

ASSESSMENT OF CONSUMERS VISUAL ATTENTION TOWARDS PACKAGING
ATTRIBUTES ON STINGLESS BEE'S HONEY BOX DESIGNS USING
EYE-TRACKING – A STUDY OF NEUROMARKETING PERSPECTIVE

BY

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LIST OF ABBREVIATIONS

ANOVA	Analysis of Variance
AOI	Area Of Interest
.avi	Audio Video Interleave
EEG	Electroencephalography
fMRI	functional Magnetic Resonance Imaging
MEG	Magnetoencephalography
ms	millisecond
RHQ	Reinventing Honey Quality
sec	Seconds
SPSS	Statistical Package for the Social Science
USM	Universiti Sains Malaysia
USB	Universal Serial Bus

LIST OF SYMBOLS

α	Alpha
β	Beta
$\pm$	Plus minus
$<$	Less Than

ABSTRAK

Kemahiran dan teknik neuromarketing telah digunakan secara meluas dalam pelbagai bidang yang bukan sahaja untuk tujuan akademik tetapi manfaatnya telah meluas ke banyak bidang lain terutamanya dalam dunia pemasaran. Neuromarketing ialah disiplin pemasaran baharu yang mengkaji reaksi bawah sedar pelanggan terhadap produk kumpulan pemasaran, jenama, barang dan bahan. Terdapat banyak kaedah yang digunakan oleh pemasar untuk mengiklankan produk mereka untuk menarik perhatian pengguna kerana pengguna bukan hanya berbeza dalam pendapat tentang jenama, tetapi juga dalam interaksi diantara mereka, yang mesti diuruskan oleh pemasar. Di sinilah neuromarketing menembusi ke dunia pengguna dengan memajukan strategi yang meningkatkan kemahiran pemasaran dan mencapai lebih banyak sasaran dalam perniagaan berbanding menggunakan pemasaran cara tradisional yang mahal dan kurang memberi keuntungan kepada perniagaan. Industri makanan adalah salah satu industri yang menggunakan teknik ini untuk menyiasat secara mendalam tentang cara menarik perhatian pelanggan dan pada masa yang sama mempengaruhi mereka untuk membeli produk tersebut. Salah satu elemen yang digunakan ialah reka bentuk pembungkusan. Dalam kajian ini kami mengumpul dan menilai perhatian visual terhadap ciri yang berbeza pada pembungkusan kotak madu kelulut yang direka kursus untuk eksperimen ini dengan menggunakan alat pengesanan mata dengan meneliti corak penetapan visual pada ciri-ciri pembungkusan pada reka bentuk kotak madu kelulut menggunakan alat pengesan mata. Ciri pembungkusan ini terdiri daripada logo jenama, logo halal, gaya tulisan, tanda harga dan cop catatan kualiti. Setiap ciri pembungkusan pula terdiri dari 3 variasi melibatkan kedudukan, saiz, gaya tulisan, peletakan harga, dan ayat cop kualiti. Variasi dalam penetapan visual terhadap ciri pada kotak juga ditentukan sama ada berhubung kait dengan persepsi daya tarikan produk dan kesediaan untuk membeli produk. Hasilnya menunjukkan bahawa daripada lima ciri yang

dikaji, hanya logo jenama yang telah menunjukkan perbezaan yang signifikan secara statistik dalam tempoh penetapan. Di sini, penetapan visual di sebelah kiri logo jenama adalah skor yang lebih tinggi dan menarik perhatian daripada variasi kedudukan tengah atau kanan. Keputusan juga menunjukkan tiada kolerasi antara hubungan penetapan visual terhadap daya tarikan serta penetapan visual terhadap kesediaan untuk membeli mengikut variasi ciri pada kotak. Selain itu, walaupun logo jenama kedudukan kiri mendapat nilai penetapan visual yang signifikan, terdapat satu kolerasi positif telah diperhatikan antara penetapan visual dan daya tarikan untuk kedudukan tengah logo jenama. Secara keseluruhan, penyelidikan ini memberikan persepsi baharu tentang visualisasi corak atribut yang berbeza terhadap pilihan subjek pada pembungkusan kotak madu kelulut dan ini menunjukkan bahawa penetapan visual pada atribut pembungkusan boleh mempengaruhi pengguna untuk tertarik dan mendorong mereka untuk membeli produk tersebut.

ABSTRACT

Neuromarketing skills and techniques were widely used in many fields that were not only for academic purposes, but their benefit has been spreading to a lot of others, especially in the marketing world. Neuromarketing is a new discipline of marketing that examines the subconscious reactions of customers to marketing products, brands, goods, and materials. There was a lot of methods that were used by the marketer to advertise their product to attract the attention of consumer as they vary not only in their opinions of brands but also in their interactions with them, which marketers must manage. This is where neuromarketing step into the area by advancing its strategies to improve marketing skills and achieving more target in business instead of using the old traditional way of marketing that was costly and less profit given to the business. The food industry was one of the industries that used this technique to investigate in-depth how to attract customer attention and at the same time influence them to buy the product. One of the elements that were used was the design of the packaging. In this study, we gathered and evaluated the visual attention towards different attributes on stingless bee honey box packaging using the eye-tracking technique by examined the pattern of visual fixation on the attributes of the packaging that was designed solely for this experiment. The attributes are composed of the brand logo, halal logo, font style, price tag, and quality remark stamp. Every attribute consists of 3 variation that are position, size, type of font styles, placement of price tag, and word quality remark. The pattern in visual attention towards all attributes is determined whether they are related to the perceived attractiveness of the product and willingness to buy the product. The result shows that the attribute of brand logo has shown a statistically significant difference in the fixation duration. Here, the visual fixation on the left side of the brand logo is higher score and caught attention rather than the center or right position variation. Result also revealed that there was no correlation between the relation of visual

fixation and attractiveness as well as visual fixation and willingness to buy according to the variation of the attributes on the box. Furthermore, even though the left position brand logo score significant value, one positive correlation between visual fixation and the attractiveness for centre position of brand logo were observed. Overall, this research provides a new insight of pattern visualization of different attributes towards subject's choice on stingless honey box packaging and this implies that gaze fixation on the attributes of the packaging can influence consumers to be attracted and motivate them to buy the product.

