

# Neuromarketing cues: an eye-tracking study on mother's visual attention to organic vegetable advertisement

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**Abstract:** This research investigates the impact that different aspects of advertising have on the attention that a consumer pays to a certain advertisement. To investigate the correlations between the components of advertising and the attention arousal of consumers, six different aspects were tested. After collecting data from mothers, a heat map analysis was performed. The findings suggest that both the text and the visual components of the advertisements influenced the viewers' levels of attention. This research provides two possible hooks that might spike a consumer's attention and arousal in an advertisement. It is the image of a mother and kids together with the quote. The research presents how mother's attention can be triggered by organic foods, which can help food advertisers to understand better the role of marketing cues in influencing consumers' purchase decisions.

**Keywords:** Neuromarketing; Eye tracking; Advertisement; Consumer; Heat map; Attention

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## 1.0 INTRODUCTION

Neuromarketing (NM) is a multidisciplinary discipline that combines marketing, neuroscience, and cognitive psychology (Oliveira, 2015). NM studies investigate the activity of distinct brain areas in response to marketing stimuli to determine the link between an individual's behaviour and neurophysiological system (Alsharif, 2021). NM is defined as utilising neurological research methodologies to understand better consumer thought patterns, with the possibility of discovering the 'buy button' in customers' brains to make marketing and advertising more efficient (Nyoni & Bonga, 2017). NM studies were the topic of several research efforts throughout the recent decade (Ungureanu et al., 2017). As a result of the widespread interest, the Neuromarketing World Forum has evolved into an annual event that brings together experts from

business, academia, and industry interested in neuromarketing (Neuromarketing Science and Business Association, 2022).

Consumers purchase products and services for themselves or their families (Kamarulzaman & Abu, 2017). In addition, women are believed to make more than 80% of all consumer purchase choices (Jones, 2018). While the market scale is appealing, marketers do not always understand women. Women acquire and utilise information differently than males, and when questioned specifically about food, 59% of women claimed food marketers mislead them (Jones, 2018). Most consumers do not wish to disclose or cannot justify their purchasing choice because 95% of consumer goods purchases are made unconsciously (Zamani, 2017). Consumer research, on the other hand,

shows that consumers make decisions at a far deeper level, one that is subconscious ([Neto et al., 2011](#)). Typically, a customer will choose a product from the shelf based on the label design, packaging, form, or colour. Due to the high proportion of the human brain dedicated to vision (about 25%), it is of particular interest to marketers to explore how certain ad visuals trigger different kinds of brain activity ([Zamani, 2017](#)).

Eye tracking (ET) is a technique that can assess what people see and is commonly used in NM because it provides useful indicators of interest, attention, and attraction ([Berčík et al., 2016](#)). The ET technique offers data on internal brain activity ([Roth, 2013](#)). ET may also be used to investigate the visual examination of items and services ([Duchowski, 2002](#)). According to Hyökki ([2012](#)), ET discloses customer behaviour by offering more precise information regarding behavioural data to be analysed. The NM and ET paradigms may be expanded to investigate the influence of various signals or stimuli on strategic monitoring inside a visual perspective memory task linked to cognitive systems ([Shelton & Christopher, 2016](#)).

The research reported in this article attempts to establish a technique for evaluating mothers' visual attention to advertisements for vegetable crops, which are one of their and their children's sources of nourishment. This research looks at mothers' attention to assist the nursery business in better serving this vital group of clients. Furthermore, this research creates a heat map analysis for the region of interest of each element in the advertising. The following section offers a quick overview of the process employed and the narrative behind each piece of advertising.

