

Areas of Interest (AOI) on marketing mix elements of green and non-green products in customer decision making

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ABSTRACT: Technological advancements in eye-tracking have enabled the development of interactive experimental setups for studying consumer behaviour. A common method for examining gaze data is Area of Interest (AOI). Therefore, this study fully utilised eye-tracking tools to measure participants' allocation of visual attention to the marketing mix elements in green and non-green products. This is because the product, price, place, and promotion are still the most crucial factors that customers consider when purchasing. The primary objective of this study is to discover and understand the primary marketing function that directly influences customer decision-making from a neuromarketing perspective. Their eye movements were simultaneously registered using SMI Eye Tracking Glasses 2 Wireless, and the gaze locations of participants were measured from AOI. The findings of this study have a significant impact on the importance of eye movements in decision-making, particularly when choosing important marketing elements before purchasing green and non-green products.

Keywords: eye tracking; Area of Interest; neuromarketing; consumer; green products;

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1.0 INTRODUCTION

Growing numbers of research focused on using eye-tracking to study human behaviour, and researchers can now use eye tracking to observe the eye movement of consumers (Yang & Wang, 2015). According to Carter & Luke (2020) eye-tracking is a research technique for capturing eye movement and gaze location throughout time and task. The results of eye-tracking research are practical in marketing applications, such as brand equity, segmentation, new product development, pricing decisions, place decisions, promotion decisions, and social marketing studies. Most of the studies used

eye-tracking to learn the processes by consumers to decide (Reutskaja et al., 2011).

Many studies have been performed to understand better how various aspects of eye visuals affect the decision-making of consumers, including the number and length of visual fixations (Krajbich & Rangel, 2011; Krajbich et al., 2010; Krajbich et al., 2012), visual salience of stimuli (Pieters & Wedel, 2004; Towal et al., 2013), and subjective meaning of stimuli influenced through branding (Philiastides & Ratcliff, 2013; Pieters et al., 1999) as cited in Karmarkar et al. (2015).

Therefore, this study would like to fully utilise eye-tracking functions to measure consumer behaviour, especially when choosing between green and non-green products. This study applied the eye-tracking method focused on the Area of Interest (AOI) of the consumers' eye movement to obtain the results. AOI is any visual stimulus object that the observer focuses on and that is identified by bounding boxes ([Lagmay, & Rodrigo, 2022](#)). It is a frequently used strategy to analyse eye tracking data, where this method assesses if a gaze point or fixation is focused at a designated zone surrounding a target point ([Vehlen et al., 2021](#)).

Studying consumers' eye movements gives a better understanding of consumers' choices of behaviour and perceptual decision-making ([Wan Adnan et al., 2013](#); [Popa et al., 2015](#)). A study confirms that eye-tracking provides more accurate information than self-reports ([O'Connel et al., 2011](#)). This proves that it is a window into the mind because eye-tracking measures consumers' responses indirectly instead of directly.

Many traditional ways of studying using pen and paper have been conducted on green purchase behaviour, and various antecedents contribute to green purchase behaviour. For example, studies conducted by Sima ([2014](#)) and D'Souza and colleagues ([2007](#)) mentioned that quality and price influenced green purchase intention, and consumers are willing to pay more for green products. Traditional product attributes such as price, quality, and brand are still consumers' most important attributes when making a green purchasing decision ([Gan et al., 2008](#)). A considerable amount of attention has been paid to consumer behaviour, yet research on the green behaviour of consumer product choice from the neuromarketing perspective has remained limited. This is supported by Mansor et al. ([2021](#)) stated that researchers and marketers can be trained in neuromarketing to develop more capable and effective marketing strategies to beat the challenges.

2.0 MATERIALS AND METHODS

The main purpose of this research is to investigate and understand the main marketing function variables: product, price, place, and promotion of green and non-green products, which directly influence consumers' decision-making from the neuromarketing perspective.

This study employed an eye-tracking method that focuses on the Area of Interest (AOI) of the consumers' eye movement to obtain the results. Visual attention to the AOIs was estimated by the fixation time in seconds at a particular point for a minimum of 80 milliseconds

and the validity of fixation time acts as an indicator of attention ([Boerman et al., 2014](#)).

