the lowest average number of fixations, at 9 times per participant.

Figure 6 (right) presents the results of a comparative analysis of consumer interest data on vitamin water packaging, aiming to identify the graphic styles that consumers "looked at the longest," based on the duration of fixations measured in milliseconds. The findings indicate that Style 1 (AOI 1)-featuring a vertical logo and a realistic image style-had the highest average viewing duration, with participants fixating on it for an average of 21,786 milliseconds, or 21.786 seconds. In contrast, Style 4 (AOI 4)-which displayed a horizontal logo and a realistic image style-had the shortest average viewing duration, at 6,378 milliseconds, or 6.378 seconds.

**Table 2:** Summary of comparative analysis of consumer interest data on vitamin water packaging

SUMMARY								
Area of interest (AOI)	Count	Number of Fixations			Duration of Fixations (ms)			Variance
		Sum	Average	Variance	Sum	Average	Variance	
AOI 1	30	653	21.77	102.46	653582	21786	92210655	
AOI 2	30	449	14.97	58.86	387428	12914	55467642	
AOI 3	30	457	15.23	62.94	317287	10576	37826791	
AOI 4	30	283	9.43	16.94	191339	6378	3867806	
AOI 5	30	297	9.90	12.30	206660	6889	7264903	
AOI 6	30	462	15.40	33.56	442658	14755	23886409	



From Table 2, it was found that the variance values, which represent the distribution of data within each Area of Interest (AOI), were clearly different across the six styles. Style 1 (AOI 1) had the highest variance values, reflecting the wide range of interest levels among participants. In contrast, Style 5 (AOI 5) had the lowest variance values, indicating similar levels of interest among participants for that particular packaging style.

**Table 3:** ANOVA results for fixation count and duration across graphic styles (AOI1-6)

Source of variation	ss	df	MS	F	p-value
Number of fixations (times)	Between groups	3035.58	5	607.11	12.688 <i>p</i> < .001
	Within groups	8324.96	174	47.84	
	Total	11360.55			
Duration of fixations (ms.)	Between groups	4910207247	5	982041449	26.71 <i>p</i> < .001
	Within groups	6395201973	174	36754034	
	Total	11305409220	179		

From Table 3, the results of the analysis of variance (ANOVA) show that the mean number of fixations and the duration of fixation for the graphics on the six styles of vitamin water packaging are significantly different at the *P* < 0.0001 level. With a *p*-value less than 0.05, it can be concluded that the mean number of fixations and the duration of fixation for the graphics on the six styles of vitamin water packaging are significantly different, with at least one style differing from the others when considering both the number of fixations and the duration of fixation.

**Table 4:** Tukey HSD Post-Hoc Pairwise Comparisons of Mean Number of Fixations Across graphic styles (AOI1-6)

Comparison	Mean Difference	SE of Difference	95% Confidence Interval		Adjusted P-Value
			Lower	Upper	
AOI 1- AOI 2	6.80	1.26	1.65	11.95	.003
AOI 1- AOI 3	6.53	1.26	1.39	11.68	.004
AOI 1- AOI 4	12.33	1.26	7.19	17.48	<i>p</i> < .001
AOI 1- AOI 5	11.87	1.26	6.72	17.01	<i>p</i> < .001
AOI 1- AOI 6	6.37	1.26	1.22	11.51	.006
AOI 2- AOI 3	0.27	1.26	-4.88	5.41	.999
AOI 2- AOI 4	5.53	1.26	0.39	10.68	.027
AOI 2- AOI 5	5.07	1.26	-0.08	10.21	.056
AOI 2- AOI 6	0.43	1.26	-4.71	5.58	.999
AOI 3- AOI 4	5.80	1.26	0.65	10.95	.017
AOI 3- AOI 5	5.33	1.26	0.19	10.48	.037
AOI 3- AOI 6	0.17	1.26	-4.98	5.31	.999



**Table 4:** (continued) Tukey HSD Post-Hoc Pairwise Comparisons of Mean Number of Fixations Across graphic styles (AOI1-6)

