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TEA PACKAGING DESIGN USING INTEGRATION OF KANSEI ENGINEERING AND EYE TRACKING FOR ENHANCING CONSUMER APPEAL

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Abstract This research aims to determine the design specifications for tea drink packaging that appeal to consumers using Kansei and eye-tracking techniques. Kansei Engineering focuses on developing products that align with consumers' feelings and emotional needs. Eye-tracking provides insights into how consumers see and interact with packaging, as evidenced by total fixation duration, allowing for the identification of design elements that attract the most attention and influence consumer perception. The application of eye-tracking and Kansei Engineering helps match customer perceptions of products with their functional and technical specifications, providing a holistic and effective approach to increasing sales and consumer satisfaction. Integrating these two methods makes the design process more consumer-focused, combining emotional and visual appeal, thereby increasing attractiveness and potential consumption. The urgency of this research lies in its potential to revitalize the tea industry in Indonesia by utilizing innovative packaging designs. Enhancing consumer appeal to tea products through the integration of Kansei Engineering and eye-tracking, which are visually and emotionally engaging, addresses the main obstacle to low tea consumption in Indonesia. Thus, it contributes to the growth of the tea market and promotes healthier beverage choices among Indonesian consumers. The research results show that an aesthetic packaging design requires a sports cap type lid, a convex bottle body, a plain motif, and a square cross-section. Ergonomic packaging design requires a flip cap type lid, a wave-shaped bottle body, a textured motif, and a round cross-section. Simple packaging design requires a straw cap type lid, a serrated bottle body, a plain motif, and a square cross-section. This research aims to revitalize Indonesia's tea industry through consumer-oriented packaging design, increasing emotional and visual appeal. Key implications include increased consumer appeal, potential for increased consumption, better marketing strategies, and packaging design innovation that resonates emotionally with consumers.

Keywords: *Design, Eye Tracking, Kansei Engineering, Packaging*

1. Introduction

Utilization of goods and products refers to how these goods are consumed, used, and incorporated into everyday life. This broad concept covers various product categories, from food and beverages to household goods, electronics, clothing, and more. The focus on food products is due to the essential nature of being consumed every day, which often makes it a major category of consumer goods, in addition to the important role of health and safety, as well as intense competition in the food industry.

Tea products themselves were quite developed in Indonesia. The tendency of the Indonesian community to consume tea products was still below the government's expectations. This was also supported by the Food and Agriculture Organization of the United Nations where more than 30 countries in the world, including Bangladesh, China, India, Indonesia, Japan, Malaysia, Sri Lanka, Taiwan, Tanzania, Thailand, and Turkey, had consumed tea and had produced 60% of its total production[1]. This was because the health benefits of tea had been recognized not only in Asia but also around the world. However, according to data presented by the Indonesian Tea Council, the per capita tea consumption of the Indonesian population per year based on the obtained data was about ± 0.35 kg/capita/year, far below Japan's 0.96 kg/capita/year, Pakistan's 0.74 kg/capita/year, and Malaysia's 0.72 kg/capita/year. World population tea consumption data could be seen in Table 1 below[2].

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Table 1. World Population Tea Consumption in 2018

Country	Consumption (Ton)	(Kg/Capita/Year)
United Kindom	123.510	1,97
Marocco	156.170	1,74
Egypt	91.630	1,14
Japan	122.290	0,96
Pakistan	125.920	0,74
Malaysia	90.860	0,72
Indonesia	51.571	0,35

From Table 1, it was observed that the tea consumption of the Indonesian population was the lowest compared to other countries. This was due to the lack of socialization and information about the benefits of tea and the low quality of Indonesian tea. Therefore, to prevent a continuous decline in consumption, the government took action by promoting tea domestically, which was useful in boosting the public's consumption rate of drinking tea.

Innovation in food products was recommended to help maintain company growth and increase competitive levels in the market[3]. The design of product packaging was a part of product innovation. Food product packaging itself was an important factor in attracting consumers because packaging was the first thing seen by consumers [4]. The function of packaging was basically used as a medium to protect the product from the external environment, and with the development of existing innovations, packaging in the current era was more than just a protector or a medium to obtain flawless products [5]. Packaging was believed to be an effective medium for marketing products[6]. It was known that 90% of consumers, especially of food and beverage products, purchased products only after assessing the physical and front part or packaging of the product[7]. Package design was one of the significant parts of the product strategy, and packaging was the only method to communicate and market products that were obtained by consumers when evaluating products for selection[8].