This study's population is made up of healthy adult consumers of both genders who were recruited voluntarily from among students in Universiti Sains Malaysia Kubang Kerian Kota Bharu, Kelantan. When using neuroscience methods, the sample sizes tend to be smaller ([Lepping et al., 2015](#)). This is supported by Bercea ([2012](#)), who stated that only small sample sizes are required for neuromarketing studies. A sample of at least 20 participants is considered appropriate for eye-tracking experiments in neuromarketing studies to achieve a similar statistical level and explain a valid conclusion ([Hensel et al., 2017](#); [Sands, 2009](#)). Lim et al. ([2006](#)) suggest that the sample size is limited to 20-30 per case in an experimental design. This experimental protocol was approved by the Human Ethical Committee of Universiti Sains Malaysia (USM) with the reference number USM/JEPeM/16080255.

For the eye-tracking experiment, the researcher developed images of two types of products: green and non-green body wash products and manipulated the information on the product, place, price, and promotion information. The body wash was chosen since the participants had a moderate level of product involvement and because the product is gender neutral, and earlier research also employed body wash ([Lin & Huang, 2012](#); [Young et al., 2008](#)).

In the eye-tracking experiment, SMI Eye Tracking Glasses 2 Wireless was used to collect all the participants' responses. In this experiment, participants were then asked to look at each picture, and their eyes were tracked to see how they reacted to the stimuli. The output from the eye movement was collected using BeGaze analysis software to preview and export data, statistics, and visualisations of any combination of user data. The neuromarketing approach reveals information on consumers' preferences that cannot be obtained through conventional and traditional methods ([Ariely & Berns, 2010](#); [Colaferro & Crescitelli, 2014](#)).

To test how the consumers' eye attention is distributed across the stimuli, this study divided the stimuli into 2 groups. Each group was divided into five (5) main AOIs of the leading marketing elements of the study. For each item, five rectangular AOIs were placed into the picture as shown in the areas named based on the marketing mix elements of the study, which are 'Product Text', 'Product Image Price', 'Promotion', and 'Place'. These will be the indicators and focus throughout the study.

3.0 RESULTS

Eye movement data can be converted into analysis, such as fixation time, fixation counts, pupil size, the proportion of fixation time, saccade counts, and scan path. Fixation and saccades are two primary indexes used to describe eye movements (Maurage et al., 2021). Fixation time is the total amount of time spent focusing on a certain AOI by the participant, which shows the level of attention (Li et al., 2022). For this study, the researchers focused on eye fixation, which shows the

degree of attention. Fixations indicate where in the visual area a person's attention is focused.

Visual attention and processing of on-screen words and pictures defined as the Areas of Interest (AOIs) were examined in this review. Figures 1 and 2 present the heat map visualised by the SMI Eye tracker and show participants' average fixation duration and gaze locations, which can be measured from AOI.



Figure 1: Area of Interest (AOI) of non-green body wash.

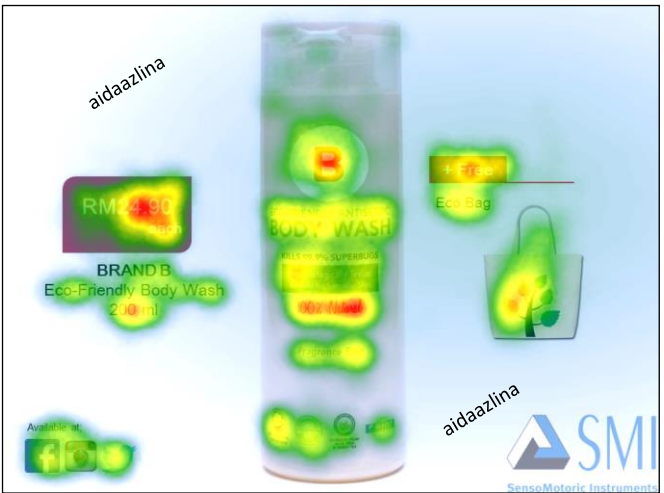


Figure 2: Area of Interest (AOI) of green body wash.

Table 1: Area of Interest (AOI) for the non-green and green products

Item	Product Image	Promotion	Price	Product Text	Place
Average fixation non-green product	460.1 ms	443.9 ms	426.1 ms	389.8 ms	326.9 ms
Average fixation green product	447.0 ms	440.1 ms	438.9 ms	403.1 ms	311.2 ms

Note: ms (milliseconds)

The results of this study have an important impact on the role of eye movements in decision making, especially between green and non-green products. The eye can be a window into the mind by tracking eye movements and fixation. Thus, the average fixation time in ms is a second element mentioned in AOI.