Comparison	Mean Difference	SE of Difference	95% Confidence Interval		Adjusted P-Value
			Lower	Upper	
AOI 4- AOI 5	0.47	1.26	-4.68	5.61	.999
AOI 4- AOI 6	5.97	1.26	0.82	11.11	.013
AOI 5- AOI 6	5.50	1.26	0.35	10.65	.029

The statistical analysis presented in Table 4 (Tukey HSD Post-Hoc Pairwise Comparisons of Mean Number of Fixations) and the design attributes of AOI1–6 detailed in Table 1 (logo and image styles) yield significant insights for packaging design strategy in the vitamin water market. The findings indicated that AOI1, including a vertical logo and realistic image, markedly surpassed all other styles in attracting visual attention (e.g., AOI1 vs. AOI4, AOI5:  $p < .001$ ; AOI1 vs. AOI2, AOI3, AOI6:  $p < .01$ ). On the other hand, the areas with abstract or semi-abstract images and horizontal logos had significantly fewer fixations and were quite similar to each other. The findings indicate that packaging designs for vitamin water that include realistic imagery and vertical logo placement are more effective in capturing and sustaining consumer visual attention.

**Table 5:** Tukey HSD Post-Hoc Pairwise Comparisons of Mean Duration of Fixations Across graphic styles (AOI1-6)

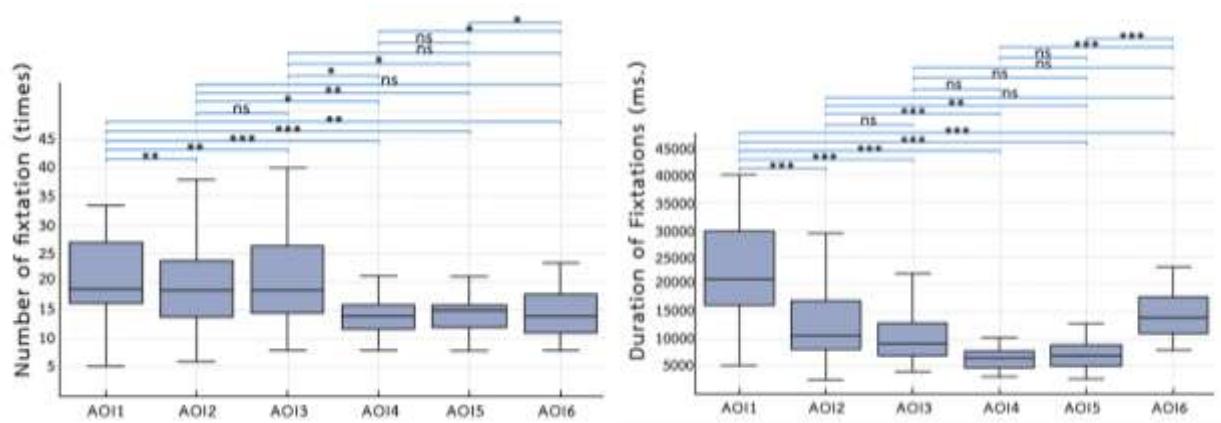
Comparison	Mean Difference	SE of Difference	95% Confidence Interval		Adjusted P-Value
			Lower	Upper	
AOI 1- AOI 2	8871.80	1106.86	4360.91	13382.69	$p < .001$
AOI 1- AOI 3	11209.83	1106.86	6698.94	15720.72	$p < .001$
AOI 1- AOI 4	15408.10	1106.86	10897.21	19918.99	$p < .001$
AOI 1- AOI 5	14897.40	1106.86	10386.51	19408.29	$p < .001$
AOI 1- AOI 6	7030.80	1106.86	2519.91	11541.69	$p < .001$
AOI 2- AOI 3	2338.03	1106.86	-2172.86	6848.92	.669
AOI 2- AOI 4	6536.30	1106.86	2025.41	11047.19	$p < .001$
AOI 2- AOI 5	6025.60	1106.86	1514.71	10536.49	.002
AOI 2- AOI 6	1841.00	1106.86	-2669.89	6351.89	.848
AOI 3- AOI 4	4198.27	1106.86	-312.62	8709.16	.084
AOI 3- AOI 5	3687.57	1106.86	-823.32	8198.46	.178