CHAPTER 1

INTRODUCTION

1.1 Background of the study

Business is one of the major activities in this evolving world. Anytime and anywhere, we will be faced with business matters whether we go shopping, pay bills, or even when we fuel our car at a petrol station. This example shows how much business has influenced our daily life. But before that, have we had any idea on how we know those businesses or on how we are attracted to buy those brands that we bought? All that questions go down to one word which is marketing.

Without marketing practice in one's business, it is very hard for the business to grow and make profits. Many researchers have been indulging in the 'world' of marketing of business and they have been giving various opinions about the definitions of marketing for the past century. American Marketing Association (AMA) has defined marketing as the action, collection of institutions, and process of generating, conveying, delivering, and trading services that are convenient for the customers, clients, and society. While according to researcher Stanton, marketing is an inclusive set of corporate activities aimed at identifying, pricing, promoting, and distributing want-satisfying goods and services to current and potential customers (Stanton, 1984). In general, neuromarketing is a branch of marketing study that bridges the gap between the sciences of neuroscience and marketing (Butler, 2008; Hubert & Kenning, 2008; Senior & Lee, 2008).

Neuromarketing is a new approach that combines 2 different fields which is the neuroscience and marketing. The term neuromarketing is usually used in the industry as interconnection with consumer neurosciences that are involved in the marketing field and is usually used in academic literature(Hubert & Kenning, 2008). Despite its disputed origins, consumer cognitive neuroscience

has gained considerable legitimacy and acceptance in the marketing research field during the last 15 years (Harris et al., 2018). In 2004, one of the first articles about the relevance of neurosciences in decision-making research was discussed in a workshop at the Invitational Choice Symposium, since then this field has made significant development in decision neurosciences (Smidts et al., 2014).

Read Montague, Professor of Neuroscience at Baylor College of Medicine was the first person to publish his neuromarketing research in 2004 where subjects were asked to drink either Pepsi or Coca-Cola and used fMRI to scan their brain (McClure et al., 2004). According to his research, different areas of the brain light up depending on whether or not people are aware of the brand they consume. (McClure et al., 2004). In that research, when people knew what brand, they consumed which is Coca Cola and they prefer the brand instead of Pepsi, their executive function will light up. Executive function is in the frontal lobe which manages our attention, controls short-term memory, and does best on thinking especially in planning. Furthermore, when they do not know what is the brand, they are consuming they were reported to prefer Pepsi which led to the opposite event occurring in which the most active area of the brain is not the executive function, but an ancient structure located near the limbic system and responsible for emotional and instinctual behavior Clure et al., 2004). The study research about Coke and Pepsi appeared to reveal some of the relations between neural activity and people's behavior.

This new marketing approach has focused on assessing consumer cognitive and emotional responses to various marketing stimuli which can determine a customer's internal subconscious reaction more effectively. Conventional marketing is constructed more on self-assessment measures that rely on the ability and willingness of the subjects to report their attitude, behavior, or emotion which were less powerful and possibly biased (Madzík et al., 2019). The advantage of this approach is the consumers would profit from the design of products and campaigns that are tailored to them, and their decisions would be facilitated rather than controlled (Madzík et al., 2019).

The main intention of this study is to investigate the impact of different attributes on stingless bee honey box packaging that are distinctly designed. To achieve this aim, this experiment was carried out by using the eye-tracking technique that will calculate the total gaze duration to targeted attribute that refer as visual fixation. Attributes in this study is refer to the brand logo, halal logo, font style, price tag and quality remark stamp. The outcome of the visual fixations for each attribute was then linked with the attractiveness of the product and the willingness of the subjects to buy the stingless bee honey according to the box design and simultaneously evaluate if they have any relation that will affect the result of the visual attention of attributes.

1.2 Rationale

Stingless bee honey is undoubtedly a health supplement product that can satisfy many needs. However, the honey was not yet achieving a good quality design product that is competent with the other commercialized honey to attract consumers in recent years. In this study, the packaging of the stingless bee honey was designed by using the neuromarketing approach to achieve the aim of the Reinventing Honey Quality (RHQ) project in repositioning the stingless bee honey in the market. The RHQ is a socio-economic community empowerment program by Universiti Sains Malaysia (USM). The eye-tracking neuromarketing technique was chosen due to it was low-cost equipment and the skill that was required to handle this equipment was minimal as compared to other sophisticated neuromarketing devices. Objectively, the eye-tracking device able to determine the gaze and eye attention to the attributes. The attributes have been selected based on several reviews of various articles that were related to this study. The five attributes are brand logo, halal logo, font style, price tag, and lastly the quality remark stamp. These attributes were analyzed and the outcome was aided to the effect on the subject's decision on the proposed honey product packaging.