The tea beverages that existed then had a variety of packaging options ranging from plastic bottles, tetra-pack cartons, or plastic pouches, which generally had the same material and shape with variations distinguished by packaging labeling. The packaging offered was still less attractive to consumers to consume the product and was yet to provide accurate information related to the product information. However, packaging itself could serve as a trigger for consumers to consume and give a first impression to consumers about the product. Therefore, there was a need for innovation, particularly concerning the innovation of packaged tea beverages.

The quality of packaging had a significant influence on the sensory perception and reactions of customers. When customers first encountered a product among many options, their sensory interaction impacted their purchase decision. This process included seeing, touching, and reading the product information on the packaging. The sensations experienced by the customers towards the product could alter their emotions, which related to the psychological aspects of humans. Kansei engineering was a method that associated the psychological emotions of customers (kansei) with the physical and visual attributes of a product as well as the method that translates consumers' emotional feelings into the design component [9]. This method was effective in articulating the mental images of customers into tangible design elements, making it very useful for understanding the psychological feelings of customers compared to other product design methods[10].

The research conducted by used eye-tracking technology to explore the combination display affects for marketing decision making[11]. The main purpose of this study is to reveal whether the display combinations affect the variable of count and fixation duration. This highlighted the importance of packaging shape in gaining consumer interest and attention. Previous research had only focused on eye-tracking testing that measured visual attention to beverage packaging. However, the emotional aspect of the user had not been considered. At that time, consumers were not only interested in the rational and logical aspects of a product, but emotional and symbolic factors were increasingly influencing their purchase decisions. Various methods, one of them being Kansei Engineering, had been used to integrate emotional value into products[12]. Kansei Engineering was

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important in determining product packaging design because it focused on the emotional and psychological aspects of the consumer experience. Unlike eye tracking, which measured visual attention, Kansei Engineering delved into how product design resonated with the feelings and needs of consumers. This approach ensured that packaging not only attracted attention but also evoked the right emotional response, in line with consumer preferences and expectations. This helped designers create packaging that was not only visually appealing but also had a deeper, more personal connection with the target audience. Therefore, in this study, an integration of kansei engineering and eye tracking was conducted to determine the design of tea beverage packaging.

Kansei engineering offers a method for creating human-centered products by incorporating the feelings and preferences of the customer into the design aspects[13]. This approach was thoroughly studied in a number of domains, including the design of automobiles, aviation, furniture, apparel, and other sectors[14]. For evaluating the Kansei design of a product, many systematic biases relating to order, scale, and halo effects plague widely used subjective assessments, such as the semantic differential technique[15]. Alternatively, objective techniques like electroencephalography (EEG) technology and eye-movement monitoring might evaluate human emotions reliably by identifying physiological signals while people see a product[16], [17], [18]. The evaluation of Kansei design in a variety of items, including furniture, cellphones, automobile style, and apparel, has previously been done extensively using these objective approaches[17], [18], [19]. In addition, few studies demonstrated that using eye-tracking technology is feasible to evaluate Kansei design of packaging design.

Based on the background described, the study proposes the design of tea drink packaging based on Kansei engineering and eye-tracking technology. The gap analysis in this study identifies differences between the current tea packaging design and the desired attributes that will increase consumer attractiveness. This analysis aims to identify areas where the current packaging does not meet consumer expectations and preferences. It involves an evaluation of existing packaging based on specific criteria obtained from kansei engineering and eye-tracking data to determine where improvements can be made to attract consumer interest and satisfaction. This research provides practical insights for designers and marketers to enhance product attractiveness, increase sales, and contribute to academic knowledge by demonstrating the effectiveness of combining such research methods. Product quality and its relationship to emotions are important in influencing purchasing decisions, so companies must design products that attract consumer attention and provoke positive emotions. Eye tracking is one of the most effective methods for obtaining objective information about various designs' visual and emotional impressions. This method allows the integration of kansei engineering and research on the design preferences of tea beverage packaging, which align with the market's taste.

Previous research on the application of Kansei Engineering and eye movement analysis on tea packaging [20] has great potential to contribute to tea packaging design research in Indonesia significantly. This research can help understand Indonesian consumers' emotional preferences towards tea packaging by combining multidisciplinary approaches that integrate Kansei Engineering and eye movement analysis. Kansei Engineering techniques enable researchers to identify design elements that are emotionally appealing to local consumers, such as colors, shapes, and images that are relevant to Indonesian culture and traditions. Meanwhile, eye movement analysis can be used to optimize visual elements on the packaging, making it more effective in attracting consumers' attention on store shelves. Additionally, applying these research findings can help create tea packaging that is not only functional but also emotionally appealing, which is important for distinguishing products in a competitive market and creating a stronger connection with consumers. This research can also be adapted to explore how Indonesian cultural elements can be incorporated into tea packaging design, creating more attractive and relevant products for local consumers. Consequently, tea producers in Indonesia can enhance local

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products' competitiveness in domestic and international markets by creating visually appealing and emotionally resonant packaging. Overall, this research provides valuable insights and methods that can be adapted to support the development of more attractive and competitive tea packaging designs in Indonesia.

