Product Infographic Labeling on Food Packaging

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ABSTRACT

This study examined the benefits of additional extrinsic cues on food packaging and the influence of informative content labels on consumer's perception based on product quality. With the development of trading industries; product circulation has increased rapidly, therefore placing more importance on product packaging and labeling strategies. Product packaging and communicative element has become a critical factor, towards how consumers are influenced when making decisions to select items. Generally, consumers do not regard sales packaging as separate from the product it contains. The product package's communicative element is divided into visual elements and information elements. Visual elements consist of colors and images while information elements relate to particular instruction and usage of the product. The label is used to identify which product matches with the consumers' needs since the label allows buyers to distinguish one product from another. In the design field, product packaging design is considered a critical element for distinguishing one from another, influencing consumers' purchasing decision.

More specifically, this study examines what variation in label styles and existence brings impact subsequences of quality aspects. In this study, participants were shown various fresh meats packaging labels, termed "product infographic labeling" in the experimental

stages of both design and content created as ordinary labeling. We conducted a survey, which was followed up with interviews to help analyze customer behavior and other ideas and beliefs. In addition, we conducted tests and collected and analyzed data to indicate and identify significant points showing additional extrinsic cues pertaining to product information by using repeated analysis of variance (ANOVA) and additional analysis through the eye-tracking data method.

The analyzed eye-tracking data showed that visual attention was significantly devoted to an additional infographic label. When these additional data were analyzed through the ANOVA method, we discovered that the infographic approach on meat packaging positively influenced consumer's perception of product quality.

Furthermore, the research discovered that the proportionality ratio of an area of interest on meat packaging affects how consumers interpret and process product quality. Additionally, an infographic labeling approach for meat packaging can decrease average time consumption on consumers' purchasing behavior of meat products respectively. As a result, we provide a design reference for meat product labeling and positioning placement to promote consumers' perception of product quality.

These findings lend valuable data that highlight how infographic labeling design has a greater impact on general product evaluation and quality expectations respectively. As a result, we are able to provide a design reference for fresh food labeling and positioning placement to promote consumers' perception of product quality. This highlights multiple-labeling design impacts more general product evaluation and quality expectations respectively.

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LIST OF PUBLICATION AND CONFERENCES

Publication

Charusiri, P., Kaori, Y., & Tanaka., T., Benefits of Extrinsic Cues on Fresh Food Package,

The 18th International Conference of Asia Digital Art and Design, pp. 34-38, 2020.

Charusiri, P., Kaori, Y., Wang, Y., & Tanaka., T., Benefits of Product Infographic Labeling on Meat Packaging, International Journal of Asia Digital Art and Design Association, Vol.25, No.2, pp. 30-38, 2021.

International Conference

Pasu Charusiri, Kaori Yamada, Takamitsu Tanaka, Benefits of Extrinsic Cues on Fresh Food Package, The 18th International Conference of Asia Digital Art and Design, December 14, 2020

Conference in Japan

Pasu Charusiri, Kaori Yamada, Takamitsu Tanaka, An additional communication extrinsic cue impacts the consumer's perception of product quality. (Communicating sensory through fresh food package labeling in the context of a supermarket), 令和元年度芸術科学会東北支部大会，January 25,2020

Pasu Charusiri,Takamitsu Tanaka：The study on the influence of info-graphical information on the meat package,The Society for Art and Science-Tohoku Section 令和2年度 第2回芸術科学会東北支部研究会，April 24,2021

Pasu Charusiri, Kaori Yamada, Takamitsu Tanaka, Additional Labeling on fresh food packaging reflects the perception of product quality, 令和 2 年度第 1 回芸術科学会東北支部研究会，July 11,2021

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CHAPTER 1

INTRODUCTION

1.1 Research Background and Objectives

Product decision-making is influenced by a complex set of variables that go beyond the product's characteristics [1]. Product labeling and packaging have become critical factors, in how consumers are influenced when deciding to purchase items. For example, a consumer's buying behavior is influenced by personal preference, cultural background, social movement, and psychological factors [2]. In general, functions of packaging are categorized into two primary elements: (1) physical elements and (2) communicative elements. While the packaging's physical structures are ensuring the facility of usage, transport, storage, and disposal process, respectively [3], communication features, on the other hand, are an initial point of contact between consumers and suppliers.

The product packaging's communicative element is divided into visual elements and information elements [4],[5]. Visual elements consist of colors and images, while information elements relate to particular instruction and use of the product. In many cases, consumers rely on a specific set of information on packaging labels to determine the intention of demand

[6],[7]. With the development of the trading industries, product circulation has increased rapidly, therefore placing more importance on product packaging and labeling strategies.

These have been investigated not only from a marketing perspective but, also for their design elements. Packaging design has been widely studied, especially in the area of visual cues that most impact consumers' attention and attitude [8],[9], the effectiveness of presented product infographic labeling on users' attraction [10],[11], an interrelation of language characteristic with the product's value [12], the effect of proportion and ratio on packaging design [13], and the influence of packaging colors to suit the consumers' preference [14].

In general, to acquire products, consumer purchase ideas are based on factors related to the product itself, including expected quality, perception of the product's intrinsic and extrinsic cues, and personal satisfaction and product's cost [15]. In the design field, product packaging design is considered a critical element for distinguishing one from another, influencing consumers' purchasing decision. Because of the location of the label and positioning of the product, which relate to the label's size and ratio, design elements have played a significant role in a consumer's decision making [16]. This refers to a set of processes by which an individual becomes aware of and interprets information concerning meat products. However, since relatively few studies have illustrated the relationship between the communicative elements on the product's packaging and the perception of the product's

quality, a research gap exists. Consumers often locate a certain product based on their visual perception, and their interpretation focuses on the expected quality of the product in advance; the perceived product quality is usually different after consumption following their decision [17].

Foods are nondurable products, and buying groceries is an essential part of everyday life. Unlike typical food packaging, fresh food packaging is mostly designed for in-house branding products, revealing little to no influence on marketing and branding. In-house branding products described as a brand name used by the retailer for the product including product line made specifically for the retailer. Product packaging and labeling has become a critical factor, towards how consumers are influenced when making decisions to purchase items.

Significant numbers of products in the market rely on extrinsic cues, and the information provided falls back on self-explanation. This study recognizes that consumer satisfaction is based on their interpretation of the product's physical characteristics, the communication around the product, or the combination of both [18]. In most countries, fresh food and pre-packaged food products require a food label that displays obligatory information including name, ingredients, quantitative declaration, and price. In many cases, a consumer's reliance

on a product's visual appearance may follow from either a lack of relevant information or an overwhelming abundance of information.

Under these circumstances, a product's packaging and labeling bring about certain effects influencing how consumers make purchasing decisions because they allow consumers to make an inference about the quality and type of product [19]. In a study conducted to evaluate the link between product design and consumer behavior, results showed that a creative and complex design will cause most consumers to be more willing to purchase one product over another. In contrast, additional buying behaviors of modern consumers affect the sales of goods, for example; buyers are often looking for a way to reduce time spent on food shopping and food preparation [20].

1.2 Thesis Overview

In this study, the goal of the research was to identify and the distinguished relationship between consumers' perception of product quality and the information displayed on the package. In order to understand the criteria for the decision-making process, this study examined the extrinsic cues on fresh food packages and alternative approach on a design element on package labels on consumers' perceptions based on product quality. This study was performed by generated and developed the new types of labeling on meat packaging.

Participants were selected to answer a questionnaire, and rate their opinion on how they perceived the product's information. In addition, tests were conducted and data were collected and analyzed to indicate and identify significant points in their investigation process. In order to, provide a reference design element on food-labeling on product aspects that consumers claim to take into consideration in their food purchase decision. This study aims to provide useful information and data that will significantly change the way consumers react to fresh food packaging.

Chapter 2 Literature review

In this chapter, we define and discuss similar previous studies that were performed related to our study. The data previously collected along with the parameters from other studies will be shown. In this chapter elements on meat, packaging will be defined, covering the area of meat packaging's communicative element, meat packaging's label positioning, size, and placement including the colors of meat package labeling respectively. Also, in this chapter presented the essential elements that affect consumers' perception of product quality as well as the process of product information perception.

Chapter 3 Research Methodology

In chapter 3, the methodology used for this research is clarified. The scope of the study and the experiments will be explained in this chapter. The label design samples used in this research is presented and explained. The further part in this chapter, explained the analysis procedure for the data collecting process.

Chapter 4 Analysis and Results

In chapter 4, the results from the experiments are shown. The results were analyzed through the ANOVA method. In this chapter, the analysis of the results provided valuable data leading to greater in-depth understanding of the benefits of the infographic label approach for food packaging and the influence of infographic labels on consumers' perception of product quality. In addition, the preference responds rate comparison among testing subject were displayed and analyzed.

Chapter 5 Conclusion and future works

Chapter 5 is the conclusion of this research. This chapter discussed potential use of the study results, providing a design reference for food product labeling and positioning placement to promote consumers' perception of product quality. These findings lend valuable

data that highlight how infographic labeling design has a greater impact on general product evaluation and quality expectations.

Appendix

This chapter is divided into two sections as following detail:

Appendix A – In this section, preliminary experiment A (Product placement) and preliminary experiment B (Information on the fresh food package label) were observed and analyzed.

Appendix B – In this section, the research survey, questionnaires and materials for the experiment were clarified. To be more specific, we investigated the different approaches of food package labeling on fresh food packages in Thailand, Japan, and China.

Definition and Terms

- *Packaging:* a form of protection, containment, handling and delivery system including preservation of goods from producer to consumers

- *Label:* a presented form of communicating information of the product

- *Perception:* perception is a set of the process by which individual becomes aware of and interpret information about the environment. Perception is concerned with the way in which we selected and recognize sensory data presented. In this study,

perception is the visual interpretation of a particular item selected before the consumers decided to purchase the product.

- *Infographic-labeling:* In this study, infographic-labeling is a design element that organizes significant visual language together in a comfortable and easy way to assist viewers to receive needed information.

- *Product quality:* In this study, product quality is an expected quality of the product that meets customer demands. In this study the product quality is based on an extension in which the element on packaging design approach affects their perception in seven criteria: (1) design aspect, (2) reliable aspect, (3) recognizability aspect, (4) product value, (5) attractiveness, (6) personal satisfaction, and (7) communication ability.

CHAPTER 2

LITERATURE REVIEW

2.1 Previous study

In preliminary experiment, a variation of fresh meat packaging prototype with a labeling design was created to be used for study as testing subjects (Figure 1.1). To investigate the influence of extrinsic cues that affects a consumer's perception of product quality, sets of the label samples were created under the different approach in design variation to test the influence of infographic labeling, multi-labeling, differentiation of colors printing and black and white of the label, and the orientation and alignment of the label to define the extent of visual perception of product labeling that can promote the visual perception of product quality.

In general, most of the retail and sales associate places employed the strategy of planogram for their products placement. A planogram, defined as a pattern of product placement that potentially maximizes the sales of the product. As the perception of a potential buyer is associated with their visual ability, the eye level is critically affecting the sales of the products. Another factor that affects the potential sales of the product is the placement and

the positioning of the product on the shelf. A large number of scholars have been studied the

placement of the product on the vertical placement systems. However, the food-related

product is generally placed on the horizontal placement which is needed to determine and

clarify the differentiation. As part of this, exploration and experiment on the differentiation of

vertical placement and horizontal placement need further investigation in order to explore and

provide a design reference for food-related product placement that reflects the quality of the

product. The purpose of the research is to define the extent of visual perception of product

labeling that can promote the visual perception of product quality. More specifically, to what

variation in label styles and existence bring impact subsequences of quality aspect. (Figure

1.1)

In this preliminary experiment, a variation of fresh food packaging prototype with

labeling design created using Adobe Illustrator and Adobe Photoshop to be used for study as

testing subjects; intended to determine participants' investigation procedure and perception

on a design differentiation as shown in Figure 1.1. A testing subject is defined as a made-up

food product commonly found on the shelf of a supermarket that resembles and replicates

food labeling including imagery and information. The set of samples placed on product shelf

were setup in a controlled environment, stimulating the context of supermarket environments.

A total of 24 participants were asked to select a testing sample; by choosing the subject

believed to contain the highest value in quality. The performing tasks were recorded and

analyzed through an eye-tracking device, along with an in-depth interview regarding the

participant's selection.