1.3 Objective

General objective

- To evaluate the neuromarketing perspective of stingless bee honey box packaging designs via visual attention on several attributes.

Specific objectives

- To examine the pattern of visual fixation of Area of Interest (AOI) on the attributes of the packaging across the stingless bee honey box designs using an eye-tracking device.
- To determine how variation in visual attention of attributes is related to the perceived attractiveness of the product.
- To determine how variation in visual attention of attributes is related to the perceived willingness to buy the product.

1.4 Hypothesis

1. Attributes of the brand logo, halal logo, font style, price tag, and quality remark stamp have a significant pattern of visual fixation of AOI toward the stingless honey box design
2. There is a correlation between the attractiveness of the stingless bee honey box design with the visual attention of the attributes.
3. There is a correlation between the willingness to buy the stingless bee honey with the visual attention of the attributes on the box design.

1.5 Research Question

1. Do the attributes of the brand logo, halal logo, font style, price tag, and quality remark stamp have a significant pattern of visual fixation OF AOI toward the stingless bee honey box design?
2. Is there any correlation occurred between the attractiveness of the stingless honey box design with the visual attention of the attributes?

3. Is there any correlation occurred between the willingness to buy the stingless honey following the box design featured with the visual attention of the attributes?

CHAPTER 2

LITERATURE REVIEW

2.1 Neuromarketing

Long before in the modern business world, organizations have used traditional marketing to attract customers' attention and advertise their products. This traditional marketing has taken up a lot of money where about over 400 billion dollars is invested in advertising campaigns (Morin, 2011). However, the effectiveness of those investments has generally failed, and this is where neuromarketing enters the 'marketing world' to help to improve the method of marketing. The word 'neuro' and 'marketing' implies of the combination of the two areas which is neuroscience and marketing.

Neuroscience is an interdisciplinary science that collaborates with a variety of different fields, including psychology, medicine, engineering, philosophy, linguistics, computer science, and in this research in the business field. Thus, the combination of neurosciences field with other areas have developed various new branch of knowledge field such as cognitive neurosciences, behavioral neurosciences, cultural neurosciences, neuroengineering, computational neurosciences, neuroinformatic, neuroimaging, neurolinguistic and neuromarketing.

For a marketer to promote products, they need specialized activities that they have to execute to find a way to make their product successful and can be differentiated from other similar products. These specialized activities are called marketing functions or capabilities. These marketing capabilities or functions can be achieved when the marketers applied their different skills and knowledge to associate those resources and activities and transform them to improve their product (Butler & Collins, 1995). Those important marketing capabilities include pricing, branding, promotion function, research & development function as well as packaging & labeling (Morgan, 2012).

A researcher Neil Borden has developed a strategy which is called a marketing mix that makes up a new marketing theory that combines a few functions of marketing capabilities to satisfy market needs and target consumers. Later, McCarthy defined the “marketing mix” more specifically whereby in his version, the marketing mix consists of 4 elements that are product, place, price, and promotions. The product element is concerned with the process of developing, adapting, maintaining, and producing products and services that are offered to satisfy customer requirements (Greenley & Oktemgil, 1997). The product elements deal with the design technology, value, packaging, brand quality, and other features. The place or physical distribution component involves the distributions and accessibilities of the products at a suitable place that can smooth the process of product marketing. The procedure must be simple and straightforward, while also building customer relationships (Dominici, 2009).

Price is a crucial component that is concerned with the suitable price of the product itself so that can cover the product's production and distribution costs as well as a suitable profit margin. According to Yudelso, the purchaser's contribution in terms of money, time, and effort to receive the goods is characterized as pricing (Yudelso, 1999). The last component is a promotion that involves the activities of selling, advertising, special offers, and publicity. It is the medium that may reach a large and diverse audience, it differs from other media in terms of interactive and multimedia aspects (DONNA & Novak, 1997).

The first approach to using this method of marketing started in 2002 when a few American companies like Brighthouse became the first to offer neuromarketing research and consulting services in promoting the use of technology and knowledge coming from the field of cognitive neuroscience while in the UK Neurosense and Neuroco have also recently opened for business(Lee et al., 2007)).

Among the advantages of neuromarketing, the approach is that the consumers and the organization will have the benefits together in a way that this method can help them understand each other better (Wilson et al., 2008). The businesses would save a huge percentage of their expenditures

that are currently spent on costly and unproductive campaigns, the result would be increased competition and better customer service. Researcher Lee has emphasized that so far, the applicability of these strategies has been limited to brands and customer behavior (Lee et al., 2007).

2.1.1 Neuromarketing Techniques

Neuromarketing uses neuroimaging techniques to evaluate marketing stimuli in quantitative terms, such as price decisions, preference evaluation, advertising messages, and brand image. Various neuroscientific techniques have been invented to assess the consumers' behavior such as functional magnetic resonance imaging (fMRI), electroencephalography (EEG), magnetoencephalography (MEG), electrocardiogram (ECG), galvanic skin response (GSR), and eye-tracking to help sell products. Particularly in eye tracking, consumers' behavior is assessed by measurement of the dilation of the pupil, the focus of customers' attention, and the pattern of visual behavior of fixations of the gaze.

Table 2. 1 Neuromarketing techniques used in research.