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2. Method

2.1 Tools and Materials

This study utilized a variety of tools and materials to design and evaluate tea packaging that appeals to consumers. The tools and materials used include the Kansei Word questionnaire, which is an initial questionnaire to identify the Kansei words most relevant to the product samples and distributed online via Google Form, as well as the Semantic Differential I (SD I) questionnaire, which contains pairs of Kansei words presented in a semantic differential format with a 7-point scale to determine the Kansei words most relevant to respondents. The selected Kansei words were then factor analyzed and reduced in number to focus on specific design areas. The study also used a monitor to display stimuli in the form of tea packaging images and related Kansei words that were analyzed using the eye-tracking approach, and a laptop to run the Gaze-point 3 eye-tracking device and gaze-point analysis software. Product sample images were displayed in grayscale as stimuli in the eye-tracking test to avoid bias among respondents, while the Gaze-point 3 eye-tracker was used to capture respondents' eye movements when viewing product samples on the monitor. The eye-tracking data was then analyzed using gaze-point analysis software. Additionally, Microsoft Excel software was used to record, organize, and process initial data from respondents after completing questionnaires and eye-tracking tests. SPSS software was used to conduct Kaiser Meyer Olkin (KMO) and Bartlett tests, as well as to assess Measure Sampling Adequacy (MSA) through Anti Image Correlation before conducting factor analysis. Finally, R software was used to perform factor analysis of the collected Kansei words and Quantification Theory Type I for items and categories of design samples after the eye-tracking test. By utilizing these tools and materials, this study aims to produce tea packaging designs that are not only visually appealing but also meet the emotional needs of consumers.

2.2 Participant Recruitment

Participants in this study were the general public aged 18 – 40 years who consumed or bought packaged tea beverages at least once a month. The research mechanism was divided into three stages. The first stage involved the collection of kansei words, which included 80 respondents. The second stage was the grouping and reduction of kansei words, involving 68 respondents. The third stage was an eye-tracking experiment on several beverage packaging samples based on the selected kansei words. There were 10 participants in the eye-tracking experiment (6 men and 4 women) with inclusion criteria of having good eye health conditions and no significant vision impairments. Additionally, participants were required to be in good physical and mental condition during the experiment. Participants who consumed substances that could affect the nervous system or eye responses were excluded from this study. To ensure optimal eye health and the absence of significant vision problems, respondents were first asked if they had any vision-related disorders or diseases before the experiment began. Additionally, it

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was confirmed that respondents did not wear glasses in their daily activities.

2.3 Kansei Engineering

The research began with the collection of kansei words that represented the packaging of tea beverage products. The term 'kansei' denoted the overall feelings and emotions that a person had towards a certain item, environment, or situation by utilizing all their sensory perceptions[20]. The process of identifying kansei words was conducted through the distribution of questionnaires via Google Form.

The collection of Kansei words conducted using Google Forms resulted in 21 Kansei words related to the design of tea beverage packaging. Table 2 presented 21 kansei words collected from 80 respondents and its antonym.

The kansei words that had been collected were then identified for their antonyms. Subsequently, a Semantic Differential I questionnaire was composed, containing pairs of kansei words with a 1-7 scale. Semantic Differential was a concept that used the principle of positioning in a series of descriptive scales between bipolar adjectives, based on the determination of the degree of similarity or difference between different concepts[21]. The next step involved selecting kansei words that had the highest level of importance related to the design of tea beverage packaging by distributing an online questionnaire to the same respondents as in the Semantic Differential I stage. The questionnaire was conducted with a scale system consisting of 5 numbers. The larger the rating number, the more important that aspect was considered for the design of the tea beverage packaging. Conversely, the smaller the rating number, the less important that aspect was for the tea beverage packaging. Meanwhile, a "3" indicated neutrality.

2.4 Current Product Packaging Selection

After the selected kansei words were identified in previous step, samples of products representing tea beverage packaging were collected. Eleven samples of tea beverage packaging were selected based on products available in Indonesian market. The product samples are shown in Figure 1.

2.5 Eye Tracking Experiment

The next step is conducting the eye-tracking pairwise comparison experiment. This stage was to replace the semantic differential II in kansei engineering. Respondents were tasked with viewing several stimulus that contained the comparison of two images of products for each selected kansei word. Each stimulus was displayed for four seconds on a monitor screen. Between each stimulus, a black blank screen was shown for two seconds to ensure that the gaze was not influenced by the previous stimulus. The design of the experiment could be seen in Figure 2.