Figure 2.1 Preliminary Experimental Setup and Testing Samples

The overall results revealed that multi-labeling and infographic labeling on packaging

significantly affected the participant's perception of product evaluation. An analysis from the

eye-tracking data of 24 participants, along with an in-depth interview regarding the

participant's selection, suggested that extrinsic cues on fresh food packages are identified as

an optimal influence of the consumers' perception of product quality. The eye tracking device

data results from 24 participants, revealed no prominent data for the food-related product

navigation pattern and placement that related to the final decision making. In contradiction to

the typical product placement on vertical alignment, the horizontal placement applied in

food-related product were solely rely on the product self.
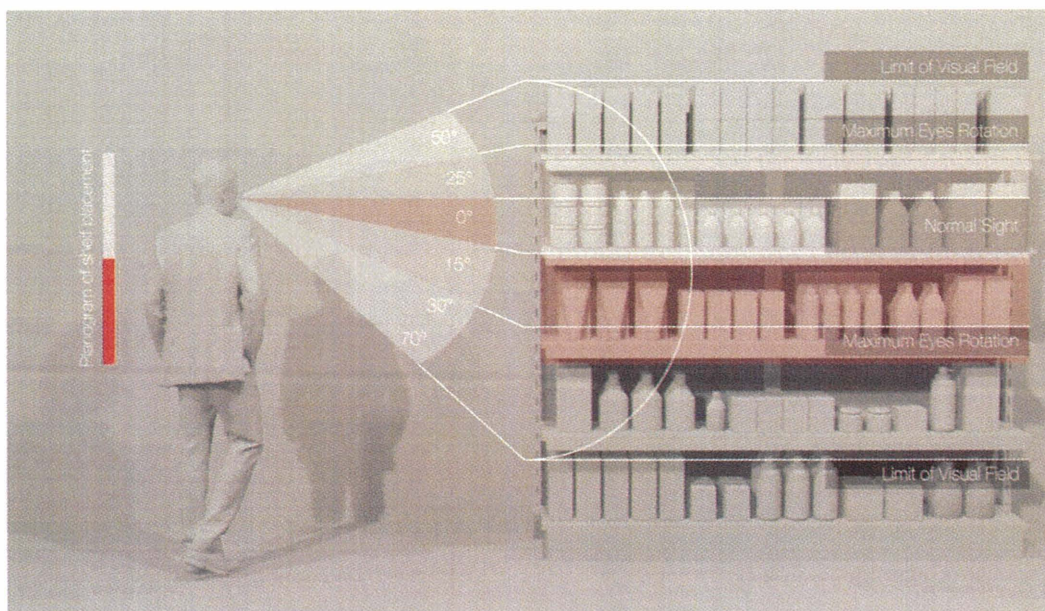
Figure 2.2 Typical Planogram for vertical shelf products placement

The extrinsic cues increased the awareness of consumer behaviors as part of a decision-

making process [21]. The preliminary experiment on meat packaging label also revealed the

way in which participant perceived information of on the label. The packaging label allows

them to distinguish one product from another. However, we realized that to discover and

obtain a more comprehensive conclusion, the coordination of infographic labeling and multi-

labeling will help further explain the significance of such integration. As part of this,

exploration and experiment on the differentiation of infographic label design characteristics,

linguistic labels, labeling size, labeling positioning, and orientation need further investigation

in order to explore and provide a design reference for fresh food labeling and positioning to

promote consumers' perception of product quality. (Figure 1.3)

Figure 2.3 Preference Statistic Chart results from preliminary experiment

2.2 Food packaging elements

In the consumers' evaluation process of a product, it is standard practice to begin with the categorization of the product's extrinsic and intrinsic cues. The purpose of the 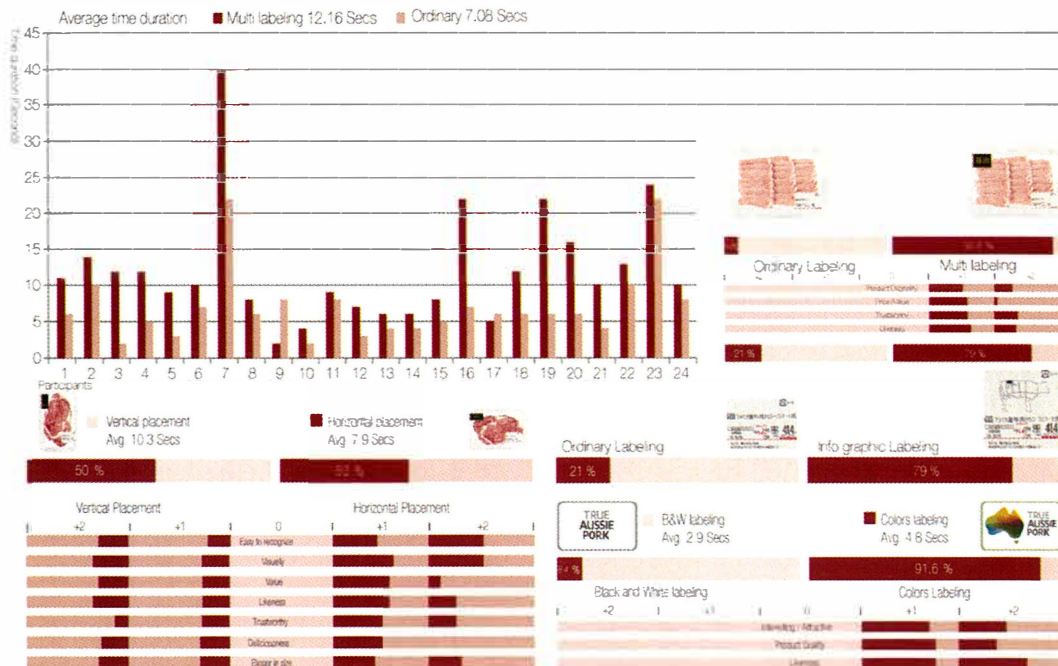research is to define the extent of visual perception of product labeling that can promote the visual perception of product quality more specifically, to what variation in label styles bring impact subsequences of quality aspect. As in this case, the visual and information elements are combined in compliance with regulations of food packaging industries. Product packaging and labeling has become a critical factor, towards how consumers are influenced when making decisions to purchase items. For example, a consumer's buying behavior is influenced by personal preference, cultural background, social movement, and psychological factors [2]. In general, functions of packaging are categorized into two primary elements; which are 1) physical elements and 2) communicative elements. While physical structures of the package are ensuring the facility of usage, transport, storage, and disposal process respectively. Also, the physical elements of packaging can be described as any package or container in which the product is marked to suit the purpose of sale, or by which the useful information is delivered to the consumers.[22] Packaging can be described as the process of designing and creating a container of protection for goods. [23], the communication features, on the other hand, are an initial point of contact between consumers and suppliers. In the

marketing field, packaging and label is a medium to inform potential consumers as well as draw their attention to the product. Due to the fact that, consumers do not regard sales packaging as separate from the food product it contains [24]. For this reason, the research explored aspects of label design, including graphics and related information, which influence consumers' perception of product quality. This study aims to explore the influence of graphical elements on fresh food packages due to the perception of product quality. More specifically, the research explored the influence of meat product labeling design with graphic information, labeling placement, ratio, and size of labeling.

2.2.1 Food packaging's communicative element

The product package's communicative element is divided into visual elements and information elements [4], [5]. Visual elements consist of colors and images while information elements relate to particular instruction and usage of the product. In most countries, fresh food and pre-packed food products require a food label that displays obligatory information including name, ingredients, quantitative declaration, and price as a mandatory information. (Figure 1.4).
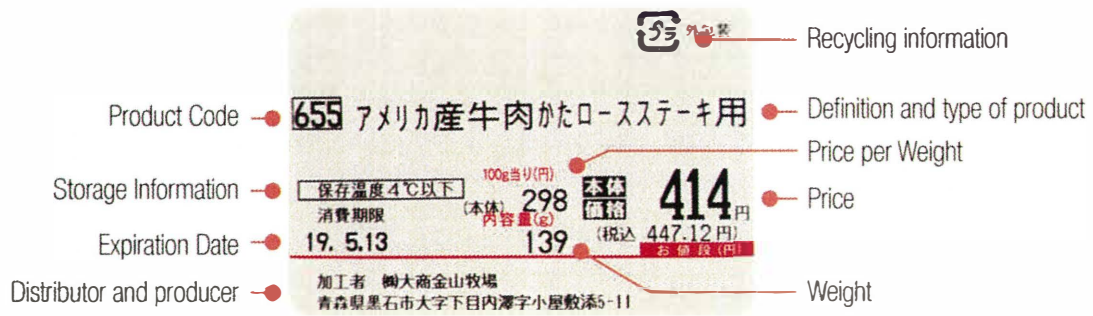
Figure 2.4 An example of typical fresh food product label in Japan

In decision making process due to the stage of acquiring the products, consumers rely

their personal impression of the product through the information provides on the product self.

On the other word, product's information plays a critical role in their decision-making

process. Packaging design has been widely studied especially in the area of visual cues that

bring the most impact on consumer's attention and attitude [8], [9]. The effectiveness of

presented informative content label to user's attraction [10]., an interrelation of language

characteristic to product's value [11]., and the influence of packaging colors to suit the

consumers 'preference [12]. In general, to acquire products, consumer purchase ideas are

based on factors which are related to the product itself including; expected quality, perception

of product's intrinsic and extrinsic cues, and personal satisfaction and product's cost [14].
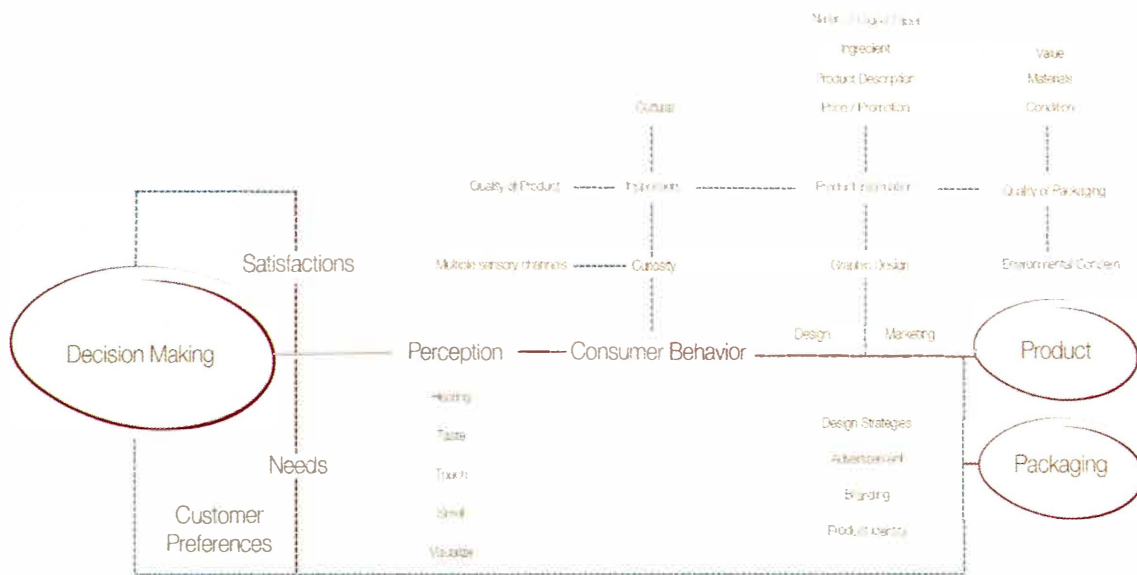
Figure 2.5 Diagram illustrated consumer behavior and the decision-making process

2.2.2 Positioning, size and placement of food packaging label

It is important to note that the concept of proportion has a significant role in the art and

design aspect. In food-related products industries, labeling is undoubtedly a key element to

create certain ratios and define an aspect consequently describing the proportion on the

package. The required obligatory information of food products must be displayed on the label

as an industry regulation. The label is used to specifically identify which product matches the

consumers' needs since the label allows buyers to distinguish one product from another. A

significant visual element for identifying labels is where the label overlays the product in the

meat package, in the foreground. It is certain that various effects due to the placement and

positioning of the labeling in relation to package size and shape exist. In addition, in the design field, the concept of proportion has a significant role in art and design aspects.