AUTHOR	TITLE	TOPICS
(Kühn et al., 2016)	Multiple “buy buttons” in the brain: Forecasting chocolate sales at point-of-sale based on functional brain activation using Fmri	❖ This study investigates consumer behavior in a supermarket using fMRI. ❖ Paradigm uses a chocolate brand and interchanges 6 different communications ❖ The result shows that the fMRI signal during communication viewing was the best predictor of sales.
(Telpaz et al., 2015)	Using EEG to predict consumers' future choices	❖ Pairs of brands are compared to predict future decisions. ❖ Prediction accuracy is influenced by the size of the discrepancy.

		❖ There is a cardinal or ordinal distance in EEG data activity between product pairings.
(Hazlett & Hazlett, 1999)	Emotional response to television commercials: Facial EMG vs. self-report	❖ Consumer emotional responses to TV commercials in terms of attention and engagement effectiveness. ❖ Self-reporting does not provide significant proof of emotional response, whereas facial EMG does.
(Ohme et al., 2009)	Analysis of neurophysiological reactions to advertising stimuli by means of EEG and galvanic skin response measures.	❖ Effectiveness of television advertising; measurements of unintentional consumer response. ❖ Measuring the impact and effectiveness of ads to an unconscious alteration of the same advertisement.

2.1.2 Neuromarketing studies on Food Products

Food selection decisions are influenced by a complex collection of feelings, attitudes, emotions, and beliefs that are difficult to determine merely by asking directly to customers (Stasi et al., 2018). Neuromarketing techniques could be used to evaluate the processes involved in food decision-making, such as the influence of attitudes and emotions on choices, which other characteristics such as demographics, psychometrics, and stated preferences do not address (Stasi et al., 2018)

Table 2. 2 Neuromarketing studies on food products

TITLE	AUTHOR	FINDINGS
Neuromarketing empirical approaches and food choice: A systematic review	(Stasi et al., 2018)	❖ Describing what is neuromarketing, its techniques, and their advantage, especially in food studies. ❖ Suggesting the most effective ways to use neuromarketing approaches in the food marketing area, with a focus on non-invasive methods.

The Use of Neuromarketing in the Study of Brand Related Mental Processes. Case Study – Romanian Food Brands	(Cîrneci et al., 2014)	❖ Use fMRI to investigate whether consumers consume the product or not by showing the product visually.
Coffee tasting experiment from the neuromarketing perspective	(Cîrneci et al., 2014)	❖ To investigate the consumer preference for coffee purchasing using ECG. ❖ ECG result shows the brands that the consumer like with the brand that they prefer to buy.
Neuromarketing: Is Campbell in Soup?	(Babu & Vidyasagar, 2012)	❖ Explained how Campbell brand use neuroscience techniques to market its brand.
Organic or popular brands—food perception engages distinct functional pathways. An fMRI study	(Fehse et al., 2017)	❖ Use fMRI to detect which part of the brain that activated while exposing the subject to 2 different brands, organic and popular brands. ❖ The result shows that choices of food are greatly affected by additional food information. ❖ Decision-making process.
Assessing information on food packages.	(Clement et al., 2017)	❖ This study aims to assess the potentially misleading elements of graphic elements on food packaging that can give false expectations to the consumer. ❖ Assessed by using eye-tracking. ❖ 2 different pairs were one is PME and the other is non PME. ❖ Result: PME on food packaging has a great influence on choices of products.

2.2 Product Packaging and Design

The primary purpose of packing is to "preserve product integrity" by protecting the real food product from "climatic, bacteriological, and transportation dangers." (Stewart, 1996). However, it wasn't until 1957 that Pilditch came up with the term "silent salesperson," suggesting that the package needed to be likable, to represent the salesman (Vazquez et al., 2003). "Good packaging is considerably more than a salesman, it is a flag of identification and a symbol of ideals," Lewis said 30 years later, expanding on Pilditch's thoughts (Lewis, 1991). Given that only a tiny percentage of companies are powerful enough to pay the expense required for national advertising, the packaging is one of the most essential methods for presenting the brand message to the target consumer directly (Nancarrow et al., 1998).

As the retail environment grows increasingly packed with competitors fighting for consumers' attention, packaging must work harder than ever to get the product visible among the crowd (Pecht, 1991). Along with this problem, marketers must contend with the fact that consumers differ not only in their opinion of brands but also in their relationships with them (Muniz & O'guinn, 2001). The packaging design of a product has a significant impact on its success. Consumer behavior has influenced the way items are created, packaged, and advertised, according to a report (Urbany et al., 1996). Currently, 70% of consumer purchase decisions are made on the shelf, with 85 percent made without ever picking up a competitor's product and 90% made after only looking at the front face of the packaging. (Urbany et al., 1996).

2.3 Stingless bee honey Industry

Honey has been a popular natural food product since the Egyptians, Assyrians, Romans, and even Greeks, and is valued for its nutritional and medicinal properties. It is made from liquid plant exudates that are collected, processed, and stored by various bee species. (Namias, 2003). Among all, European honeybees scientifically called *Apis mellifera* and stingless bees are the two most common

honey producer bees (Zulkhairi Amin et al., 2018). The European honeybee belongs to the *Apis* genus, whilst stingless bees are divided into two genera: *Melipona* and *Trigona* (Michener, 2000).

The RHQ initiative was launched in 2012 to support the expansion of Malaysia's stingless bee sector and to have a significant impact on the production of high-quality honey (Mustafa et al., 2018). The Stingless Bee Honey has been known as one of the natural remedies that is used to treat diseases or as food since ancient times. Stingless bee honey is one of the species of honey that can be used as an alternative source of honey due to its good adaptation in tropical countries. One component of the reinvention is rebranding conventional stingless bee honey on the international market with neuromarketing technologies to design stingless bee honey packaging in the industry (Mustafa et al., 2018). A good design packaging of a product has a very significant contribution to influencing the honey purchase decision of consumers.