Before the experimental process begins, a calibration process is conducted first. When the calibration process starts, the screen will go blank and a calibration marker will move through five positions on the screen. The marker must be looked at by the respondent at each calibration position. Then, 11 circles containing the marker will appear. The respondent is required to focus their gaze into these circles alternately. After the calibration is complete, a green point-of-gaze estimate will be displayed by the software on the screen. The accuracy of the calibration must be checked by observing the points on the screen and ensuring that the green point-of-gaze aligns with the positions viewed by the respondent. If the calibration is not satisfactory, the results can often be improved with a second calibration, as first-time users may not have followed the calibration dots accurately. In this stage, respondents were asked to focus their attention on one design that corresponded with the displayed kansei word. The total fixation duration for each sample product image was recorded at this stage. The eye-tracking experiment used the Gazepoint 3 Eye Tracker, which was placed 40 cm below the monitor, below the eyes. The distance between the monitor and the respondents was 65 cm. The implementation of the experiment could be seen in Figure 3.

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Table 2. 21 Pairs of Kansei Words

No	Kansei Words
1	Unattractive - Attractive
2	Simple - Complex
3	Single Use - Repeated Use
4	Not Eco Friendly – Eco Friendly
5	Plain – Patterned
6	Uncomfortable - Comfortable
7	Non Ergonomic - Ergonomic
8	Small – Large
9	Light – Heavy
10	Impractical - Practical
11	Not Elegant - Elegant
12	Non Aesthetic - Aesthetic
13	Unhygienic - Hygienic
14	Ordinary - Unique
15	Low Quality - High Quality
16	Easy to Carry - Hard to Carry
17	Fragile – Strong
18	Thin – Thick
19	Non Transparent - Transparent
20	Hazardous – Safe
21	Non Sleek – Sleek

Fig. 1 Tea Beverage Packaging Samples

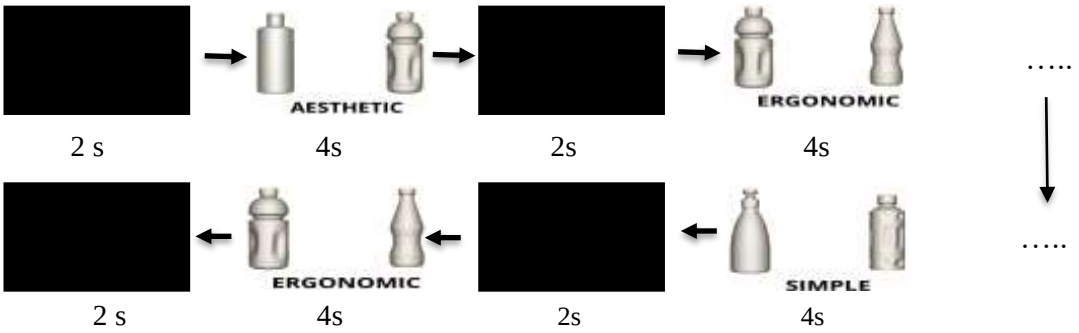

Fig. 2 Design of Experiment

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Fig. 3 Experiment Implementation