One of the most frequently used methodologies, applied to a broad range of fields, from architectural design to artistic work, is known as the "golden ratio". Evidence of 1:1.618 can trace back to the time of the ancient period. In the academic-related field, an application of the golden ratio to consumers' buying behavior has been explored and analyzed [25],[26].

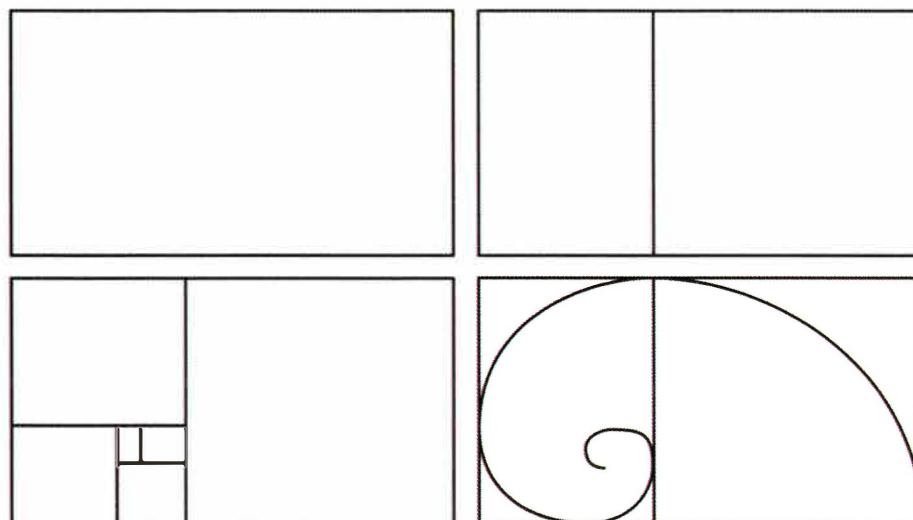Figure 2.6 A sample of utilization theory of the golden ratio in design

However, relatively few studies have focused on applying the golden ratio to investigating the perception of product quality. For this reason, this research explored the influence of the golden ratio-based design placement and size of meat packaging labeling on

the perception of product quality. The basis of this study is formulated on previous research and literature and other recognized label design characteristics for the purpose of meat packaging and labeling, which recognize mainstream international standards and regulations. We believe that the results from this study would provide useful information to designers and producers, enabling them to determine the most effective informative elements to apply to their fresh meat products. Specifically, these findings will also help designers and manufacturers choose a suitable design that could influence consumers' perception related to products' quality, within a designated market.

2.2.3 Colors of the food packaging label

Visual perception, especially the color perception of food products, influences how consumers perceive products in various ways.[27]. The consumer's perception of food is primarily affected by the various sensory properties of the food itself. In general, color plays an essential role in the potential decision-making of consumer's process, specific colors set can draw consideration. Different colors also signify different interpretations of consumers. [28] Furthermore, colors are directly associated with product liking [29], and people tend to correlate specific colors with particular tastes [30], [31]. Color can be used by the supplier to

influence how people think and behave toward the product, and how they interpret any information on the product.

2.3 The process of the information conceiving

Enormous numbers of products in the market rely on the extrinsic cues and information provided falls back on self-explanation. The label is used to identify which product matches with the consumers' needs since the label allows buyers to distinguish one product from another. In many cases, consumer's reliance on a product's visual appearance may follow from either a lack of relevant information or overwhelming of abundance of information. A majority number of scholars indicate that visual elements can convey the essential message in an effective way that can help people comprehended the product's contents effectively.

In general consumers do not regard the sales packaging separate from the food product it contains [22]. The purpose of the research is to define the extent of visual perception of product labeling that can promote the visual perception of product quality. More specifically, to what variation in label styles and existence bring impact subsequences of quality aspect. As in this case the visual elements and information elements are combined in compliance with regulations of food packaging industries.

2.4 The perception of product quality

In general, to acquire products, consumer purchase ideas are based on factors which are related to the product itself including; expected quality, perception of product's intrinsic and extrinsic cues, and personal satisfaction and product's cost [15]. Which refers to a set of processes by which an individual becomes aware of and interprets information concerning each food product. In food-related products, and the consumers interpretation focusing on the expected quality of the product in advance; the perceived product quality is usually different after consumption following their decision [17]. Unlike typical food packaging, fresh food packaging mostly designed for in-house branding products, reveals little to no influence on marketing and branding.

Multiple factors such as packaging size, shape, design, and materials can influence a purchasing decision. It stands for a reason, that a physical approach in food packaging design can be redefined to suit the purpose of appealing, motivating, and inspiring to potential buyers. Despite that, the effective communication of product advantage through the packaging design determines the consumer's first and, in many times, lasting impression of the product. As consumers pay more attention to the way the product is presented than to the product itself.

Perceiving product quality is an important concept for both suppliers and consumers. The consumer's perception of product quality is linked to the consumer's perception and is influenced by various characteristics of the product.[32] In a potential consumer view, in fact, several aspects contribute to defining the quality of a food product. There are not only intrinsic qualities such as expecting taste and the use of the product but including external factors such as origin and labeling[33], [34].

Reference to the study on Benefits of Extrinsic Cues on Fresh Food Package (Charusiri, P., Kaori, Y., & Tanaka., T., 2020). The survey conducted in 2020 has shown that consumer perception of the quality of food products is related to the appearance of the product, product reliability, product value, product recognizability, product attractiveness, product information, and personal satisfaction respectively.

CHAPTER 3

RESEARCH METHODS

3.1 Procedure

In this research, we used a variation of fresh meat packaging prototype with labeling design created using Adobe Illustrator and Adobe Photoshop as testing subject; we intended to determine the participants' investigation procedure and perception of design differentiation, as shown in Figure 1.7. A testing subject is defined as a made-up meat product commonly found on the shelf of a supermarket that resembles and replicates food labeling, including imagery and information. The testing subject has been used as part of online questionnaires (Figure 1.7) The questionnaire survey was conducted over a period of 21 days, (January 5 -26, 2021). An online survey questionnaire can be found at shorturl.at/GQVY1.

3.2 Information of labeling design

To investigate the influence of extrinsic cues that affects a consumer's perception of product quality, five sets of the label samples representing beef, pork, and chicken products were created under the different design approach by applying the golden ratio principle,

including TA: ordinary labeling; TB: graphical labeling with 38.22 % area coverage (golden

ratio proportion and placement labeling); TC: graphical labeling with 38.22 % area coverage

(golden ratio proportion center placement labeling); TD: graphical labeling with 61.78 % area

coverage (contradiction of golden ratio proportion center placement labeling); and TE:

graphical labeling with 100 % of area coverage (Figure 1.7).
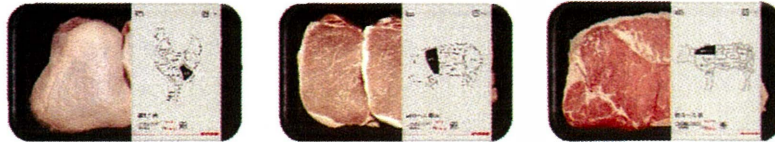
Figure 3.1 Testing Samples TA, TB, TC, TD, and TE

For this study experiment, the participants were composed into 2 set; Set (1) 200

participants (Group A) and Set (2) 27 participants (Group B). Participant groups A and B

comprised individuals from three different countries Japan, China, and Thailand in order to

acquire international perceptions and views. To avoid any deviations in the results, the

respondents included those who did not know Japanese characters. A total of 227 participants

were asked to evaluate a testing sample composed of 108 males and 119 females. The age

range of participants was between 18 and 64 years of age as they are prospective consumers

that buy groceries as an essential part of everyday life. A variation of labeling design was

created to test the influence of product infographic labeling, size of labeling, and placement of

labeling, respectively.

Testing Subject type T(TL)
Typical labeling

Testing Subject type T(BW)
Black and White labeling

Testing Subject type T(BG)
Black and Gold labeling

Testing Subject type T(GW)
Green and White labeling

Testing Subject type T(BLW)
Blue and White labeling

Testing Subject type T(RW)
Red and White labeling

Figure 3.2 Testing sample T(TL), T(BW), T(BG), T(GW), T(BLW), and T(RW)

To investigate the influence of colors on the food labeling design that affects a

consumer's perception of product quality, six sets of the label a sample representing a

chicken product was created under the different design approach by applying the color on the

labeling, including T(TL) : typical labeling colors; T(BW) : labeling with black background

and white information; T(BG) : labeling with black background and gold information;

T(GW) : labeling with green background and white information; T(BW) : labeling with blue

background and white information; T(RW) : labeling with red background and white

information. (Figure 1.8).

To investigate the influence of labeling placement on the perception of product

quality. A set of six samples were created to determine whether or not the positioning,

number, and style of product labeling affect the consumers' perception during the

investigation process. Six sets of the label a sample representing a chicken product was

created under the different design approach by applying the different labeling placement

methods, including T(OL) : sealed package with ordinary labeling, T(ML) : sealed package

with multi-labeling on left, T(MR) : sealed package with multi-labeling on right, T(CP) :

sealed package with graphical labeling on center, T(GP) : sealed package with golden ratio

graphical labeling , T(CG) : sealed package with graphical labeling on center (contradiction

to the golden ratio).

Figure 3.3 Testing sample T(OL), T(ML), T(MR), T(CP), T(GP), and T(CG)

3.3 Data Collection

3.3.1 Data Set (1) Collection

For the collection of data collection set (1), 200 participants (Group A) were asked to rate

the extension in which the labeling design approach affects their perception in seven criteria:

(1) design aspect, (2) reliable aspect, (3) recognizability aspect, (4) product value, (5)

attractiveness, (6) personal satisfaction, and (7) communication ability. A Likert scale [35]

was used for each sample ranging from 1 to 5 (1 being the lowest ranking and 5 being the

highest ranking) in order to determine the effect of the labeling design approach and labeling

placement on the consumers' perception of product quality. The data obtained from data set

(1) were analyzed through a repeated measures ANOVA method and a pairwise comparison

method to identify aspects of label design, including graphics and related information that

influence the consumers' perception of product quality accordingly.

3.3.2 Data Set (2) Collection

Data collection set (2) for Group B recorded a total of 27 evaluation processes on

testing sample tasks, which were analyzed through (a) an eye-tracking device, and (b) an in-

depth interview regarding the participant's selection. During the experiment, the

differentiation between focusing time and visit count for each sample was recorded by the eye-

tracking device and later analyzed using the visual attention method and the ANOVA method

regarding the evaluation process performed by each of the participants.
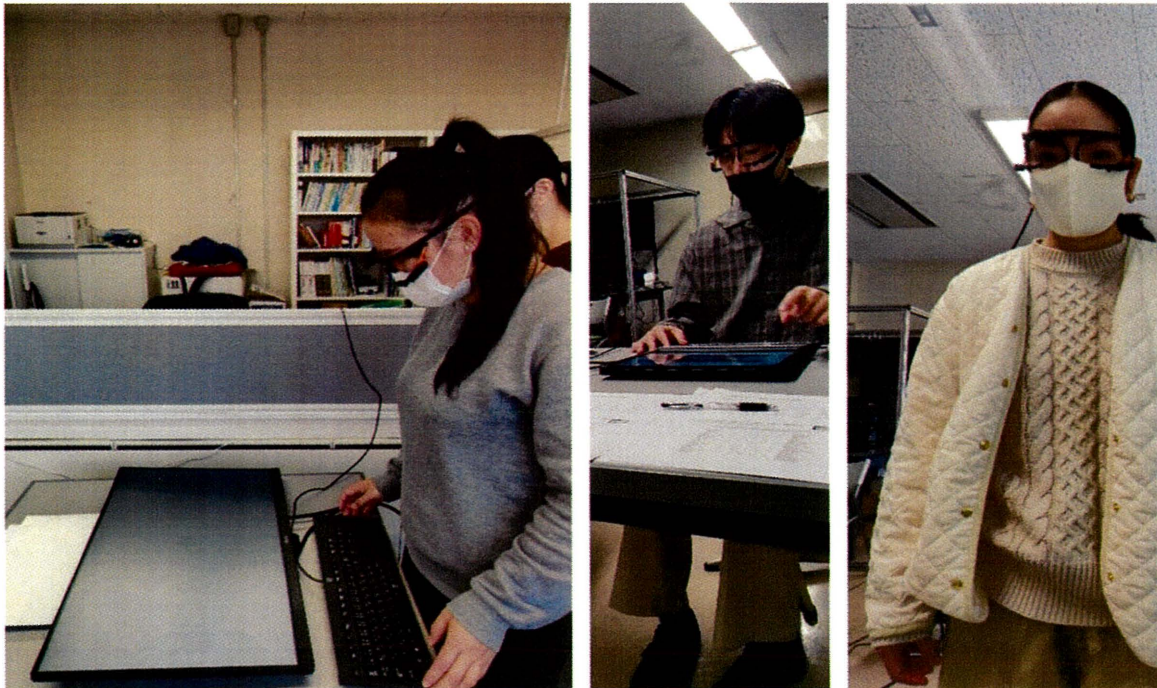
Figure 3.4 Group B experiments, eye-tracking device data collecting process

A proposed interview was set up as a qualitative measure after the survey responses

were evaluated to expand our scope of understanding and after the initial testing was

conducted using the visual detection method. The interview asked follow-up questions to ask

participants more in-depth questions concerning their perception of label information and

other imagery displayed. The purpose was to determine what aspects of labeling influenced

them when differentiating between the levels of product quality. These responses would offer

valuable support to our initial investigation of visual detection so that we could make a

connection between the type of labels and the design features that were appealing and

influenced our participants in the product evaluation process, thus aiding in understanding the

benefits of additional extrinsic cues on meat packaging.