Average Fixation duration is linked to cognitive processes. Overall, the highest average fixation time of participants is on 'Product Image' (460.1 ms.), followed by 'Promotion' (443.9ms), 'Price' (426.1ms), 'Product Text' (389.8ms), and 'Place' (326.9ms) for the non-green product. The higher average fixation of participants is

on the 'Product Image' of green body wash (447ms) compared to the second-highest element, 'Promotion' (440.1ms). The difference between 'Promotion' and third-ranking of average fixation is only 37ms which is 'Price' (438.9ms). 'Product Text' (403.1ms) and 'Place' (311.2ms) make the last element that gets the participants' attention. The highest marketing mix elements receive a higher average fixation. Overall, total fixation time is closely related to the tendency to focus on a given target. The longer the time spent on the fixation time, the longer the participants focus on the target. It also indicates that participants took more time than expected to analyse and evaluate the contents.

4.0 DISCUSSION

The eye-movement information obtained through eye-tracking provides a ton of sophisticated data ([Rim et al., 2021](#)). As eye-tracking technology becomes popular in research, it is essential to evaluate its practical value. Therefore, this study focuses on the AOIs of the participants on green and non-green products. According to Sharafi et al. ([2015](#)), longer fixations show that participants take longer to analyse and interpret the contents of the AOIs during the task. The basis for analysing the activity and performance of the participants are fixations because they can be connected directly to 'attention'.

In summary, Product Image produced the longest fixation duration on the AOIs, with the highest fixation viewed by the participants. The difference in fixation time between 'Product Image' in non-green products and green products is only 13ms. This indicates that more fixations are on non-green products since they are very close to consumers in the daily usage of the products, and it is also feeding the basic needs and wants of the consumers. This is supported by Jayawardena & Jayarathna ([2021](#)); the number of fixations within an AOI indicates the effectiveness of identifying that component compared to others. Meanwhile, 'Price' in the green product is the main criterion with the highest fixation from the participants. One of the main reasons that trigger consumers to either purchase the products or not is mainly because of the price factor. This study supports the finding and discovers that the marketing mix elements impact decision-making. Based on the results of the study, marketing managers can plan appropriate marketing strategies for marketing mix elements to meet their target and profit.

References

- Aman, A. H., & Lizawati, A. H. Hussein Zuhail. 2012. The Influence of Environmental Knowledge and Concern on Green Purchase Intention the Role of Attitude as a Mediating Variable. *British Journal of Arts and Social Sciences*, 9578(7), 2.
- Ariely, D., & Berns, G. S. (2010). Neuromarketing: the hope and hype of neuroimaging in business. *Nature Reviews Neuroscience*, 11(4), 284–292. <https://doi.org/10.1038/nrn2795>.
- Bercea, M. D. (2012). Anatomy of methodologies for measuring consumer behavior in neuromarketing research. In Proceedings of the Lupcon Center for Business Research (LCBR) *European Marketing Conference*. Ebermannstadt, Germany.
- Boerman, S. C., van Reijmersdal, E. A., & Neijens, P. C. (2014). Using Eye Tracking to Understand the Effects of Brand Placement Disclosure Types in Television Programs. *Journal of Advertising*, 44(3), 196–207. <https://doi.org/10.1080/00913367.2014.967423>
- Carter, B. T., & Luke, S. G. (2020). Best practices in eye-tracking research. *International Journal of Psychophysiology*, 155, 49–62. <https://doi.org/10.1016/j.ijpsycho.2020.05.010>
- Colaferro, C. A., & Crescitelli, E. (2014). The contribution of neuromarketing to the study of consumer behavior. *Brazilian Business Review*, 11(3), 123–143.
- D'Souza, C., Taghian, M., & Khosla, R. (2007). Examination of environmental beliefs and its impact on the influence of price, quality, and demographic characteristics with respect to green purchase intention. *Journal of Targeting, Measurement, and Analysis for Marketing*, 15(2), 69–78. <https://doi.org/10.1057/palgrave.jt.5750039>

5.0 CONCLUSIONS

Consumers are increasingly concerned about the environment, so marketers have begun to change how they produce their products and implement new marketing strategies. The decisions made on the products are based on a variety of factors; the main factors are 4Ps. The best instrument for a green marketing campaign for companies is a traditional marketing mix. This is supported by Aman et al. ([2012](#)), who agreed that it is also possible to implement conventional 4P mix marketing strategies (Product, Price, Promotion, and Place) in the green marketing area. This is because the most important features consumers consider when making a green purchase are traditional product features such as price, quality, and brand ([Gan et al., 2008](#)).