### 1.1 Consumer and Advertisement

Almost nine out of ten mothers report being the major shopper for their families ([Clopeck, 2018](#)). Over half also think they make most parenting choices, with little over a third sharing that burden ([Clopeck, 2018](#)). Researchers extensively study mothers as conduits to other family members, particularly children ([Petersen et al., 2014](#); [Rigney, 2012](#)). Mothers are generally the focus of initiatives to address children's concerns, such as obesity, since they are thought to be custodians of their families' health. While parents have been regarded as gatekeepers for their children's food choices ([Savage et al., 2017](#)), mothers have been recognised as responsible for meal planning and preparation. Mothers feel responsible for their children's eating habits and suffer anxiety because of this duty ([Jones, 2018](#)).

A study of Australian mothers found that their children's eating choices mirrored the quality of their parenting ([Petersen et al., 2014](#)). When mothers thought they had failed to manage their children's weight and food effectively, they were anxious and defensive ([Jones, 2018](#)). Mothers are seen as the key socialising agents in the family, a position that mothers have chosen for themselves ([Petersen et al., 2014](#); [Savage et al., 2017](#)). Another research found that mothers are responsible for their children's dietary choices, stating that "it is up to the parent to educate boundaries and select what limits are" ([Rigney, 2012](#)). Given this perceived obligation, mothers will seek methods to deal with it. Mothers will ensure their children have a nutritious, balanced meal that includes carbohydrates, protein, fat, fruit, and vegetables.

A balanced and diverse diet is essential for maintaining excellent health ([Keatinge et al., 2011](#)). The children under five years old mortality rate are a major indicator of child health and general development in countries ([Keatinge et al., 2011](#)). Child malnutrition, as assessed by the proportion of underweight children under five, is essential for monitoring the population's nutritional condition and health ([Keatinge et al., 2011](#)). Childhood starvation decreases intellectual skills. However, some brain damage from malnutrition may be restored ([Brown & Pollitt, 1996](#)). Early childhood malnutrition is a crucial component in predicting later cognitive development. Consuming nutrient-dense vegetables is the first step toward overcoming malnutrition ([Yang et al., 2007](#)).

All the nutritious value of vegetables might be lost if they are polluted with dangerous microbes, heavy metals, or pesticides. Growers must utilise proper agricultural production techniques to reduce contamination from pesticide residue, bacteria, viruses, or helminths harmful to humans, or mycotoxins caused by inadequate drying and storage. Growing your vegetables is the greatest approach for the customer to ensure the quality of the produce. In continuation, nursery industry marketers must strengthen their marketing approach to grab consumers' attention, which will lead to the purchase of vegetable crops and increase the nursery industry's profit.

The eye is an anatomical extension of the brain, with several similarities in neurons, vasculature, and immunological response ([Nguyen, 2021](#)). Most human information about the outside world is received via their eyes. As a result, vision is the most crucial of the human senses. Light passes through the cornea and lens,

combining to generate a clear picture of the visual world on a sheet of photoreceptors called the retina. The lateral geniculate nucleus of the thalamus relays visual information from the retina to the main visual cortex, which is situated in the occipital lobe close to the back of the brain.

The information will be processed, and the brain will create an image of what the eye sees. In addition, at this same instant, the brain will process an action which is a direct consequence of the visual information. For instance, when a customer makes a purchase, the brain will first process a picture of the item being purchased, and then it will process the decision-making. What is crucial here is the visual information captured by the eye since that information will be processed by the brain and lead to decision-making. Where humans focus their eyes (gaze) and how they move their eyes is related to where they pay attention. ET use sensor technologies to track an individual's gaze and eye movement ([Punde et al., 2017](#)).

ET is a current neurophysiological instrument utilised in various investigations, including marketing, behavioural, psychology, and cognitive psychology ([Chae & Lee, 2013](#)). The eye location is monitored using ET technology as its concentration moves along the visual trigger surface. ET monitors what the user desires (the screen's point of view), the movement of the eyes concerning the head, and pupil dilation ([Zurawicki, 2010](#)). The ET system can estimate an eye's attachment point on a computer screen or a supermarket shelf and accurately detect where the user's attention is focused ([Duchowski, 2003](#)). ET enables the measurement of an individual's brain's numerous processes in response to stimuli, providing significant information regarding consumer behaviour in response to marketing stimuli such as brand and advertising ([Fortunato et al., 2014](#)). As a result of the link between visual attention and eye movements, it is a helpful tool for experimental psychology and neurological study ([Hoffman, 1998](#)).