3.3.3 Data Set (3) Collection

For the collection of data collection set (3), 200 participants (Group A) were asked to rate the

extension in which the colors represented on meat product labeling design approach affects

their perception in four sections included (1) reliable aspect, (2) design aspect, (3) product

quality aspect, and (4) product preference. In order to determine the effect of the color of the

meat product labeling design approach on the consumers' perception of product quality, the

participants were asked to select one testing sample that best represent for each criterion

respectively. The purpose was to determine which color on food package labeling influenced

them when differentiating between the levels of product quality accordingly.

3.3.4 Data Set (4) Collection

In this session of an experiment, 200 participants (Group A) were asked to rate the

extension in which the labeling style on meat product labeling design approach affects their

perception in four sections included (1) reliable aspect, (2) design aspect, (3) product quality

aspect, and (4) product preference. In order to determine the effect of the labeling positioning and styles of the meat product labeling design approach on the consumers' perception of product quality, the participants were asked to select one testing sample that best represents each criterion respectively. The purpose was to determine which design approach on food package labeling placement influenced them when differentiating between the levels of product quality accordingly.
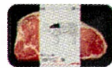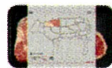
CHAPTER 4

ANALYSIS AND RESULT

4.1 Data Set (1) Group A Results

An analysis to determine preferences from the sample data preference regarding the

different labeling designs on meat packaging have been categorized into seven sections

included (1) design aspect, (2) reliable aspect, (3) recognizability aspect, (4) product value, (5)

attractiveness, (6) personal satisfaction, and (7) communication ability. To investigate what

impacted the participants' product quality perception, the result from 200 respondents (Group

A) was analyzed through the repeated measure ANOVA method with significance at 0.05.

On design aspect (1), the analysis of its characteristics revealed a statistical significance

between all five testing samples ($p = .001 < 0.05$). These findings revealed that the different

approaches on the labeling design of meat packaging are optimally affected by the

participants' perception of design appreciation. The result from the analysis showed that the

infographic labeling approach (TB type) had the highest mean rate at 3.950, while the

ordinary design label (TA) had the lowest mean rate at 1.995 score points, as shown in Table

4.1 and Figure 4.1.

Table 4.1 Repeated Measures ANOVA Analysis for TA, TB, TC, TD, and TE

(Participant Group A)

Type (N)		Design (M)	Reliability (M)	Recognizability (M)	Value (M)	Attractive (M)	Satisfaction (M)	Comunication (M)
	TA (200)	1.995	2.960	2.960	2.665	2.420	2.875	3.235
	TB (200)	3.950	3.890	4.070	3.825	3.985	3.970	4.255
	TC (200)	3.660	3.570	3.620	3.605	3.575	3.365	3.730
	TD (200)	3.770	3.350	3.555	3.355	3.500	3.200	3.450
	TE (200)	3.710	2.665	3.145	2.960	3.165	2.615	2.955
df P-value		4.00 < 0.01	4.00 < 0.01	4.00 < 0.01	4.00 < 0.01	4.00 < 0.01	4.00 < 0.01	4.00 < 0.01

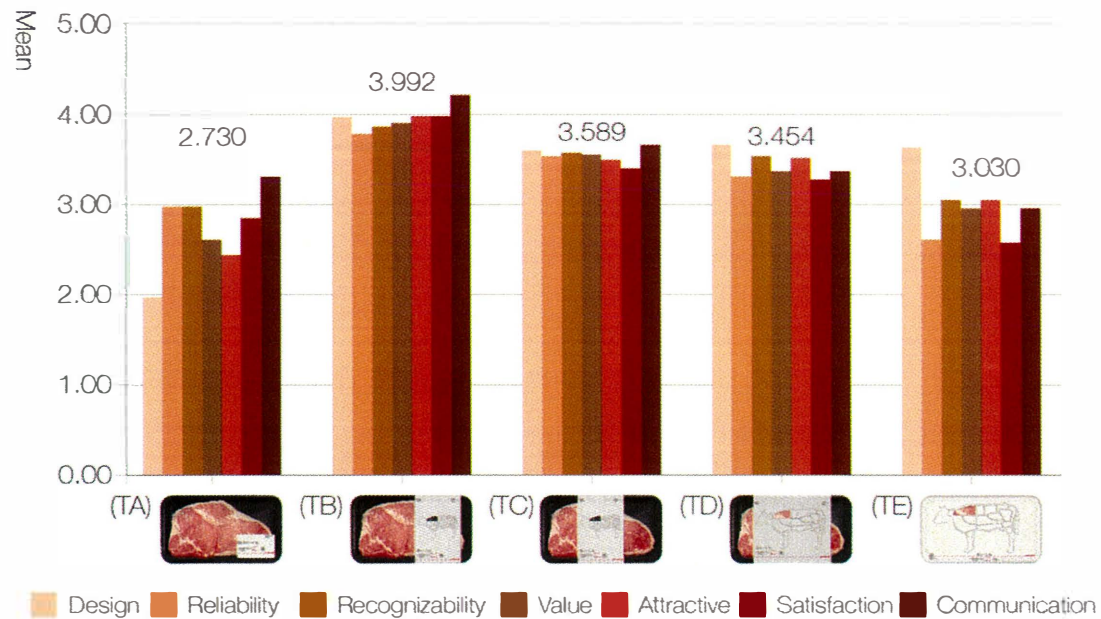(N): Number; (M): Mean; df: degree of freedom; P-value: Significance

Figure 4.1 Testing Samples TA, TB, TC, TD, and TE Rating Results Presented in Bar Charts

(Participant Group A)

To understand the differentiation of design aspects between labeling types, the

pairwise comparison method was applied to determine the difference in the design

appreciation aspect. As shown in Table 2, the multiple comparisons of design appreciation

rates between non-infographic label (TA) and infographic label (TB, TC, TD, and TE)

indicated a significant difference in the participants' preference for a design aspect. However,

the multiple comparisons between testing samples TC, TD, and TE showed no significant

differences. (Table 4.2)

Table 4.2 Pairwise Comparison on Design Preference

		Design				
					95% Confidence Interval for Difference	
(I)Type	(J)Type	Mean difference (I-J)	Std.Error	P-value	Lower Bound	Upper Bound
TA	TB	-1.955*	.094	<.001	-2.223	-1.687
	TC	-1.665*	.107	<.001	-1.969	-1.361
	TD	-1.775*	.124	<.001	-2.126	-1.424
	TE	-1.715*	.134	<.001	-2.096	-1.334
TB	TC	.290*	.067	<.001	.098	.482
	TD	.180	.088	.426	-.070	.430
	TE	.240	.107	.258	-.063	.543
TC	TD	-.110	.083	1.000	-.346	.126
	TE	-.050	.095	1.000	-.319	.219
TD	TE	.060	.094	1.000	-.207	.327

P-value: Significance; *.The mean difference is significant at the .05 level.

In the scope of reliability (2), the analysis result on product reliability is showed in

Table 1, revealing a statistical significance in the different design approaches to meat

packaging labels. The highest mean rate score from the 200 participants belonged to labeling

design type TB at 3.890 scale points. The multiple comparisons of product reliability were

significant between TA -TB, TA -TC, and TA -TD (p = .001 < 0.05). However, the

comparison between ordinary meat packaging's labeling designs (TA) and the 100%

coverage labeling approach (TE) showed no significant difference (p = .135 < 0.05). This

finding suggests that infographic labeling on a meat product can promote the products'

reliability. However, the limitation of the visual field where the labeling stamp placement

covered most of the packaging's surface area (TE) dramatically decreases the reliability of

the product with the lowest mean rate score points of evaluation at 2.665. The multiple

comparison results, as shown in Table 3, indicated the descending order of the reliability of

the design method for meatpacking labels, which can be placed in order as TB, TC, and TD,

while TA and TE are the least reliable labeling design approaches.

Table 4.3 Pairwise Comparison on Product Reliability

		Reliability				
		Mean difference			95% Confidence Interval for Difference	
(I)Type	(J)Type	(I-J)	Std.Error	P value	Lower Bound	Upper Bound
TA	TB	-.930*	.084	<.001	-1.168	-.692
	TC	-.610*	.097	<.001	-.885	-.335
	TD	-.390*	.120	.013	-.730	-.050
	TE	.295	.118	.135	-.041	-.631
TB	TC	.320*	.066	<.001	.133	.507
	TD	.540*	●91	<.001	.282	.789
	TE	1.125*	.199	<.001	.944	1.506
TC	TD	.220*	.068	0.14	.027	.413
	TE	.905*	.089	<.001	.652	1.158
TD	TE	.685*	.090	<.001	.429	.941

P-value: Significance; *. The mean difference is significant at the .05 level.

The further analysis on the influence of extrinsic cue affecting the perception of

product quality was focused on the scope of product recognizability dimension (3). In this

study, five different label design methods were tested, as shown in Figure B. The results of

the repeated measures ANOVA analysis (Table 1) showed that, the highest mean rate of

product recognizability aspect appertained to the TB sample, scoring an average of 4.070, and

the lowest score appertained to the TA sample at 2.960 score points. The multiple comparison

results shown in Table 4 allege the design approach of a TB sample to the product

recognizability aspect. The recognizability rate between label TB to TA, TC, TD, and TE

were statically significant ($p = .001 < 0.05$). The further analysis on the multiple comparison

results indicated that the TB label acquires the highest rate in the recognizability aspect,

followed by TC. However, no significant difference was detected in the multiple comparisons

between TA, TD, and TE.

Table 4.4 Pairwise Comparison on Product Recognizability

(I)Type	(J)Type	Recognizability				
		Mean difference (I-J)	Std.Error	P-value	95% Confidence Interval for Difference	
					Lower Bound	Upper Bound
TA	TB	-1.110*	.118	<.001	-1.444	-.776
	TC	-.660*	.124	<.001	-1.012	-.308
	TD	-.395*	.136	.042	-.782	-.008
	TE	-.185	.143	1.000	-.591	.221
TB	TC	.450*	.108	<.001	.143	.757
	TD	.715*	.109	<.001	.405	1.025
	TE	.925*	.124	<.001	.574	1.276
TC	TD	.265*	.078	0.08	.043	.487
	TE	.475*	.108	<.001	.169	.781
TD	TE	.210	.092	.236	.051	.471

P-value: Significance; *.The mean difference is significant at the .05 level.