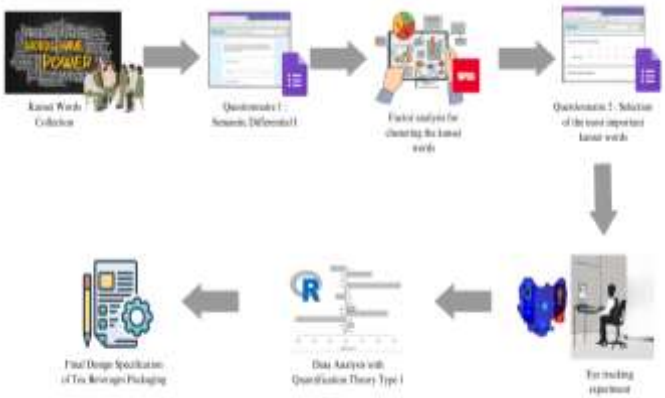

Fig. 4 Flowchart of This Study

3. Results and Discussion

3.1 Kansei Words Explanation

All of those kansei words (table 2) were used in the first stage questionnaire, namely Semantic Differential I, which aimed to understand the respondents' perception and preference towards the design of packaged tea beverages. This was followed by a reduction of kansei words through factor analysis. Parameters in the Kansei questionnaire provide a comprehensive assessment of various aspects of tea packaging design. The first parameter, "Unattractive - Attractive," evaluates the visual appeal of the packaging design, where attractive designs can influence consumers' purchasing decisions by creating a positive first impression. The "Simple - Complex" parameter measures the simplicity or complexity of the form, with simple forms being easier to understand and remember, while complex forms give a unique and exclusive impression. The "Single Use – Repeated Use" parameter assesses whether the packaging is designed for single use or can be reused, with reusable packaging enhancing the functional value and sustainability of the product. " Not Eco Friendly – Eco Friendly " evaluates the sustainability aspects of the materials and design of the packaging. The "Plain - Patterned" parameter assesses whether the packaging has a plain or patterned design, with patterned packaging attracting attention and providing a strong identity for the product, while plain packaging gives a minimalist impression.

The "Uncomfortable - Comfortable" parameter measures the comfort of using the packaging for consumers, where comfortable packaging enhances user experience. "Non-Ergonomic - Ergonomic" assesses how ergonomic the packaging design is, with ergonomic packaging being easier to use and hold. The "Small - Large" parameter measures the physical size of the packaging, where appropriately sized packaging affects storage and usage convenience. "Light - Heavy" evaluates the weight of the packaging, with lighter packaging being easier to carry but still needing to be strong enough to protect the product. The "Impractical - Practical" parameter measures how practical the packaging is to use, with practical designs making it easier for consumers to open, close, and store the packaging.

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The "Not Elegant - Elegant" parameter assesses the elegance of the packaging design, where elegant packaging enhances the perceived value and quality of the product. "Non-Aesthetic - Aesthetic" evaluates the aesthetic appeal of the packaging design, with aesthetic packaging attracting consumers' attention and giving a positive impression of the product. The "Unhygienic - Hygienic" parameter measures how well the packaging design maintains the cleanliness of the product inside. "Ordinary - Unique" measures the uniqueness of the packaging design, where unique designs differentiate the product from competitors and attract consumers' attention. "Low Quality - High Quality" evaluates consumers' perception of the packaging quality, with high-quality packaging increasing consumers' trust and desire to purchase the product.

The "Hard to Carry - Easy to Carry" parameter assesses the ease of carrying the packaging, where easy-to-carry packaging is preferred by consumers who travel frequently. "Fragile - Strong" evaluates the strength and durability of the packaging, with strong packaging protecting the product well during distribution and use. "Thin - Thick" measures the thickness of the packaging material, with thicker material providing extra protection but potentially adding weight. The " Non Transparent - Transparent " parameter assesses whether the packaging is transparent or not, with transparent packaging allowing consumers to see the product inside and increasing trust. "Hazardous - Safe" measures the safety aspects of the packaging, where safe packaging ensures the product is not harmful to consumers. Finally, the "Non Sleek – Sleek" parameter evaluates the tidiness and perfection of the packaging design, with neat and well-organized packaging enhancing the perceived quality and professionalism of the product.

3.2 *Semantic Differential I*

A Semantic Differential I questionnaire distributed via Google Forms to 68 respondents. The results from the Semantic Differential questionnaire were grouped and reduced to a smaller number of variables using factor analysis. However, before conducting factor analysis, the Kaiser-Meyer-Olkin (KMO) test, Bartlett's Test, and the Measure of Sampling Adequacy (MSA) assessment were required.

In the results of the KMO and Bartlett's Test, a KMO value of 0.820 was obtained with a significance of 0.000. This indicated that the variables and samples were suitable for factor analysis processing. Subsequently, the MSA assessment showed values greater than 0.5 only for 19 kansei words, leading to the elimination of kansei words with MSA values less than 0.5, specifically the words 'plain – patterned' and 'small – large'. A retest of the KMO and Bartlett's Test was then conducted, resulting in KMO and Bartlett's Test values of 0.849 and 0.000, respectively. Table 3 presents the results of the KMO and Bartlett's Test using SPSS software.
The next step involved conducting factor analysis to extract the existing pairs of kansei words, resulting in the formation of 5 factors as shown in Table 4. Subsequently, kansei words representing each group were selected by choosing the pairs of kansei with the highest loading factor.

This five concepts were subsequently reduced to three concepts based on the results of an online questionnaire distribution. The questionnaire, consisting of five initial Kansei words, was narrowed down to three most important Kansei words related to the design of tea beverage packaging. As a result of the selection, the words "aesthetic," "ergonomic," and "simple" were chosen. Next, 11 sampled products that have been collected are identified by item and category as indicated in Figure 5.