The ET may offer vital information to the NM, such as gaze spots, gaze duration, saccade, and pupil dimension, from which heatmaps for the area of interest (AOI), time spent, visits, and revisits can be determined ([Alsharif et al., 2020](#); [Zamani, 2017](#); [Khushaba, 2013](#)). Saccadic eye movements are roughly 200 milliseconds, with eye fixations lasting between 200 and 350 milliseconds for reading text and viewing video sequences, respectively ([Rayner, 2009](#)). The scan route is called after the discoveries of fixations and saccades that examine visual perception, cognitive purpose,

interest, and connection ([Zurawicki, 2010](#)). Furthermore, pupil dilation with a longer blinking duration provides us with more information regarding processing ([Fortunato, 2014](#)).

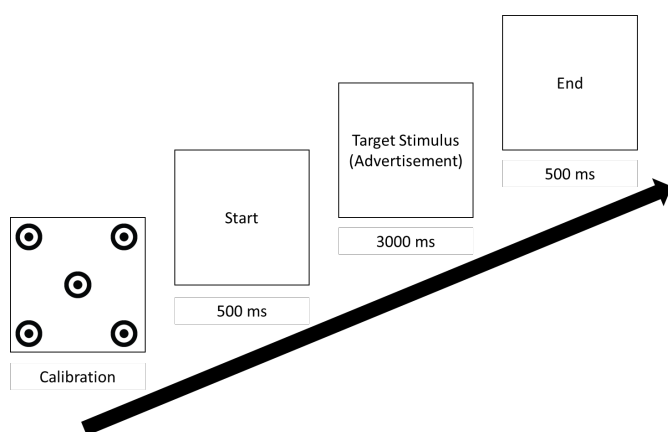
AOI are user-defined subregions of a stimulus object presented on screen ([Punde, 2017](#)). Metrics for separating AOI are assessed based on the performance of two or more discrete sections in the same image, website, or programme interface. A heat map demonstrates the variation of visual attention generated by static, dynamic, or static aggregations of gaze points and fixations ([Punde, 2017](#)). Heat maps are a good approach for visualization since they highlight the most important areas of stimuli. Heat maps use an easy-to-read color-coded approach. The presence of many gaze points in a red region indicates a greater degree of interest. In contrast, gaze points in a yellow or green area indicate less visual attention.

With technological advancement, the ET has various applications related to human-computer interactions, which may be used in laboratory and real-world settings ([King et al., 2019](#)). For instance, in marketing research, the ET has typically been used to evaluate the individual's reactions to a variety of stimuli (such as the usability of the website, packaging, product designs, attention, the individual's responses to the ads, the product's position on the shelves in the shops, and the cognitive and emotional influences on the brain regions) ([Rossi et al., 2017](#)). The knowledge of a process that guides customers to choose certain components from an image has a variety of applications in the world of business ([Zhao & Koch, 2013](#)). Thus, neuro-marketers and researchers may profit from the knowledge provided by using it professionally to grab consumers' attention and represent them in visual activities ([Piqueras-Fiszman et al., 2013](#)). It may also combine ET and EEG to get important insights on consumers' emotional and cognitive responses to marketing stimuli ([Alsharif et al., 2021](#)).