Meliponine honey, stingless bee honey (SBH), pot-honey, and in Malaysia, kelulut honey are some of the names given to honey produced by stingless bees (Zulkhairi Amin et al., 2018). Due to honey's outstanding antibacterial, bacteriostatic, anti-inflammatory, wound, and sunburn healing qualities, several investigations on its chemical and biological properties have been done throughout the twentieth century (Alvarez-Fischer et al., 2013).

In 2007, the Malaysian Agricultural Research and Development Institute (MARDI) established stingless beekeeping for pollination activity, which was followed by the first workshop on medicinal kelulut honey production by Universiti Sains Malaysia in 2010 (Mustafa et al., 2018). The Reinventing Honey Quality (RHQ) project began in 2012 intending to encourage the stingless bee honey sector and turn it into a sustainable source of revenue for Malaysian beekeepers through premium honey production (Mohd Rafie et al., 2018).

2.4 Eye Tracking

Eye-tracking has become one of the valuable tools in assessing consumers' attention towards willingness in buying a product. This approach involves measuring a person's eye movements at any given time, as well as the order in which the person's eyes move from one spot to another. (Ghute et al., 2013; Poole & Ball, 2006).

The history of the use of eye-tracking started more than 100 years ago when it was first used in reading research to track eye movements (Reichle et al., 1999). Since then, the technique of eye-tracking has been invented to track eye movement such as Electroculographic techniques. This method used electrodes attached to the skin around the eye to detect eye movements by measuring variations in electrical potential (Ghute et al., 2013). Another previous method that had already been invented is by measuring the fluctuations in an electromagnetic field when the metal coil moved with the eyes (Duchowski, 2003). Most modern eye-tracking systems now use video images of the eye to determine where a person is looking, as this method proved to be extremely invasive (Ghute et al., 2013).

Nowadays, the approach of the eye-tracking technique has appeared as a window into observers' visual and cognitive processes. Among the advantages of this technique, researchers can correlate eye movement and people's behavior as they can give an insight into problem-solving, reasoning, mental imagery, and search strategies (Ball et al., 2003). So how the researcher correlates between these two areas is by analyzing what they called as fixation and saccades of the eye. The definition of fixation is the measurement of the eye during pauses over informative regions of interest and the saccades mean the rapid movement between the fixations (Goldberg & Kotval, 1999). The benefit of fixation identification is that it's a simple way to reduce the complexity of eye-tracking data while keeping the most important qualities to better understand cognitive and visual processing behavior. Thus, good identification algorithms are important to ensure valid fixation and saccade locations and durations.

Researchers can learn more about visual and display-based information processing, as well as the elements that influence the usability of system interfaces, by tracking people's eye movements (Tehranchi et al., 2020). Eye-movement recordings might thus serve as an objective source of interface evaluation data that can help designers create better interfaces (Tehranchi et al., 2020). (Ghute et al., 2013).

Table 2. 3 Neuromarketing studies using the eye-tracking method.

TITLE	AUTHOR	FINDINGS
Shining in the Center: Central Gaze Cascade Effect on Product Choice	(Atalay et al., 2012)	❖ To identify the impact of gaze effect with central fixation and horizontal centrality in customer choices in product. ❖ Used position of brand as attribute
Muslim Consumers' Halal Product Choice Behaviour: An Eye-Tracking Investigation on Visual Choice Process	(Yunus Ali et al., 2018)	❖ The purpose of this study is to look into the Halal product selection behaviour of Muslim consumers by using eye-tracking.
Eye-tracking research on sensory and consumer science: A review, pitfalls and future directions	(Gere et al., 2020)	❖ To gather summarizes of cognitive element of sensory and consumer science. ❖ Give several examples of sensory attributes used in visual processing in consumers.
Have an eye on the buckled cucumber: An eye tracking study on visually suboptimal foods	(Helmert et al., 2017)	❖ To study the price badge attribute on food packaging choices of selection(Alvarez-Fischer et al., 2013).

There are three components of the eye-tracking instrument, which include Eye Tracking camera system, a Pupil Lab workstation, and stimulus presentation. The Eye Tracking camera system which is the Pupil Core headset has 4 components that consist of world camera, nose support, an adjustable eye camera, and a USB-C connector clip that is used to connect the Pupil Core headset to the workstation computer via USB-C to USB-A cable. The world camera has a high-speed camera,

and they have two lenses which are the narrow-angle lens and a wide-angle lens. They are interchangeable so the lens can be swapped depending on the field of view. The lightweight camera is adjustable as it can be slid in and out of the headset frame to suit subjects as each subject have their face proportion and also can be rotated to get a good image of the subject's eye. When the camera captures the image information, it will be brought through an optical fiber to the Pupil Player system to be processed.