The continual analysis of the repeated measures ANOVA results displayed in Table 1

illustrated the different perception aspects of the product value (4). The evaluation of results

on product value reached a top rate of 3.825 score points on labeling type TB, followed by

TA (3.665), TC (3.605), TD (3.355), TE (2.960), and TA (2.665), respectively. The results

from cross-analysis between samples are shown in Table 5; it was suggested that the

descending sort of design approach on consumers' perception of product value can be defined

as TB, TC, and TD, respectively, although the comparison on testing subjects TA and TE

showed no significant difference (Md = -.295, p = .107 > 0.05). The overall results suggested

the benefits of an infographic labeling approach to meat products with regards to the

perception of product value. However, in a specific approach to TE, where the participants'

perception of the contained products was limited to the size of the attached label, the

perception of product value consequently subsided.

Table 4.5 Pairwise Comparison on Product Value

					95% Confidence Interval for Difference	
(I)Type	(J)Type	Mean difference (I-J)	Std.Error	P-value	Lower Bound	Upper Bound
TA	TB	-1.160*	.085	<.001	-1.403	-.917
	TC	-.940*	.097	<.001	-1.214	-.666
	TD	-.690*	.101	<.001	-.976	-.404
	TE	-.295	.114	.107	-.620	.030
TB	TC	.220*	.057	.002	.058	.382
	TD	.470*	.078	<.001	.248	.692
	TE	.865*	.094	<.001	.598	1.132
TC	TD	.250*	.070	0.04	.052	.448
	TE	.645*	.086	<.001	.402	.888
TD	TE	.395*	.087	<.001	.149	.641

P-value: Significance; *.The mean difference is significant at the .05 level.

The results in Table 1 show that, the visual appeal has been measured and displayed

under an attractive category (5). The order of attractive mean rates is 3.985 for the TB design,

3.575 for TC, 3.500 for TD, 3.165 for TE, and 2.420 for TA. The analysis through the

pairwise comparison method in Table 6 highlighted that the infographic label on meat

packaging design has a significant role in a visual perception aspect. The comparison

between ordinary labels (TA) to infographic labels (TB, TC, TD, and TE) showed a

significant difference ($p = 0.001 < 0.05$).

Table 4.6 Pairwise Comparison on Product Attractive

		Attractive				
(I)Type	(J)Type	Mean difference (I-J)	Std.Error	P-value	95% Confidence Interval for Difference Lower Bound	Upper Bound
TA	TB	-1.565*	.086	<.001	-1.810	-1.320
	TC	-1.155*	.091	<.001	-1.414	.896
	TD	1.080*	.114	<.001	1.404	.756
	TE	-.745*	.121	<.001	-1.088	-.420
TB	TC	.410*	.068	<.001	.218	.602
	TD	.485*	.086	<.001	.242	.728
	TE	.820*	.107	<.001	.515	1.125
TC	TD	.075	.082	1.000	-.159	.309
	TE	.410*	.104	<.001	.113	.707
TD	TE	.335*	.090	.003	.079	.591

P-value: Significance. *.The mean difference is significant at the .05 level.

The analysis noted an important aspect of infographic label design in the perception

of attractiveness. To determine which approach for meat product labeling is the most

appealing, these results suggested that the golden ratio proportion label placement on TB had

a significantly higher attractive rate of appreciation than TC, TD, and TE ($p = 0.001 < 0.05$).

However, the center placement of the labeling design approach in TC and TD showed no

significant difference ($p = 1.000 > 0.05$). This finding suggested that the label design

approach proceeding from the principle of the golden ratio in both size and placement will

most likely promote an appreciation of visual perception. The critical finding in label

placement in the comparison of TB and TC showed that both labels are identical in size;

however, the center placement of the TC sample decreases one's appreciation of product

attractiveness, and the comparison of TB and TC on product attractiveness showed a

significant difference (Md = .410, $p = .001 < 0.05$). The multiple comparison results, as

shown in Table 6, indicated that the descending order of product attractiveness to the design

approach taken for meat packaging labels is TB, TC, TD, TE, and TA.

The repeated measures ANOVA method for the testing samples showed the highest

satisfaction mean rate at 3.97 score points for the label design type TB and the lowest rate for

type TA at 2.875 score points. The cross-comparison between subjects indicated that label

design types TB, TC, and TD promoted more significant product satisfaction compared to the

ordinary label (TA). However, in the design approach, where most visual ability of the

contained product was obstructed by the labeling tag (TE) the satisfaction rate compared

showed no significant difference with the ordinary labeling design (TA -TE: Md = .260, $p = $

$.106 > 0.05$).

Table 4.7 Pairwise Comparison on Product Satisfaction

(I)Type	(J)Type	Mean difference (I-J)	Std.Error	P-value	95% Confidence Interval for Difference Lower Bound	Upper Bound
TA	TB	-1.095*	.076	<.001	-1.311	-.879
	TC	-.490*	.093	<.001	.755	-.225
	TD	-.325*	.107	.028	.630	.020
	TE	.260	.101	.106	-.026	.546
TB	TC	.605*	.069	<.001	.408	.802
	TD	.770*	.088	<.001	.521	1.019
	TE	1.355*	.097	<.001	1.079	1.631
TC	TD	.165	.073	.254	-.043	.373
	TE	.750*	.092	<.001	.489	1.011
TD	TE	.585*	.090	<.001	.329	.841

P-value: Significance; *.The mean difference is significant at the .05 level.

One of the essential factors in the existence of packaging labels is to communicate between suppliers and consumers; for this reason, the study measured product communication ability (7), as shown in Table 1. The result indicated that info graphic label design label (TB) received the highest score point rate in a product communication evaluation, with a mean rate of 4.255 score points and with an average mean of 18.26% above another testing subject. The pairwise comparison of product communication (Table 8) displays the mean difference between each type. The results suggested that the info graphics on label design types TB and TC had a significantly higher mean average in product communication than TA ($p = 0.001 < 0.05$). However, the comparison of the ordinary label (TA) with the enlarged graphic label samples TD (61.78% of surface area coverage) and TE (100% of surface area coverage) was not statically significant (TA-TD, $p = .905 > 0.05$; TA-TE, $p = .382 > 0.05$). This finding indicated a transformation of the product's information into a form of graphics promoting an ability to understand the contained product. However,

the participants' perception of the product did not only rely on the information of products

but also cohesively with the actual product itself.

Table 4.8 Pairwise Comparison on Product Communication

		Communication			95% Confidence Interval for Difference	
(I)Type	(J)Type	Mean difference (I-J)	Std.Error	P-value	Lower Bound	Upper Bound
TA	TB	-1.020*	.098	<.001	-1.297	-.743
	TC	-.495*	.108	<.001	-.803	-.187
	TD	-.215	.126	.905	-.574	.144
	TE	.280	.134	.382	-.101	.661
TB	TC	.525*	.072	<.001	.321	.729
	TD	.805*	.093	<.001	.541	1.069
	TE	1.300*	.112	<.001	.982	1.618
TC	TD	.280*	.076	.003	.064	.496
	TE	.775*	.094	<.001	.508	1.042
TD	TE	.495*	.093	<.001	.232	.758

P-value: Significance; *.The mean difference is significant at the .05 level.

4.2 Data Set (2) Group B Results

The testing results from 27 participants (Group B) were analyzed by the visual

detection method to identify whether a significant point related to a design reference

noticeably affected the participants in their evaluation process. In addition, 27 subjects were

measured and interviewed using the eye-tracking device, and the findings show the

usefulness of infographic design. The ViewTracker3 eye-tracking device developed by

DITECT was equipped in this particular experiment.

The priority function of the eye-tracking device is to detect and track the movements

of the eyes. The basic concept is to use infrared light to illuminate the eye causing a reflection

(Dark pupil with 3D model), and a camera to capture an image of the eye showing these

reflections. Through analysis performed by ViewTRacker3 software program, eye-tracking

data displayed the focus point and the time length of focus time on the testing subjects

respectively. These findings identified such points and revealed that visual attention and the

areas of interest were significantly devoted to the packaging's infographic labeling.

An additional in-depth interview and a comparison of survey data suggested that

graphic labeling approaches contribute to how consumers are influenced and perceive a

product's quality. In general, information on the food product label is presented in the form

of text and explanation wordings. In this study, infographic labeling representing important

information on the contained product was tested and is shown in Figure B. The result

illustrated the importance of infographic labeling design on the participants' level of

attention. In this experiment, the focused time span for each product's evaluation and the visit

count on the area of interest were recorded.

Figure 4.2 shows the, comparison of the visual attention time span and visit count

areas between the contained product and labels. In this experiment, different kinds of

graphic-label design approaches were displayed on the product package, showing a difference

between infographic labeling packaging types and ordinary packaging types. Throughout the

procedure analyzing the eye-tracking data of 27 participants, the average focused time

durations for infographic labeling were 32.1, 29.3, 28.7, and 27.9 seconds for types TB, TC, TD, and TE, respectively, while the ordinary label recorded an average of 45.3 seconds.
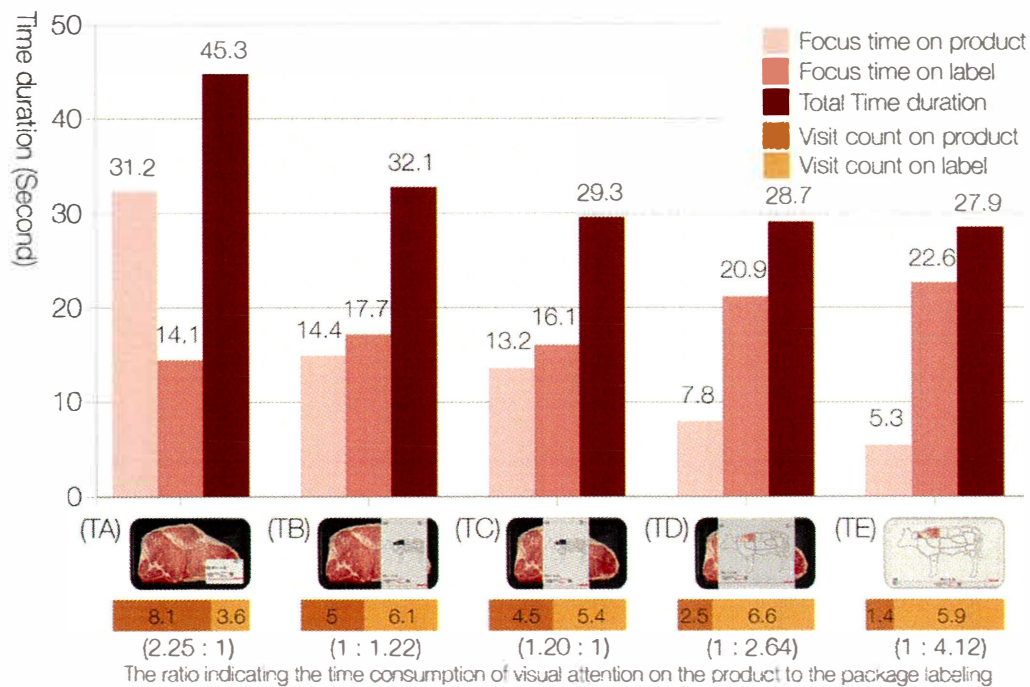

Figure 4.2 Comparison of visual attention span and visit count on testing samples

These results indicated that the span of attention on packaging represented with infographic labeling was significantly lower, with an average of 15.8 seconds throughout the evaluation process. In addition, it was shown that transforming the product's information into graphic form is more efficient to convey a piece of essential information to the participants. The analysis on eye-tracking data revealed the recorded visit count, which refers to the fixation area on the package samples, where participants focused their attention.

As shown in figure 4.2, the ordinary label (TA) participants focused on the contained product in an average of 8.1 time counts and 3.6 times on the product label. In product sample type TB, an average visit count on the product to label is 5 -6.1 times, 4.5 -5.1 times for TC, 2.5 -6.6 times for TD, and 1.4 -5.9 times for TE, respectively. The comparison of data from visual attention (Figure 4.2) and the responses of participants in group B, as shown in Table 4.9, revealed important findings on the product infographic labeling approach for meat packaging design. The statistical results indicate that visit counts on the contained product to the packaging label are comprehensively related to the perception of product quality interpretation.

The results from the average visit count ratio of product and label for testing sample type TB (1:1.22) and TC (1.20:1) were optimally obtained from the highest mean rate scores at 3.952 and 3.660 respectively. Regarding the graphical-labeling types TD and TE, the scores for visit counts favor labeling rather than the product, with 1:2.64 for TD and 1:4.12 for TE, for which the mean rate scores were 3.327 and 3.354, respectively.