Table 3. Results of the KMO and Bartlett's Test

Kaiser-Meyer-Olkin Measure of Sampling Adequacy		,849
Bartlett's Test of Sphericity	Approx. Chi-Square	674,378
	df	171
	Sig.	,000

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Table 4. Results of Kansei Word Factor Analysis

Factor	Kansei Word	Loading Factor	Aspect
Factor 1	Non ecofriendly - Ecofriendly	0.731	Non aesthetic – Aesthetic
	Non elegant - Elegant	0.610	
	Non aesthetic - Aesthetic	0.772	
	Non hygienic - Hygienic	0.592	
	Ordinary - Unique	0.575	
	Low quality - Quality	0.629	
	Fragile - Strong	0.572	
	Hazardous - Safe	0.616	
Factor 2	Uncomfortable - Comfortable	0.784	Non ergonomic – Ergonomic
	Non ergonomic - Ergonomic	0.857	
	Impractical - Practical	0.825	
	Low quality - Quality	0.522	
	Difficult to carry - Easy to carry	0.633	
	Bulky - Sleek	0.325	
Factor 3	Simple - Complex	0.795	Simple – Complex
	Light - Heavy	0.764	
	Thin - Thick	0.745	
Factor 4	Unattractive - Attractive	0.514	Opaque – Transparent
	Opaque - Transparent	0.814	
Factor 5	Single use - Reusable	0.790	Single use – Reusable

Table 5. Items and Categories of Tea Beverage Packaging

Item	Categories			
	Screw Cap (X1.1)	Flip Cap (X1.2)	Sport Cap (X1.3)	Straw Cap (X1.4)
Bottle Cap(X1)				
Bottle Body(X2)	Straight (X2.1)	Convex (X2.2)	Waves (X2.3)	Serrations (X2.4)
				
Bottle Motif (X3)	Plain (X3.1)	Texture (X3.2)		
				
Bottle Cross-Section (X4)	Square (X4.1)	Round (X4.2)		
				

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3.3 Results of Eye Tracking Test

Based on the items and categories that have been organized, a product sample matrix can be formed, as shown in Table 6. This matrix will be used for processing eye tracking data.

3.4 Results of Quantification Theory Type 1 (QT 1)

Quantification Theory Type I (QT I) is used to directly analyze and quantify the relationship between each Kansei word and the design elements of each sample. The average value of the design characteristics for each sample is obtained from the total fixation duration of a sample on a Kansei word, as presented in Table 7. In the study on tea packaging design using Kansei Engineering and eye-tracking, the focus on fixation duration is due to its effectiveness in indicating which design elements attract and hold the customer's attention. Fixation duration data are the data of the consumers' attention to certain products they see [22].

The results obtained from processing QT I using R software are in the form of a plot diagram along with category scores derived from the coefficient values of each category. The larger the positive value in a category, the stronger its association with positive Kansei words. Conversely, a larger negative value in a category indicates a stronger association with negative words. The category with the highest value in each item is selected as the combination of elements for the final design[23].

Based on the QT I analysis, it was found that the bottle cap ($p = 0.006635$) and the bottle motif ($p = 0.047494$) have a significant influence on the design of tea beverage packaging related to the Kansei word aesthetic. Figure 4 shows the results of the QT I, indicating that the design elements associated with the Kansei word aesthetic are the sport cap type bottle cap (X1.3) and the plain bottle motif (X3.1).

Based on the QT I analysis, it was found that no elements significantly influenced the design of tea beverage packaging related to the Kansei word ergonomic. Figure 5 shows the results of the QT I and it can be determined that there are design elements associated with the Kansei word ergonomic.

Table 6. Product Sample Matrix

Bottle	Bottle Cap	Bottle Body	Bottle Motif	Bottle Cross-Section
B3	2	1	1	2
B4	1	4	2	2
B5	2	2	2	2
B6	3	2	1	2
B7	1	4	2	2
B8	1	3	1	2
B9	1	1	2	2
B10	1	3	1	2
B11	1	4	2	2
B12	4	1	1	1
B13	1	1	1	1

Table 7. Fixation Duration of Each Sample

Type of Bottle	Item Code				Kansei Word		
	X1	X2	X3	X4	Aesthetic (s)	Ergonomic (s)	Simple (s)
B3	2	1	1	2	1.212	0.966	1.572
B4	1	4	2	2	1.187	1.226	0.792
B5	2	2	2	2	1.187	1.398	0.948
B6	3	2	1	2	1.609	1.102	1.365
B7	1	4	2	2	0.943	1.448	0.964
B8	1	3	1	2	1.441	1.026	1.343
B9	1	1	2	2	1.095	1.026	0.743
B10	1	3	1	2	1.271	1.828	1.297
B11	1	4	2	2	1.273	1.485	0.678
B12	4	1	1	1	0.718	0.527	1.813
B13	1	1	1	1	1.305	0.663	1.376