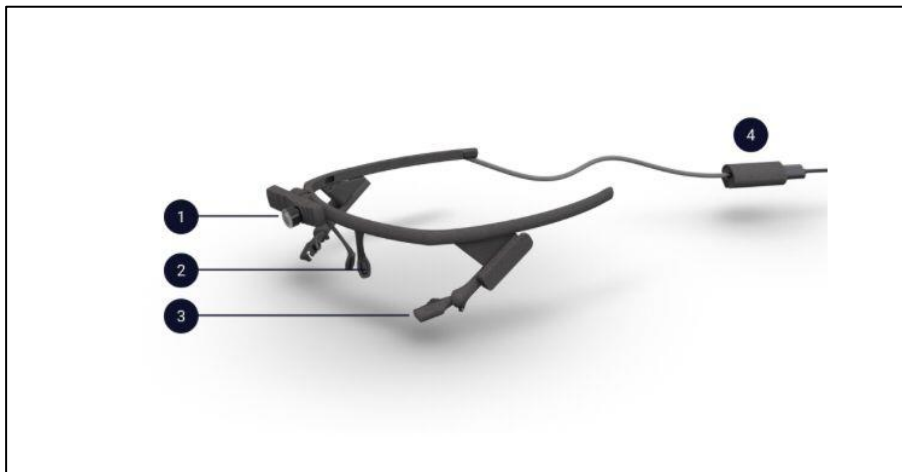


Figure 2. 1 Picture of Pupil Core Glasses Headset; 1) World Camera, 2) Nose Support, 3) Adjustable Eye Camera, 4) USB-C connector clip: ("Core - Hardware - Pupil Labs", 2022)

The second component is the Pupil Lab workstation which consists of a computer monitor that will project the image of the stimulus to the subject. The computer monitor was also installed with the Pupil Core software that allowed the system to capture eye movements, control the equipment of the camera, and finally, process all the eye signals collected from the experiment to be analyzed. The last component is the stimulus presentation that will be projected from the computer monitor. The stimuli were prepared in a video format (.avi) with various images of the honey box that have been designed specifically for this study. Figure 2.4 shows an illustration of how the eye-tracking system works.

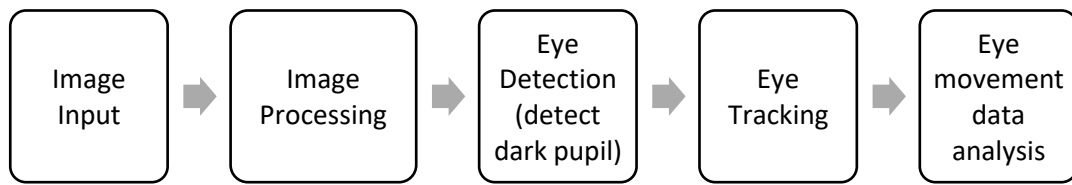


Figure 2. 2 Illustration of the basic process of eye-tracking.

CHAPTER 3

METHODOLOGY

3.1 Ethics and consent

Ethics for this research was approved by the local Ethical Committee of Universiti Sains Malaysia (Kampus Kesihatan) with the reference number (USM/JePeM/20030165).

Subjects who agreed to participate have been explained the aim of the study and the procedure of the research before proceeding. They've also been told that they have the right to withdraw from the study at any moment, with no implications. Each subject was also compulsory to state their signature on a written consent form. An example of the consent form is available in the appendix. All data collected were kept private and confidential.

3.2 Subjects

Thirty healthy subjects were randomly recruited from the Universiti Sains Malaysia. The sample size was calculated by statistician using G*Power 3.1.9.2 software with the following inputs:

F tests - ANOVA: Fixed effects, omnibus, one-way

Analysis: A priori: Compute required sample size

Input: Effect size f = 0.60

α err prob = 0.05

Power ($1-\beta$ err prob) = 0.8

Number of groups = 3

Output: Noncentrality parameter λ = 10.8000000

Critical F	= 3.3541308
Numerator df	= 2
Denominator df	= 27
Total sample size	= 30
Actual power	= 0.8004441

3.3 Inclusion and exclusion criteria

Inclusion criteria included students from Universiti Sains Malaysia ranging from 19–50 years old female and male, normal/corrected to normal vision, right-handedness, or left-handedness according to (Kühn et al., 2016). The exclusion criteria included lifetime history of a major medical disorder (neurological, hepatic, or cardiovascular), uncorrected visual, history of affective disorder using psychiatric medication, and allergy to honey. The exclusion criteria were structured following previous study (Polden et al., 2020) where they found out that subjects that have impairment have reduce mean reaction times on the ability of engage and disengage attention and thus, we exclude any possible probability that can cause error during the experiment.

3.4 Tool

3.4.1 Eye Tracking

The eye-tracking recording uses the equipment of the Pupil Labs system, which includes Pupil Capture, Pupil Player, Eye Tracking Glasses Pupil Core Headset, and Pupil Core software. This equipment analysis was done according to Kassner and the college's previous study (Kassner et al., 2014). This Pupil Core system used infrared illumination and computer-based processing to detect the subject's pupil. Eye images were analyzed in real-time by detecting the subject's pupil, and calculating

the center, and any artifacts were eliminated. The experiment was done in the Eye-tracking laboratory at Universiti Sains Malaysia.



Figure 3. 1 Picture of Simulation of Subject wearing the eye-tracker from Pupil Core Headset.

3.4.2 Stimulus

Stimuli were prepared in a video format (.avi) with different attributes on the honey box. Images have been presented against a white background for individual presentation. Images are randomly presented. The honey box was designed to test 5 different categories of attributes. Each attribute was divided into 3 separate variations of Area of Interest (AOI). The first variation is the placement of the brand logo whether on the right side, left side, or the center.



Figure 3. 2 The variation for the brand logo location attribute.