Table 4.9 Repeated Measures ANOVA Analysis for TA, TB, TC, TD, and TE

(Participant Group B)

Type (N)	Design (M)	Reliability (M)	Recognizability (M)	Value (M)	Attractive (M)	Satisfaction (M)	Comunication (M)
TA (27)	2.629	3.370	3.518	3.000	2.888	3.185	3.555
TB (27)	4.074	3.888	3.963	3.777	3.703	4.037	4.222
TC (27)	3.925	3.777	3.518	3.555	3.518	3.518	3.814
TD (27)	3.740	3.222	2.925	3.370	3.370	3.296	3.370
TE (27)	4.185	3.370	3.074	3.222	3.444	3.000	3.185
df	4.00	4.00	4.00	4.00	4.00	4.00	4.00
P-value	< 0.01	.049	.048	.036	.080	.013	.046

(N): Number; (M): Mean; df: degree of freedom; P-value: Significance

With regard to ordinary labeling design (TA), the analysis shows that the majority of fixation areas focused on the contained product at 2.25:1, with a mean rate score of 3.163. This finding suggested a similarity of visit counts for contained product and labels ratio in TB and TC that was most appealing to the participants' perception of product quality. However, in the case that the area of interest on labeling is significantly greater than the product found in TC and TD, the average mean rate for seven dimensions droped by 16.19%, as shown in Figure 4.3. As for the ordinary label design, the participants' visual attention was focused on the contained product, and this type of design showed the lowest mean rate at 3.163 score points.
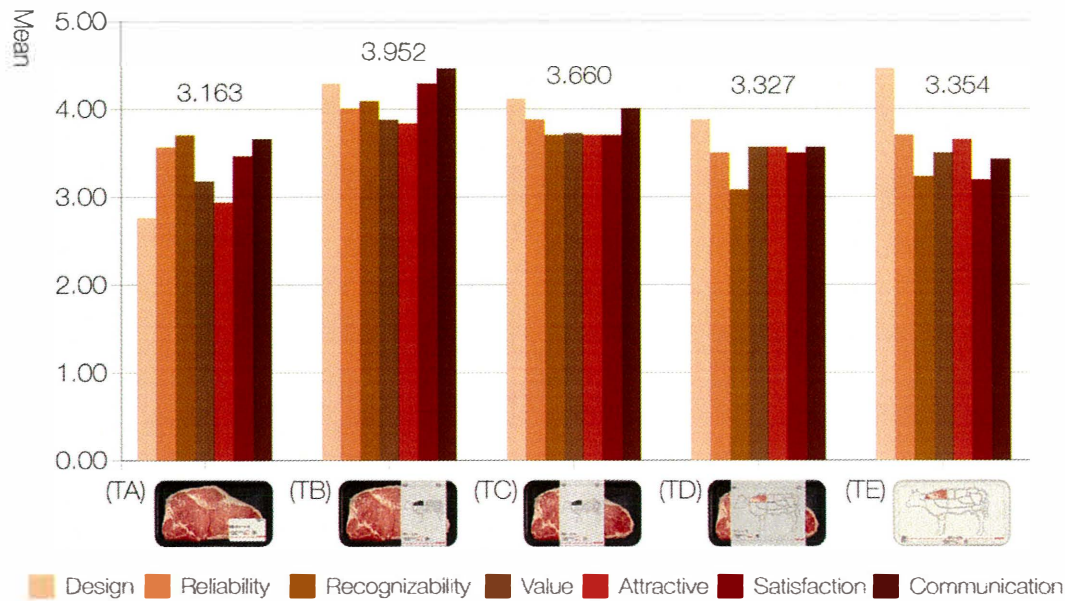
Figure 4.3 Testing Samples TA, TB, TC, TD, and TE Rating Results Presented in Bar Charts (Participant Group B)

An in-depth interview regarding their evaluation process revealed that infographic labeling packaging significantly enhanced the participants' perception of the product's originality and trustworthiness. Moreover, the statistical results indicating that additional extrinsic cues labeling can increase the value of the product, consumer's trustworthiness, personal preference, product quality, and increase product appearance, affecting their decision. In addition, an interview confirmed the finding related to the size and placement of labeling on meat packaging. Regarding, both the TB and TC's labeling approaches with 33.28% of coverage were the most appealing to participants.

4.3 Data Set (3) Results

An analysis to determine preferences from the sample data preference regarding the different color meat packaging have been categorized into four sections included (1) product reliability aspect, (2) design aspect, (3) product quality aspect, and (4) product preference. On the product reliability aspect (1), the analysis of its characteristics revealed a significance between all six provided samples. This finding revealed that the different approached on color on labeling of meat packages are optimally affected by the participants' perception of product reliability. The result from the analysis showed that the white background color with black printed information on sample T(TL) had the highest score rate of 54 % of participants, followed by T(BG) 22%, T(BW), and T(RW) 8.5 %, T(BLW) 4% and T(GW) 3%, respectively. In addition, the highest rate of the color on meat package labeling design approach that negatively brought impacts on the perception of reliability was devoted to T(GW) at 27 %, as shown in Figure 4.4. This crossing results regard to the product reliability aspect revealed that the green color was not suitable for the meat packaging design accordingly.

The further analysis on the different approached on color on labeling of meat packages was focused on the scope of design aspect. The comparison of results highlighted that the white background color with black printed information on sample T(TL) had the

highest score rate of 41.5%, followed by followed by T(BG) 33%, T(BW) 9%, T(RW) 7.5%, and T(BLW) and T(GW) 4.5%. The color that least appreciated in a scope of design criteria was dedicated to T(GW) sample at 27.5 %.

One of the essential factors in the existence of packaging labels is the quality aspect. The results indicated that in the area of the product's quality aspect, the testing sample T(TL) had the highest rate at 38.5 % followed by 36% on sample T(BG), 6.5% T(RW) and 4.5% on T(BLW) and T(GW). However, the T(GW) testing sample held the highest rate of 23% on the unsuitable color in an aspect of product quality in meat packaging label design. With regard to a decision process upon purchasing, the results from 200 participants were analyzed by rating scores to identify point related to a color on labeling that noticeably affect the participants in their decision-making process. As shown in in Figure 4.4, 48% of participants selected sample T(TL) as their preferred option, T(BG) 26%, T(BW) 10.5%, T(RW) 8%, T(GW) 5% and 2.5% T(BLW). However, cross checking process indicated that, the sample T(GW) received the highest negative response at 30%.

The overall results revealed that the color option on sample T(TL) which consisted of the majority of surface area in white color and essential information in black had the highest rate in all criteria.
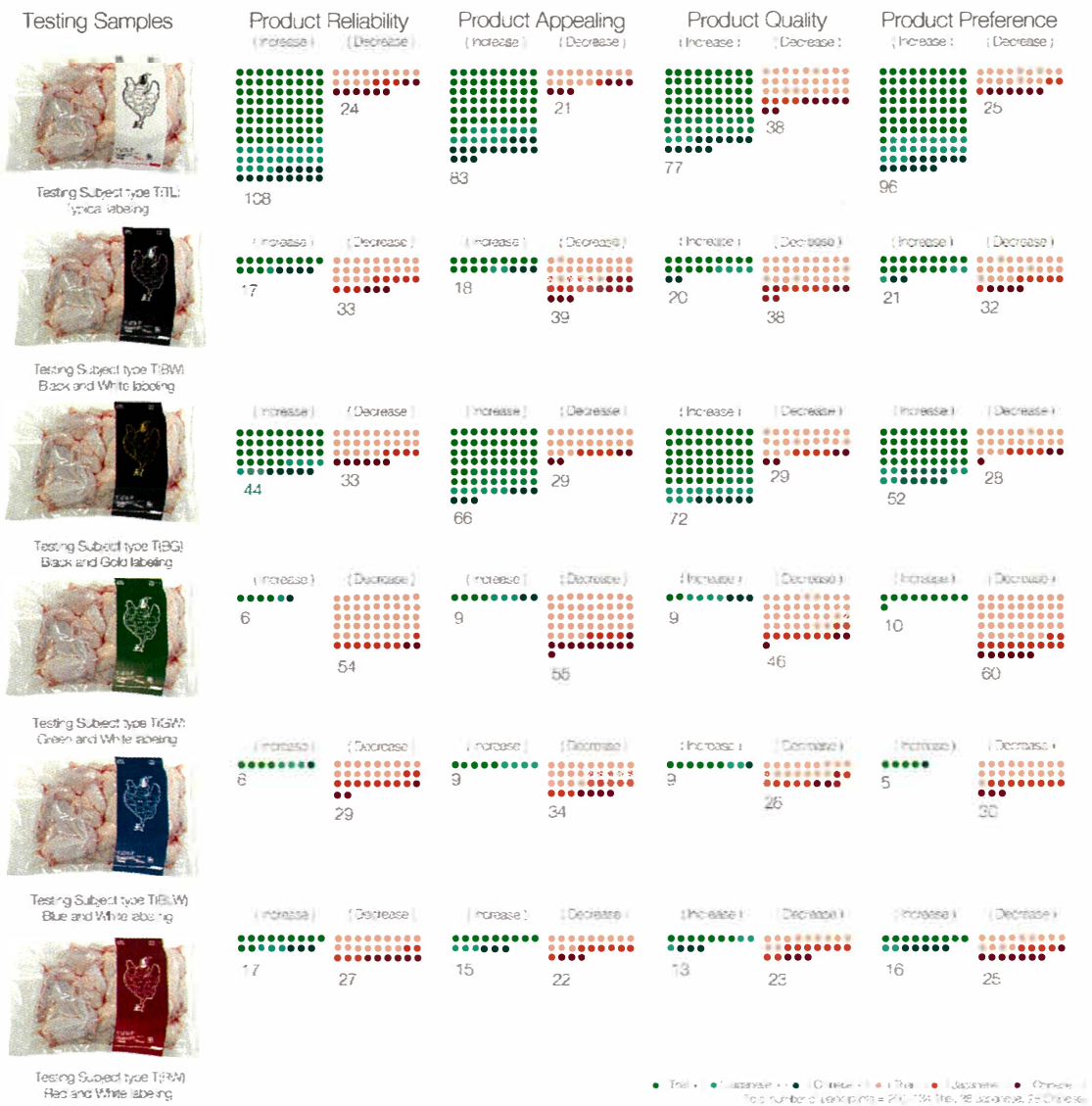
Figure 4.4 Testing Samples T(TL), T(BW), T(BG), T(GW), T(BLW), and T(RW)

Selected Option Charts

In general, white represent cleanness and purity with properties that contain no other

hue and pigments. In addition, the white color labeling influences consumers the perception

of cleanness, purity, and safety. White not just only best represents the information on its

labeling, brought less to no effect to the contained product within the package. The black

color in contrast is based on a unique property, that absorbed all sources of visible light

without any reflection. When black color was placed on a white background, a good amount

of tonal contrast was created, providing clear visibility and promoting benefits for viewers to

conceive the information on the label. The contrast effect of the colors on the packaging

design approach significantly affects the attentive behavior of consumers, their perception of

the quality of the product, visual appeal, and purchase intention accordingly [36]. The result

from the study revealed an essential information of the green color on meat products'

packaging label. The green color design approach T(GW) on the meat package sample was

negatively affected participants in the scope of product reliability, product appeal, product

quality, and preference. In summary, the colors for the meat packaging label indicated that

the descending order of effective use of colors on the meat packaging label is white and black

T(TL), black and gold T(BG), black and white T(BG), red and white T(RW), blue and white

T(BLW) and green and white T(GW).

4.4 Data Set (4) Results

In this experiment, the sample of sealed food packaging were test to clarify the

differentiation of product labeling design approached. An analysis to determine preferences

from the sample data preference regarding the multi-labeling and infographic labeling design

approach have been categorized into four sections included (1) product reliability aspect, (2) design aspect, (3) product quality aspect, and (4) product preference.

On the product reliability aspect (1), the analysis of its characteristics revealed a significance between all six provided samples. This finding revealed that the different approached on labeling style of meat packages are optimally affected by the participants' perception of product reliability. The result from the analysis revealed the benefit of the sealed package with golden ratio graphical labeling placement T(GP), received the highest rate score points followed by T(MR), T(CG), T(CP), T(ML) and T(OL), respectively. In contrast, the scoring rate of on labeling style of meat packages that negatively brought impacts on the perception of reliability was devoted to T(OL) at 27 %, as shown in Figure 4.5. This result regarding the product reliability aspect revealed that the infographic labeling and multi-labeling design approach on meat packaging label significantly affect the perception of information conceiving regard to reliability aspect.