**Table 5:** (continued) Tukey HSD Post-Hoc Pairwise Comparisons of Mean Duration of Fixations Across graphic styles (AOI1-6)

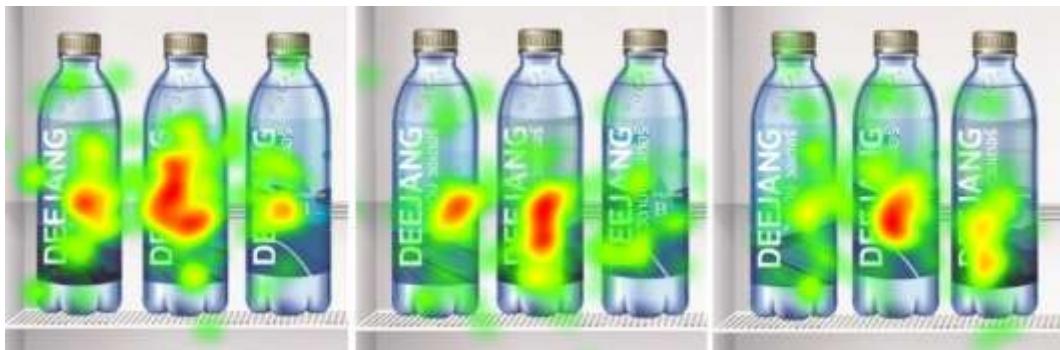
Comparison	Mean Difference	SE of Difference	95% Confidence Interval		Adjusted P-Value
			Lower	Upper	
AOI 3- AOI 6	4179.03	1106.86	-331.86	8689.92	.087
AOI 4- AOI 5	510.70	1106.86	-4000.19	5021.59	.999
AOI 4- AOI 6	8377.30	1106.86	3866.41	12888.19	<i>p</i> < .001
AOI 5- AOI 6	7866.60	1106.86	3355.71	12377.49	<i>p</i> < .001

The statistical analysis presented in Table 5 (Tukey HSD Post-Hoc Pairwise Comparisons of Mean Duration of Fixations) and the design attributes of AOI1–6 detailed in Table 1 (logo and image styles) indicated that AOI1, including a vertical logo and realistic image, attained the highest average fixation duration, exhibiting statistically significant differences relative to all other AOIs ( $p < .001$ ). This signifies a robust ability to attract and maintain consumer visual focus. Conversely, AOI4 and AOI5, which employed horizontal logos, exhibited markedly reduced fixation lengths relative to AOI1 ( $p < .001$ ), indicating diminished visual engagement. Other areas of interest—specifically AOI2, AOI3, and AOI6, which included a semi-abstract and abstract image—showed shorter viewing times compared to AOI1; however, some differences between them were not statistically significant (for example, AOI2–AOI6:  $p = .848$ ; AOI3–AOI5:  $p = .178$ ).

**Figure 7:** Box plots of pairwise comparisons of fixation counts (left) and fixation durations (right) across vitamin water packaging styles.

**From Figure 7 (left), The box plot depicting paired comparisons of number of fixations offers detailed insights that surpass the numerical data in the summary table.** Significantly, AOI3, despite having a comparable mean number of fixations to AOI1, demonstrates a far broader range, suggesting variability in its capacity to attract attention. Conversely, AOI4 and AOI5 exhibit both a reduced mean number of fixations and a narrow interquartile range, indicating continuously inadequate visual engagement.