The second attribute is the size of the halal logo on the honey box. The variation of the attributes includes a large halal logo, a small halal logo, and no placement of the halal logo on the box.



Figure 3. 3 The variation for the halal logo attribute.

The third category is the font style of the “Madu Kelulut Stingless Bee Honey”. The first variation of the category is Arial Narrow font style, the second is the Monotype Corsiva and the third style is Arial Rounded.



Figure 3. 4 The variation for the font style attribute.

The fourth attribute is the price tag placed on the honey box. The first variation is the price tag of RM80, the second variation is RM79.99 and the last variation is there is no placement of the price tag that was put on the honey box.

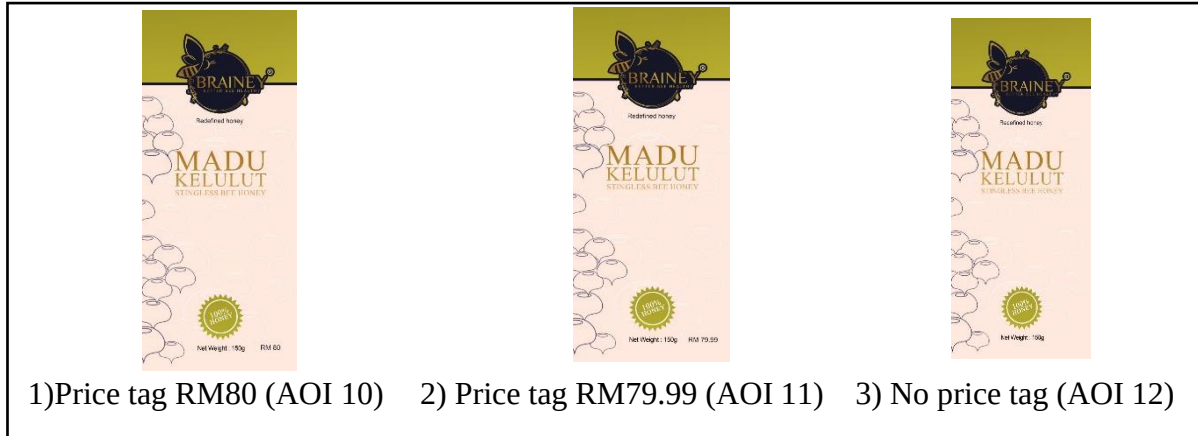


Figure 3. 5 The variation for price tag attribute.

The last category of the attribute is the quality remark logo. The first variation is the “100% honey”, the second variation is “pure honey” and the last variation is “Dijamin Asli”.

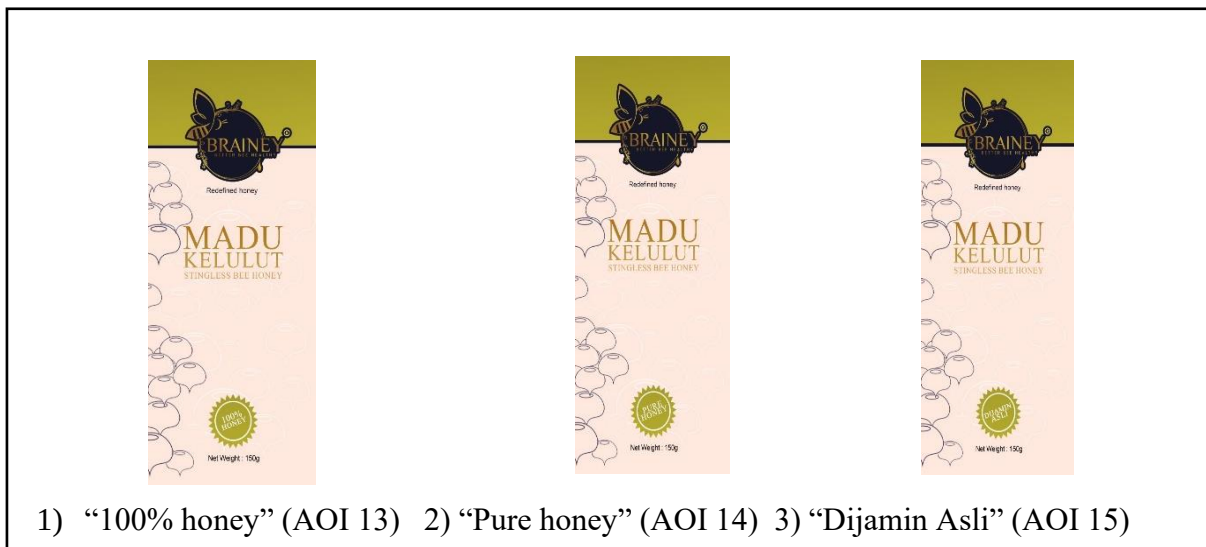


Figure 3. 6 The variation for brand quality remark attribute.