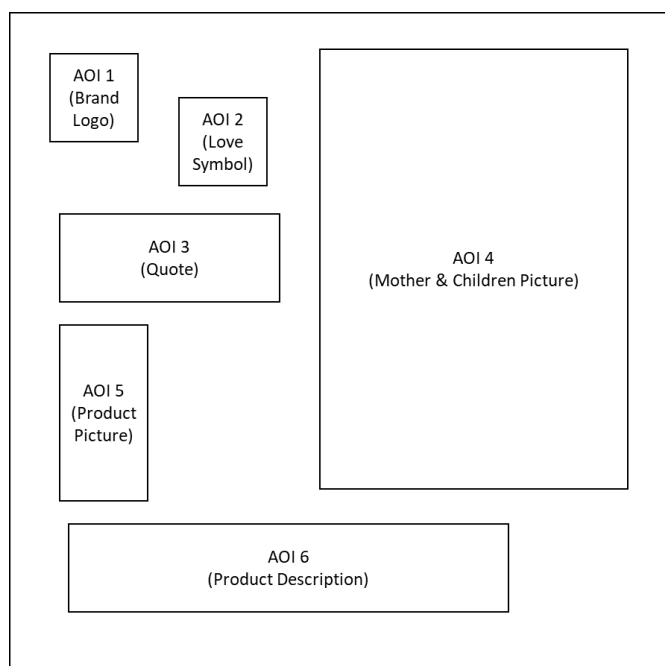
## 2.0 MATERIALS AND METHODS

The Human Ethical Committee of USM has approved this study with the reference number USM/JEPeM/16080255. This study recruited female participants (mothers) with a mean (SD) age of 34.80 (5.72), and all of them had a tertiary degree of education that was at least equivalent to that of a bachelor's degree. All test subjects completed a written informed consent form before participating in the study. An eye-tracking device called Pupil Core Pupil Labs was employed for this study. Participants wore the Pupil Core headset while connected to a computer. The

subject was sat with around 100 centimetres (cm) between his or her eye location and the computer screen, which displayed the stimuli. Pupil Capture software was also utilised to track eye movements in real-time and capture information about the pupils. The stimulus on the screen was a marketing advertisement for vegetable crops (**Figure 1**). The display of the visual stimuli in ET starts with calibration and is then followed by the presentation of the stimulus for a duration of 3000 milliseconds. This ad's area of interest (AOI) is shown in **Figure 2**. Using the collected data, pupil Player was used to build a sophisticated representation of participant gaze video. The data will be improved before exporting it for further analysis using an analysis plugin.



**Figure 1.** Eye tracking visual stimulus presentation.



**Figure 2.** Stimulus Area of Interest (AOI).

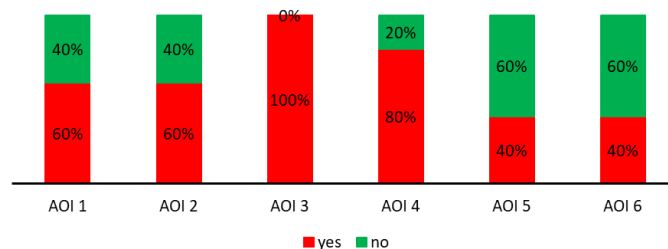
### 3.0 RESULTS

Eye tracking delivers a variety of detailed eye-movement data ([Rim et al., 2021](#)). As eye tracking technology becomes more common in research, it is critical to assess its practical use. As a result, this research emphasises the consumer's AOI on vegetable crop advertisements. The heat map results for each AOI component are shown in **Table 1** and **Figure 3**.

**Table 1.** The heat map results for area of interest in advertisement.

Area of Interest (AOI)	High Heat Map Respond (%)
AOI 1 - Brand Logo	60
AOI 2 - Love symbol	40
AOI 3 - Quote "Mothers know, a healthy child is a happy child"	100
AOI 4 - Mother and Children picture	80
AOI 5 - Product Picture	40
AOI 6 - Product description	40

According to **Table 1**, the quote "Mothers know, a healthy kid is a happy child" could capture 100% of the consumer's attention. Furthermore, an image of a mother and her children could capture 80% of the viewer's attention. 60% of consumers would notice a brand's logo. Other elements, such as the love symbol, product image, and product description, only capture 40% of the consumer's attention. For example, if the primary target customer is a mother, the marketer may utilise a quote about the mother or the kid and a picture of the mother and children. These two factors are important when determining their target. The primary goal of advertising is to draw attention to the product itself, which may result in a sale. Based on the results, only 40% of the attention can be captured, indicating that this advertising must be improved in relation to the product itself.