**From Figure 7 (Right), The box plot illustrating pairwise comparisons of durations of fixations provides a visual summary** of how distinct vitamin water packaging styles influence sustained consumer attention. Beyond confirming AOI1's superior performance, the plot reveals that AOI6, although statistically different from AOI1 ( $p < .001$ ), demonstrated relatively longer fixation durations than AOI4 and AOI5, which had the shortest and most consistent viewing times. Interestingly, despite AOI3 and AOI6 showing similar median durations, their variability differed, suggesting that design complexity may lead to fluctuating engagement.



**Figure 8:** Example of participant's interest data utilizing a heat map

Figure 8 shows the results of a comparison of participants' visual attention to the graphic styles of vitamin water packaging in the form of a heat map. In the heat map, red areas represent regions where participants fixated for a longer duration, while green areas indicate shorter fixation times. The images show that the center of the screen consistently appears red, indicating longer fixations on the center than on the left and right sides. However, the heat intensity can also shift to the left and right positions in cases where a particular graphic style captures the consumer's interest, regardless of its position on the screen. This suggests that although the center position generally receives the most attention, consumers will still focus on a design they find appealing—even if it is not in the center. For example, Style 1 (AOI 1), which had the longest average viewing time, received consistent attention when shown in all three positions—left, center, and right. When comparing all images, those placed in the center had the highest red intensity, indicating that the center position receives the most visual attention. The left position also showed a high red intensity, though less than the center, showing that the left position can still attract substantial attention. In contrast, the right position consistently had the lowest red intensity and distribution across all images, showing that it receives the least visual attention compared to the other positions.

The results of the data analysis on the graphic styles of vitamin water packaging that influenced consumers' purchasing decisions, using frequency distribution analysis, are shown in Table 6.



**Table 6:** Results of the frequency distribution analysis showing the graphic styles of vitamin water packaging that influenced participants' purchasing decisions

Consumer choice				
	Frequency	Percent	Valid percent	Cumulative percent
Valid AOI 1	17	56.67	56.67	56.67
AOI 2	7	23.33	23.33	80.00
Valid AOI 3	1	3.33	3.33	83.33
AOI 4	2	6.67	6.67	90.00
AOI 5	2	6.67	6.67	96.67
AOI 6	1	3.33	3.33	100
Total	30	100	100	

From Table 6, it was found that the majority of participants chose Style 1 (AOI 1), which is a style with graphic elements on the vitamin water packaging in the form of a vertical logo and a realistic image style. This style was selected by 17 participants, accounting for 56.67 percent. From interviews regarding the reasons for choosing this format, it was found that Style 1 evokes a sense of nature, making it most suitable for a product like vitamin water that emphasizes natural origins. Additionally, the logo stands out prominently and exudes beauty.

The analysis of the consistency between the time spent looking at graphic styles on vitamin water packaging and consumers' purchasing decisions was conducted to answer the question: "Does the graphic style on vitamin water packaging that consumers look at the longest have an effect on their purchasing decisions?" The results of this analysis were used to determine the dummy variables for the one-proportion Z-test, as shown in Table 7.

**Table 7:** Proportion of vitamin water packaging styles that each consumer looked at the longest and the effect on their purchasing decisions

Participant	Maximum duration of fixation (milliseconds)	Graphic style on vitamin water packaging with longest fixation	Graphic style chosen by consumer (from questionnaire)	Dummy variable
1	26954	AOI 1	AOI 1	1
2	27454	AOI 1	AOI 1	1
3	19575	AOI 1	AOI 1	1
4	13685	AOI 1	AOI 1	1
5	18674	AOI 2	AOI 2	1



**Table 7:** Proportion of vitamin water packaging styles that each consumer looked at the longest and the effect on their purchasing decisions