The further analysis on the different approached on color on labeling of meat packages was focused on the scope of design appealing aspect. The comparison of results highlighted that the golden ratio designs on sample T(GP) had the highest score rate of 46%, followed by T(MR) 18.5 %, T(CP) 12 %, T(ML) 11%, T(OL) and T(CG) 6.5%, respectively.

However, the cross analysis on the design approach that negatively brought affect to the

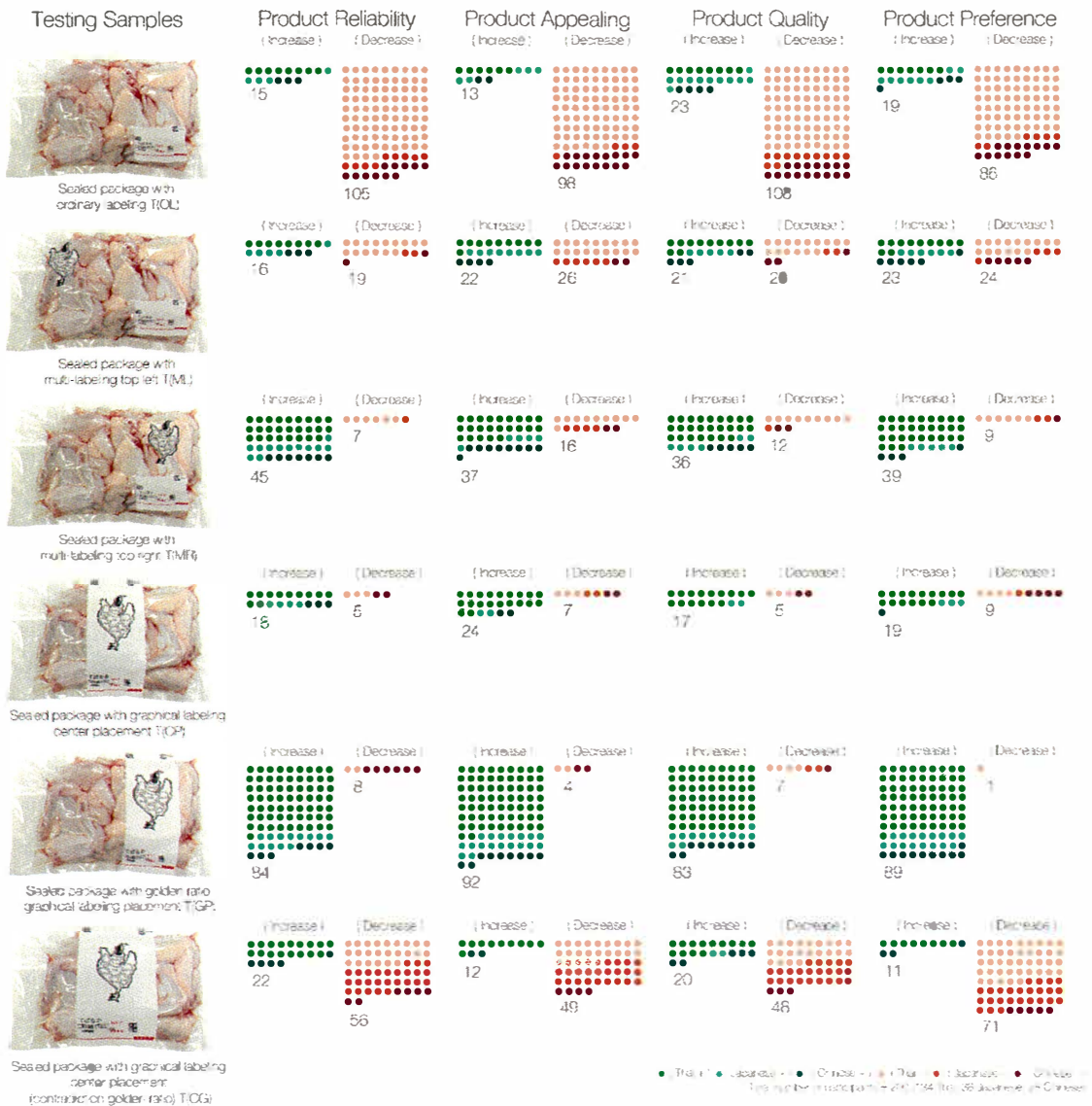design appealing was significantly found on sample T(OL) at 49%.

Figure 4.5 Testing Samples T(TL), T(BW), T(BG), T(GW), T(BLW), and T(RW)

Selected Option Charts

One of the essential factors in the existence of packaging labels is the quality aspect. The results indicated that in the area of the product's quality aspect, the testing sample T(GP) had the highest rate at 41.5 % followed by 18% on sample T(MR), 11.5% T(OL), 10.5% T(ML), 10% on T(CG) and 8.5% T(GW). In addition, comparison score rate points on negative impact brought by labeling design approach were devoted to the sample T(OL) at 54%. This finding suggested that in the scope of product quality, the additional information on products' labeling significantly influences consumers' perception during an information conceiving process.

With regard to a decision process upon purchasing, the results from 200 participants were analyzed by rating scores to identify points related to the labeling design approach that noticeably affect the participants in their decision-making process. As shown in in Figure 4.5, 44.5% of participants selected sample T(GP) as their preferred option, T(MR) 19.5%, T(ML) 11.5%, T(RW) 8%, T(CP) and T(OL) 9.5% and 5.5% T(CG). However, the cross-checking process indicated that the sample T(OL) received the highest negative response at 43%.

CHAPTER 5

CONCLUSION AND FUTURE WORK

5.1 Conclusion

The study purpose was to investigate label design and more specifically, particular design

aspects influencing consumer perception of product quality, and to establish whether or not

there were any noticeable links or connections. The study results and significant findings

have provided valuable data, leading to greater in-depth understanding of the benefits of the

infographic label approach for meat packaging and the influence of infographic labels on

consumers' perception of product quality. The overall results revealed that the influence of

the infographic label approach for meat packaging significantly affected the participant's

perception of product quality. An important component of this study included an experiment

conducted on infographic labeling and labeling proportion for meat packaging. Our finding

suggests that labeling proportion and ratio significantly affect the perception of product

quality. The survey results indicated that the golden ratio principle applied to labeling is the

most effective approach given its optimal benefits, which influenced consumers' perception

of all measured dimensions, including design appreciation, product reliability, product

recognizability, product value, attractiveness, satisfaction, and communication ability. As a

result of the analysis of variance (ANOVA) and the eye-tracking data analysis, the product infographic labeling design with golden ratio proportion (TB) is one of the optimal benefits influencing consumers' perception of the importance of product quality. In relation to this, infographic elements can further enhance consumers' interpretation of product quality.

5.2 Future work

The product infographic labeling approach design increases our awareness of consumer behaviors as part of a product evaluation process, therefore recognizing consumer ideas and beliefs. It ensures that the product is certified and increases the reliability of the products in the areas of design appreciation, product reliability, product recognizably, product value, product attractiveness, consumers' satisfaction, and communication ability, respectively. In addition, the infographic label represents the product's identity, which matches the consumers' needs as the label allows them to distinguish one product from another. Furthermore, infographic labeling can undeniably decrease consumption time in the product purchasing process compared to the ordinary label. However, an infographic labeling approach to fresh meat packaging is not compensated by the appearance of the contained product. Infographic labeling has a cohesive function to enhance product evaluation and quality expectation. This leads to and provides a design reference for fresh food labeling and positioning placement to promote consumers' perception of product quality. In addition, the

findings indicated that infographic labeling design further impacts general product evaluation

and quality expectation, and we expect to conduct further research on the matter.

APPENDIX A

PRELIMINARY EXPERIMENT

A.1 Preliminary experiment A (Product placement)

To understand the process of product selecting methods, the preliminary experiment was created to clarify the differentiation of product placement on the horizontal alignment. In this experiment, 27 meat packages were created as testing subjects as shown in figure A.1. A testing subject is defined as a made-up food product commonly found on the shelf of a supermarket that resembles and replicates food labeling including imagery and information. The set of samples placed on the product shelf was set up in a controlled environment, stimulating the context of supermarket environments. A total of 24 participants were asked to select a testing sample; by choosing the subject believed to contain the highest value in quality. (Figure A.2) Participants participating in this study were from five different countries Japan, China, the United States, Mongolia, and Thailand in order to acquire international perceptions and views. In this experiment, participants were asked to select the food product, believed contained the potential in their purchasing decision.
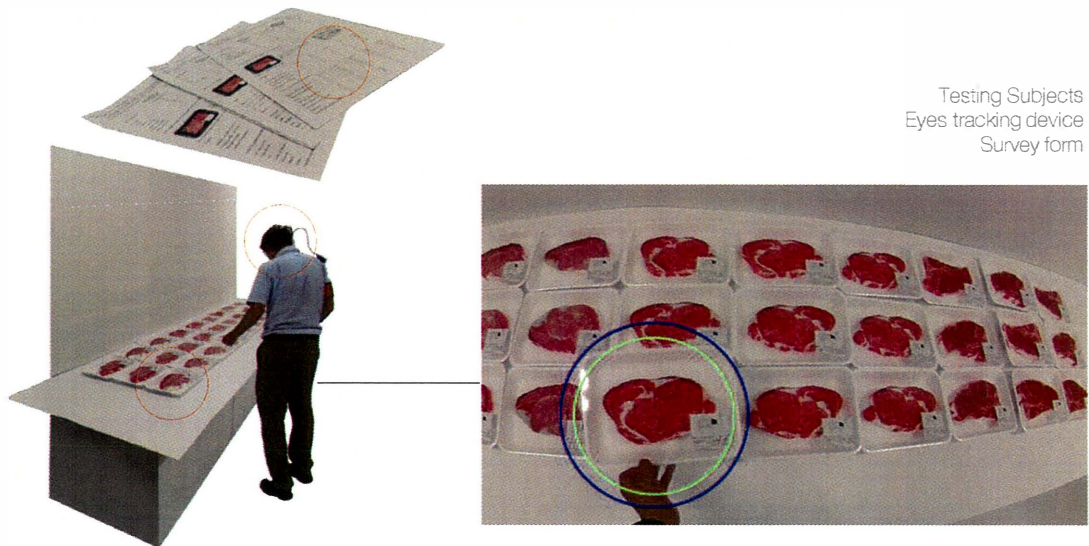
Figure A.1.1 Testing samples and procedure for product placement experiment

Figure A.1.2 Observation on participants performing task

The results from choosing product on the horizontal placement displayed on figure A.3. The result shows inconclusive results, which leads to the summary of this particular experiment that, during the product investigation a set of the process by which an individual becomes aware of an interpret information on the investigated subject has been performed.