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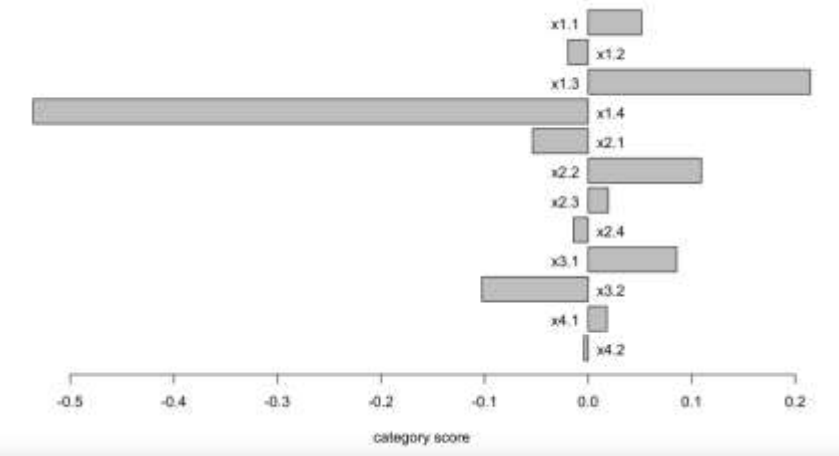

Fig. 4 QT1 Results for the Kansei Word Aesthetic

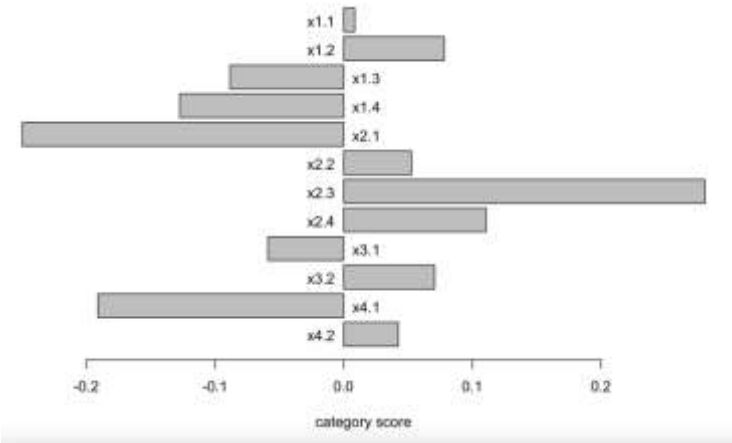

Fig. 5 QT1 Results for the Kansei Word Ergonomic

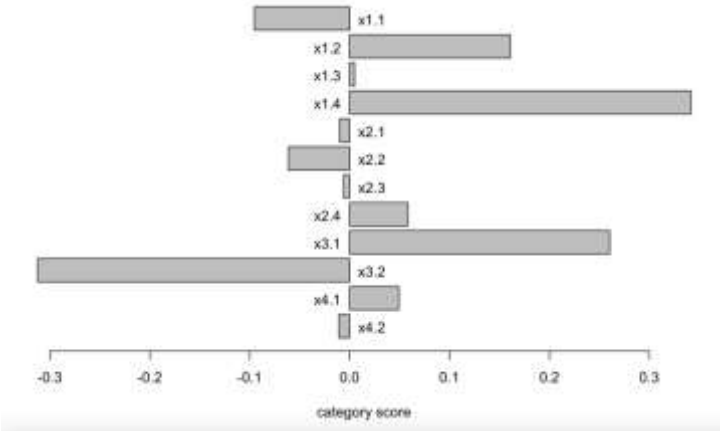

Fig. 6 QT1 Results for the Kansei Word Simple

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Based on the QT I analysis, it was found that the bottle cap (p = 0.00332413) and the bottle motif (p = 0.00010796) have a significant influence on the design of tea beverage packaging related to the Kansei word simple. Figure 6 shows the results of the QT I, indicating that the design elements associated with the Kansei word simple are the straw cap type (X1.4) and the plain motif type (X3.2).

Based on the results obtained from processing QT I using R software, various final design options for Tea Beverage Packaging were identified, which can be seen in Table 8.

4. Discussion

Table 8 shows the design specifications desired by consumers for tea beverage packaging based on the integration of Kansei Engineering and eye tracking methods. Products designed according to user preferences have the potential to significantly enhance consumer appeal. This is because products designed with consideration for user desires, needs, and preferences are more likely to elicit an emotional response from consumers. Furthermore, products that meet consumers' need and expectation tend to have higher visual and functional appeal, thus providing significant added value. The elicitation of visual impressions with Eye-Tracking means to derive objective data of customers' product perception and evaluation. Applying Eye-Tracking in the Kansei Engineering design assessment approach may help match customers' perceptions of a product with its functional and technical specifications, resulting in products that have a high perceived quality[24].