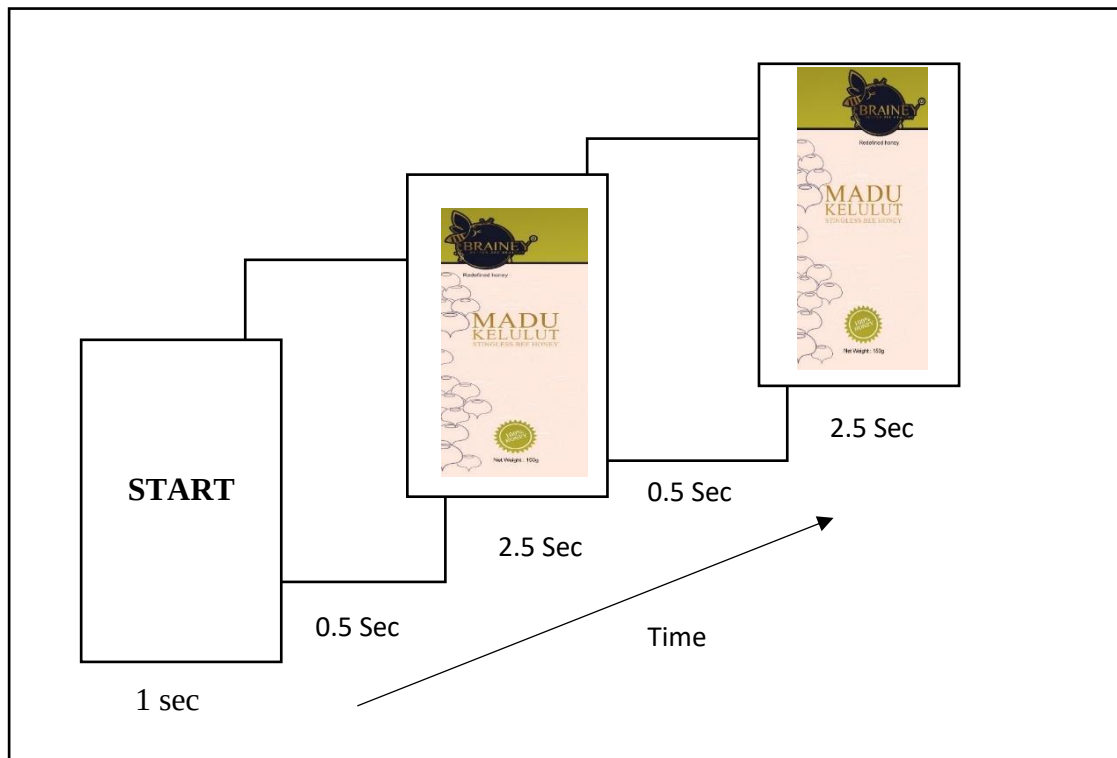


Figure 3. 7 Example of presentation of visual stimulation for all the variety of attributes by Pupil lab software

3.5 Procedures

3.5.1 Procedure in this Eye Tracking study:

A. Preparation of stimulus (paradigm) using the Pupil Lab System

The video of the stimulus was prepared by using the Pupil Core experiment computer software in a video format (.avi) with a 60-second duration. The stimulus then was synchronized using the Pupil Capture system.

B. Initial setup of the subject's placement and eye camera.

The Pupil Core headset was plugged into the computer and was put on to the subject. the headset is adjusted to suit the subject's face and there should be space between the headset frame and the subject's forehead. The camera was mounted on the upper side of the computer monitor. The camera was placed centrally aligned in front of the subject's eye to be able to keep track of the

position of the subject's pupil. The distance between the camera and the subject's eye was between 100- 180 cm.

C. Launch Pupil Capture and Pupil Detection Checking

The subject will be asked to sit comfortably while wearing the Pupil Core headset facing the computer monitor. The Pupil Capture system was then launched on the computer. After the program has initialized, the world camera and eye window appeared on the screen. The headset will be adjusted manually so that the headset will get a good image of the eyes. The Pupil detection was a success when the eye model (green circle that appeared on the window screen) fit with the subject's eye.

D. Calibration

Calibration was carried out to know what the subject is looking at and to carry out this process, the mapping must be made between the pupil of the subject and gaze positions. The Pupil Capture system used the screen marker calibration method.

E. Running of the Eye Tracking experiment

After the eye tracker calibration was set up to 5 point of corner correction, the stimulus was presented to the subject. Each subject was told to look at the video that contain images of the honey box design.

F. Extraction of data to set AOI

After subjects has done looking at the video, their datas were saved and loaded into Pupil Player to be analyzed. Pupil player provided various data views to analyze gaze data. In the Pupil Player program, the saved data were extracted into each AOI using the surface tracker that have individual marker of AOI on each image. After each AOI have been marked, the program analyzed the data and result data were exported into Excel spreadsheet.

G. Data Analysis

The results from the eye-tracking data were analyzed by using Excel spreadsheet Statistical Package for the Social Science version 28 (SPSS 28) software. Data that have been collected were exported into an Excel spreadsheet and the total sum of the duration fixation was calculated for each AOI. After the total sum of all AOI has been calculated, the data were transferred into SPSS 28 to be analyzed by using one-way Analysis of Variance (ANOVA) to check the pattern of each AOI and comparing the means between the group. The comparison of the mean was said to be a significant difference when the $p\text{-value} < 0.05$ and proceed with the Tukey test to identify which factors that were significantly different. The data from the survey questionnaire between the attractiveness and willingness toward the different variations of attributes were analyzed by using the Pearson correlation analysis.

3.5.2 Attractiveness and Willingness Survey Assessment

After subjects have done the looking at the simulation videos, they were required to answer survey questions that aimed to know their opinions about the attractiveness of the stingless bee honey box and their willingness to buy the product. They will be asked to evaluate each opinion on 2 separate scales using a 7- point hedonic scale according to previous research Zellner, D. A., Lankford, M., Ambrose, L., & Locher, P. (2010). The 7 -point structure for attractiveness is labelled from “very unattractive” to “very attractive” and the willingness scale structure labelled starts with “strongly disagree” to “strongly agree”.