A.2 Preliminary experiment B (Information on food package label)

To investigate the influence of extrinsic cues that affects a consumer's perception of product quality, four set of label samples were created under the different approach in design variation to test influence of info graphical labeling, multi-labeling, differentiation of colors on the label, and the orientation and alignment of the label respectively. In this preliminary experiment B, 27 participants were asked to perform a selecting process of food packaging. During the experiment, the differentiation of focusing time on each sample was recorded by eye-tracking device and later analyzed using visual attention method and interview regarding the selection process carried out by each of the participants. A proposed interview was set up as a qualitative measure after the survey responses were evaluate to expand our scope of understanding after the initial testing was conducted using the visual detection method. The interview asked follow up questions to ask participants more in depth questions concerning their perception of label information and other imagery displayed. The purpose was to

determine what aspects of labeling influenced them when differentiating between a high-
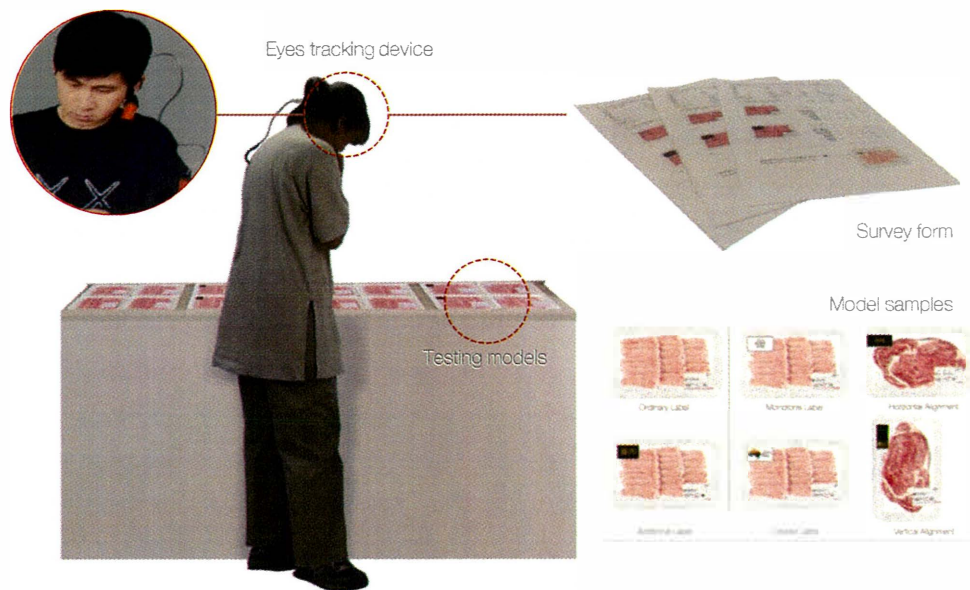
quality product or not.

Figure A.2.1 Testing samples for an influence of extrinsic cues on food package experiment poecedure

Figure A.2.2 Observation on participants performing task (eyes tracking device data)

The overall results revealed the influence of the multi-labeling package significantly affected the participant's perception of product quality. The extrinsic cues, providing info graphical information increases our awareness of consumer behaviors as part of a decision-making process therefor recognizing consumer ideas and beliefs; ensuring the product is certified and increases the reliability of the products in an area of product quality, product value, and product trustworthy and consumer preference respectively. On top of that, the info graphical label is representing the product's identity, which matches with the consumers' needs as the label allows them to distinguish one product from another.

Our finding suggests that multi-labeling approached on fresh food packages is one of the optimal benefits realized which influenced consumer's perception on the importance of product quality. In relation to this, info-graphical elements can additionally elevate the consumers' interpretation of product quality. This leads to and provides a design reference for fresh food labeling and positioning placement to promote consumers' perception of product quality. In addition, the findings indicated that multiple-labeling design impact more general product evaluation and quality expectation respectively.

APPENDIX B

THE RESEARCH QUESTIONAIRE

B.1 Criteria for evaluation

To acquire how participants conceive information methods and essential information in fresh

food packaging label design preference. We created a survey form to evaluate the response to

rate the extension in which the labeling design approach affects their perception in seven

criteria: (1) design aspect, (2) reliable aspect, (3) recognizability aspect, (4) product value, (5)

attractiveness, (6) personal satisfaction, and (7) communication ability respectively.

In order to get the most effective result for this study and, we provided the

questionnaire in each of their native languages. Participant were comprised individuals from

three different countries Japan, China, and Thailand in order to acquire international

perceptions and views. To avoid any deviations in the results, the respondents included those

who did not know Japanese characters. The survey form was presented in 3 languages

including Japanese, Thai and English.

1. サンプルは一般的な生肉のパッケージとラベルです。
The sample of ordinary fresh meat product package and label
(ตัวอย่างภาพ สินค้าประเภทเนื้อสดและบรรจุภัณฑ์ ในรูปแบบปกติ)

画像サンプルから：あなたは自分の知覚に関して何を解釈しますか（高-左から 右に低）
From the image sample; what do you interpret regarding your perception. (High - Low from Left to right)
ท่านมีความรู้สึกอย่างไรกับตัวอย่างภาพผลิตภัณฑ์และบรรจุภัณฑ์ ข้างต้น (ประเมินระดับ มาก-น้อย จาก ซ้ายไปขวา)

ユニークなデザイン Unique design มีเอกลักษณ์	☐	☐	☐	☐	☐	平凡なデザイン Normal design ไม่มีเอกลักษณ์
信頼がある Reliable มีความน่าเชื่อถือ	☐	☐	☐	☐	☐	信頼できない Unreliable ไม่น่าเชื่อถือ
店舗で見つけやすい Easy to recognize สังเกตเห็นได้ง่าย	☐	☐	☐	☐	☐	店舗で見つけにくい Hard to recognize สังเกตเห็นได้ยาก
価値が高くに感じる Valuable มีคุณค่า ราคา	☐	☐	☐	☐	☐	価値を感じない No value ไม่มี คุณค่า ราคา
人目を引く Interesting / Attractive น่าสนใจ ดึงดูด	☐	☐	☐	☐	☐	人目を引かない Not interesting / Unattractive ไม่น่าสนใจ ไม่ดึงดูด
好感がもてる Satisfied พึงพอใจ	☐	☐	☐	☐	☐	好感をもてない Not satisfied ไม่มีความพึงพอใจ
商品が理解しやすい Understanable เข้าใจในผลิตภัณฑ์	☐	☐	☐	☐	☐	商品が理解しにくい Not understandable ไม่ เข้าใจในผลิตภัณฑ์

Figure B.1 A sample of questionnaire format used in the experiment

A Likert scale was used for each question, ranging from 1 to 5. (1: check box on most left, being the lowest ranking and 5: check box on most right, being the highest ranking) to determine the effect of the labeling design approach and labeling placement on the consumers' perception of product quality.

B.2 Product labeling design approach

In Japan and many countries, food and food-related product are required a food label that displays product essential information including product name, ingredients, quantitative, price, expiration date including storage information. In spite that, the aim of the research is to provide an alternative approach of food packaging label design that transfer the essential

information into the form of info-graphical representation as a testing sample TB, TC, TD
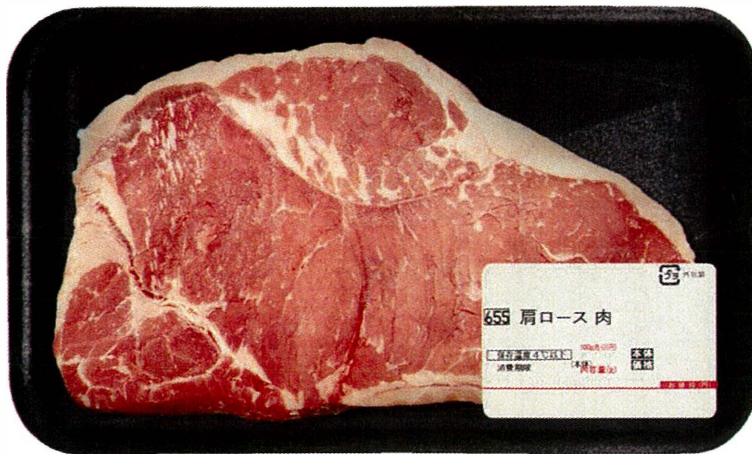
and TE (referred to methodology on chapter 3).

Figure B.1 (TA) Ordinary Design label on fresh food package
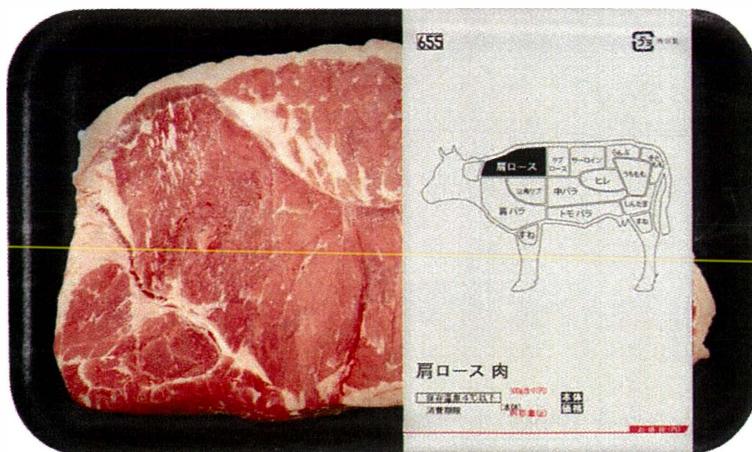

Figure B.2 (TB) Graphical Labeling

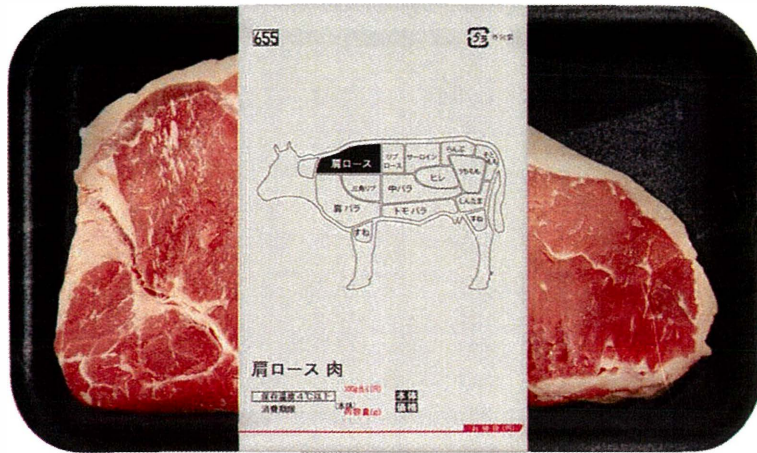38.22 % area coverage, Golden ratio proportion and placement

Figure B.3 (TC) Graphical Labeling

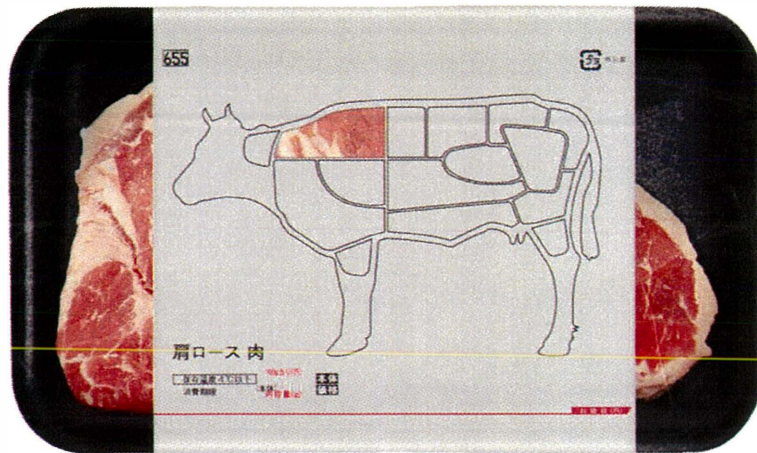38.22 % area coverage, Golden ratio center placement

Figure B.4 (TD) Graphical Labeling

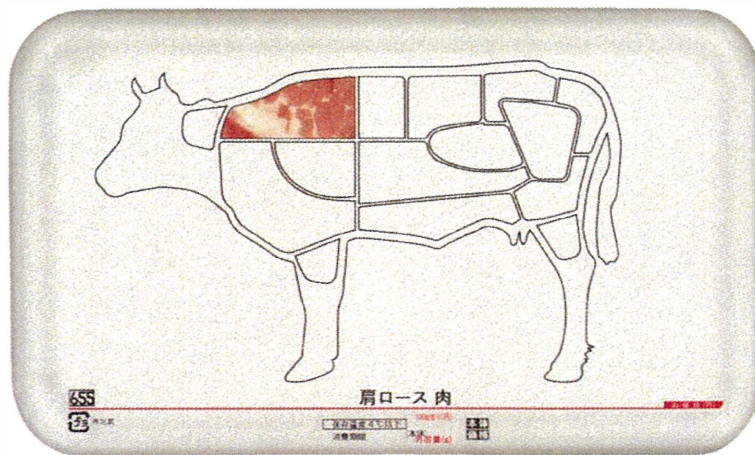61.78 % area coverage, Contradiction of golden ratio , center placement

Figure B.5 (TE) Graphical Labeling 100 % of area coverage

To investigate the influence of extrinsic cues that affects a consumer's perception of product quality, five sets of the label samples representing beef, pork, and chicken products were created under the different design approach by applying the golden ratio principle.

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