Kansei Engineering is applied to associate emotional reactions with specific design features. This method ensures that the design correlates with the emotional and psychological elements of the consumer, which in turn increases the product's appeal. On the other hand, Eye Tracking technology reveals which parts of the packaging are most successful in attracting attention and how consumers interact with the design visually. With this pattern analysis, designers can identify which components are most efficient in captivating consumers and their influence on perception and decision-making. This is beneficial in refining the packaging design to make it more appealing. This combined method creates a more detailed and effective design strategy that responds to both subconscious emotional reactions and conscious visual appeal. The application of Quantification Theory Type I (QT I) along with data from Eye Tracking facilitates the measurement of the relationship between design elements and kansei words. This objective analysis allows for a more accurate understanding of the contribution of each design element to the overall appeal. By identifying the components with the greatest impact, designers can prioritize these elements to enhance the product's appeal. In conclusion, a deep understanding of how users view and interact with the product is vital in creating attractive packaging. The integration of Kansei Engineering and Eye Tracking makes the design process more user-focused by combining emotional and visual appeal. This approach results in packaging design that is not only visually appealing but also emotionally resonant, significantly increasing its attractiveness to consumers.

Previous research on tea packaging design confirmed that specific design elements such as color, shape, and texture have a significant impact on consumer perceptions and purchasing decisions, which is in line with the results of this study, which found that design specifications such as lid type, shape The bottle body and motif have a big influence on the attractiveness of the packaging [25].

Table 8. Final Result Design Tea Beverage Packaging

Kansei Word	Bottle Cap	Bottle Body	Bottle Motif	Bottle Cross-Section
Aesthetic	Sport cap*	Convex	Plain*	Square
Ergonomic	Flip cap	Waves	Texture	Round
Simple	Straw cap*	Serrations	Plain *	Square

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Thus, the findings from Wang's research strengthen the validity of the approach used in this research, providing additional evidence that the integration of Kansei Engineering and eye-tracking is an effective method for creating visually and emotionally appealing packaging designs, thereby increasing attractiveness and potential product purchases[25].

This study has several limitations. First, the small sample size and lack of participant diversity, particularly in the eye-tracking experiment with only 10 participants, may limit the generalizability of the findings. Second, the experiments were conducted in a controlled environment that might not reflect real-world conditions where many factors influence consumer behavior. Third, the study's focus on specific design elements such as the bottle cap, bottle body, bottle motif, and bottle cross-section may overlook other important aspects of packaging design such as color, typography, and branding. Lastly, consumer preferences can change over time and vary across cultures, thus the findings of this study may be limited to specific cultural and temporal contexts. These limitations suggest areas for improvement in future research to address these considerations. Future research can focus on several areas to address the existing limitations. First, studies with larger and more diverse sample sizes can enhance the generalizability of the findings. Second, conducting experiments in real-world environments will better reflect actual market conditions. Third, research should include additional design elements such as color, typography, and branding for a more holistic view. Fourth, longitudinal studies can track changes in consumer preferences over time. Fifth, cross-cultural research can help understand differences in preferences across various cultural contexts. Lastly, the use of advanced technologies such as VR or AR can simulate shopping experiences more accurately. By addressing these limitations, future research can provide a more comprehensive understanding of consumer behavior and packaging design.

5. Conclusion

In designing tea beverage packaging using kansei and eye tracking, the steps involved are identifying kansei words, conducting Semantic Differential I, eye tracking, and Quantification Theory Type I using R software. Initially, 21 kansei words were collected, followed by the distribution of the Semantic Differential I questionnaire and factor analysis, resulting in 5 factors, which were then reduced to 3 key kansei word concepts: aesthetic, ergonomic, and simple. Next, Quantification Theory Type I was used to directly analyze and quantify the relationship between each kansei word and the design elements of each sample. The average design characteristic value of each sample was obtained from the total fixation duration in eye tracking for a kansei word. The results from processing QT I using R software were in the form of plot diagrams. Based on the QT I analysis, it was found that the bottle cap (p= 0.006635) and bottle motif (p=0.047494) had a significant influence on the design of tea beverage packaging related to the kansei word aesthetic. According to the QT I analysis, it was found that there was no significant influence on the design of tea beverage packaging related to the kansei word ergonomic. Furthermore, based on the QT I analysis, it was found that the bottle cap (p= 0.00332413) and bottle motif (p= 0.00010796) had a significant influence on the design of tea beverage packaging related to the kansei word simple.

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