**Figure 3.** Heat map resolution for each AOI.

#### 4.0 DISCUSSION

According to this research, all consumers (100%) pay attention to AOI 3 (text), whereas 80% pay attention to AOI 4 (image). Images are processed by the human brain 60,000 times quicker than words. The human brain processes a picture in approximately 13 milliseconds. Other factors may have an impact on the findings of this research. According to prior research by Beitlich and Reiss (2017), humans glance at the picture but concentrate longer on the text than the image, switching between text and image. The author also discovered a minor trend in which less educated people concentrated longer on the pictures and returned to them more often than more educated people. It is reasonable to conclude that their educational degree will influence the consumer's attention. Because all the participants in this study had a higher education, they focused more on AOI 3 than AOI 4. Furthermore, 95% of B2B customers preferred shorter and more visual information (Brown, 2018). Female participants in the study attended visually to most of the information area on online purchasing, according to Hwang and Lee (2018). The fact that every one of our subjects is a mother and a female is presented here as evidence for why the result at AOI 3 got more attention than the other components.

Advertising is the process of creating a paid communication message to inform people about something or persuade them to purchase, test, or do something. Regarding product advertising, the essential factor is the product itself and how these commercials may persuade consumers to purchase it, resulting in increased sales and profits. However, AOI 5 (product image) and AOI 6 (product description) get around 40% of the consumer's attention in this advertisement. According to Mansor and Isa (2022), product images attract greater attention than product text. Product selections are decided based on a range of variables, the most important of which are the 4Ps, i.e. product, price, place, and promotion. The flow will begin with the product picture, then go on to the promotion, price, product text, and finally, the place (Mansor & Isa, 2022). From this, product appearance is the most important factor influencing consumers to buy. This advertising must enhance the product image; otherwise, it will just draw the consumer's attention to the advertisement and not lead to the purchase of the product. Compared to the image in this advertisement, AOI 4 is greater than AOI 5. Perhaps because of the image's size, AOI 5 attracts less attention than AOI 4.

This advertisement has successfully attracted customer attention, but the product image has failed to do so. Merging AOI 3, AOI 4, and AOI 5 is recommended for this advertisement's research and development. People pay a lot of attention to AOI 3 and AOI 4; thus, combining them with AOI 5 might indirectly increase its attractiveness. There is a strong correlation between product awareness and subsequent purchases. Well-designed advertisements are particularly crucial when their primary target audience is women since women have a larger visual attention span than males (Hwang & Lee, 2018). Visual attention to product information and customer opinion area substantially affected female shoppers' attitudes (Hwang & Lee, 2018).

#### 5.0 CONCLUSIONS

In food advertisements, the presentation of organic vegetables does not automatically lead to higher visual attention or emotional arousal. Nevertheless, the mother's role in preparing food at home influences their attention and arousal toward healthy products. Rephrased, these roles can lead to higher emotional arousal when making decisions with organic products. Based on increased attention and arousal, advertisements with cues may prompt mothers to consume organic products. On a methodological level, this study concludes that implicit measurements do reveal important insights into how health messages can influence certain target audiences. Nowadays, mothers understand the need to ensure their children eat enough high-quality food, including vegetables. Research like this identifies two potential hooks that might get a consumer interested in an ad. It is the quote and picture of mother and child. Suppose a marketer knows that their target customer is a mother. In that case, they may include these indicators in their ads to increase the chances of a successful response and, ultimately, sales and profits. It is, therefore, extremely important to conduct more eye-tracking experiments with mothers to fully understand which processes are taking place during food consumption with integrated food cues. Such studies may also show how healthy foods can trigger a mother's attention.

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**Author Contributions:** SMI and NNAA designed the experiments, contributed analysis tools, performed the experiments, analysed the data, and wrote the paper.

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