Participant	Maximum duration of fixation (milliseconds)	Graphic style on vitamin water packaging with longest fixation	Graphic style chosen by consumer (from questionnaire)	Dummy variable
6	16009	AOI 1	AOI 1	1
7	20821	AOI 1	AOI 1	1
8	30967	AOI 2	AOI 2	1
9	19156	AOI 2	AOI 2	1
10	22081	AOI 4	AOI 6	0
11	30397	AOI 1	AOI 1	1
12	30333	AOI 1	AOI 1	1
13	29938	AOI 2	AOI 2	1
14	25792	AOI 5	AOI 5	1
15	21427	AOI 5	AOI 5	1
16	20206	AOI 2	AOI 2	1
17	33613	AOI 1	AOI 1	1
18	28030	AOI 5	AOI 4	0
19	34009	AOI 3	AOI 3	1
20	27988	AOI 2	AOI 2	1
21	24944	AOI 1	AOI 1	1
22	25489	AOI 1	AOI 1	1
23	30653	AOI 1	AOI 1	1
24	21161	AOI 1	AOI 1	1
25	40212	AOI 1	AOI 1	1
26	36396	AOI 1	AOI 1	1
27	16390	AOI 2	AOI 2	1
28	18122	AOI 6	AOI 4	0
29	36670	AOI 1	AOI 1	1
30	18837	AOI1	AOI 1	1



**Table 8:** Results of the one-proportion Z-test: consistency between longest viewing duration and purchasing decisions for vitamin water packaging styles

One proportion Z-test	
Number of participants whose purchasing decision was consistent with the longest viewing duration	27
Number of participants whose purchasing decision was inconsistent with the longest viewing duration	3
Total sample size (n)	30
Observed proportion	90%
Expected proportion	50%
Z-statistic	4.3818
p-value	$p < .001$

The analysis results indicate that the proportion of participants whose chosen graphic style of vitamin water packaging—namely, the one that had the most influence on their purchasing decision—was consistent with the style that the participant looked at the longest, and the proportion of participants whose chosen graphic style of vitamin water packaging was inconsistent with the style that the participant looked at the longest were significantly different. This conclusion is supported by a  $p$ -value  $< 0.001$ , which is less than the significance level of 0.05. Therefore, the null hypothesis ( $H_0: p \geq 50\%$ ) was not rejected. It can be concluded that the graphic style of the vitamin water packaging that each consumer looked at the longest had a significant effect on their decision to buy the product, as shown in Table 8.

## V. CONCLUSION AND DISCUSSION

The research findings revealed that the graphic style of vitamin water packaging with a vertical logo and realistic image style (AOI 1) was rewritten it to vertical logo and realistic image style (AOI 1) as shown in Figure 9. It received the most attention from consumers, both in terms of the number of fixations and the duration of fixations. There was a clear consistency between the packaging style that received the most attention and the style that significantly influenced purchase decisions. These behavioral insights can serve as practical guidelines for designing clearer and more prominent graphic styles of vitamin water packaging. Specifically, using a vertical logo, realistic imagery with natural shadows, and placing the product in the center of the shelf, which is the area that receives the most attention, can increase the chance of consumers seeing the product and making a decision to purchase it. In addition, while the center position proves most effective, the left and right areas of the shelf should not be overlooked, as they also have the potential to attract attention to a certain extent.

The research results are consistent with the findings of Kang et al. (2014, pp. 113-120), who stated that vertical logos influence consumer preferences. They are also consistent with those of Febriant et al. (2023, pp. 5-12), who found that realistic images attracted more attention than computer-generated illustrations, especially when used with display typography. Similarly, Kattibut (2022, p. 87) confirmed that a clear logo can effectively enhance brand credibility and recognition. This finding is also consistent with those of Oliveira (2016, pp. 160-167) and Bialkova et al. (2020, pp. 1-44), who used eye-tracking technology with other products and found that the duration of fixation was directly related to consumer interest in the product and purchasing behavior. Consumers often use gaze patterns to assess product value, essence, and emotional connection. Therefore, the selection of images that convey freshness, naturalness, and product value is an important guideline for designing packaging that can truly meet consumer needs and support entrepreneurs in developing effective and sustainable products and marketing strategies.





**Figure 9:** Example of vitamin water packaging applying vertical logo and realistic image based on research findings

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