The experiment concludes that non-green products dominate consumers' decision-making, while green products are primarily based on the experience felt while consuming the products. Thus, neuromarketing can identify movements that are not accessible to the traditional research method. This evidence offers a new marketing opportunity for marketers to improvise their marketing strategy and increase sales growth. This concludes that the simple yet basic marketing strategy concept becomes better with the neuromarketing approach.

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- Gan, C., Wee, H. Y., Ozanne, L., & Kao, T.-H. (2008). Consumers' purchasing behavior towards green products in New Zealand. *Innovative Marketing*, 4(1), 93–102.
- Hensel, D., Iorga, A., Wolter, L., & Znanewitz, J. (2017). Conducting neuromarketing studies ethically-practitioner perspectives. *Cogent Psychology*, 4(1), 1–13.
- Jayawardena, G., & Jayarathna, S. (2021). Automated Filtering of Eye Movements Using Dynamic AOI in Multiple Granularity Levels. *International Journal of Multimedia Data Engineering and Management (IJMDEM)*, 12(1), 49–64.
- Karmarkar, U., Yoon, C., & Plassmann, H. (2015). Marketers should pay attention to fMRI. *Harvard Business Review*, 3, 2015.
- Krajibich, I., & Rangel, A. (2011). Multialternative drift-diffusion model predicts the relationship between visual fixations and choice in value-based decisions. *Proceedings of the National Academy of Sciences*, 108(33), 13852–13857.
- Krajibich, I., Armel, C., & Rangel, A. (2010). Visual fixations and the computation and comparison of value in simple choice. *Nature Neuroscience*, 13(10), 1292–1298.
- Krajibich, I., Lu, D., Camerer, C., & Rangel, A. (2012). The attentional drift-diffusion model extends to simple purchasing decisions. *Frontiers in psychology*, 3, 193.
- Lagmay, E. A. D., & Rodrigo, M. M. T. (2022). Enhanced Automatic Areas of Interest (AOI) Bounding Boxes Estimation Algorithm for Dynamic Eye-Tracking Stimuli. *APSIPA Transactions on Signal and Information Processing*, 11(1), e20. <http://dx.doi.org/10.1561/116.0000002>
- Lepping, R. J., Papa, V. B., & Martin, L. E. (2015). Cognitive neuroscience perspectives on food decision-making: A brief introduction. *Journal of Agricultural and Food Industrial Organization*, 13(1), 5–14.
- Li, Q., Xu, S., Chen, Y., Lu, C., & Zhou, S. (2022). Detecting preservice teachers' visual attention under prediction and nonprediction conditions with eye-tracking technology. *Physical Review Physics Education Research*, 18(1), 010134.
- Lim, K., Sia, C., Lee, M., & Benbasat, I. (2006). Do I Trust You Online, and If So, Will I Buy? An Empirical Study of Two Trust-Building Strategies. *Journal of Management Information Systems*, 23(2), 233–266.
- Lin, P. C., & Huang, Y. H. (2012). The influence factors on choice behavior regarding green products based on the theory of consumption values. *Journal of Cleaner Production*, 22(1), 11–18.
- Mansor, A. A., Mohd Isa, S., & Mohd Noor, S. S. (2021). P300 and decision-making in neuromarketing. *Neuroscience Research Notes*, 4(3), 21–26. <https://doi.org/10.31117/neuroscirn.v4i3.83>.
- Maurage, P., Bollen, Z., Masson, N., & D'Hondt, F. (2021). Eye tracking studies exploring cognitive and affective processes among alcohol drinkers: a systematic review and perspectives. *Neuropsychology Review*, 31(1), 167–201.
- O'Connell, L. A., & Hofmann, H. A. (2011). The vertebrate mesolimbic reward system and social behavior network: a comparative synthesis. *Journal of Comparative Neurology*, 519(18), 3599–3639.
- Philastides, M. G., & Ratcliff, R. (2013). Influence of branding on preference-based decision making. *Psychological Science*, 24(7), 1208–1215.
- Pieters, R., & Wedel, M. (2004). Attention capture and transfer in advertising: Brand, pictorial, and text-size effects. *Journal of Marketing*, 68(2), 36–50.
- Pieters, R., Rosbergen, E., & Wedel, M. (1999). Visual attention to repeated print advertising: A test of scanpath theory. *Journal of Marketing Research*, 36(4), 424–438.
- Popa, L., Selejan, O., Scott, A., Mureşanu, D. F., Balea, M., & Rafila, A. (2015). Reading beyond the glance: eye tracking in neurosciences. *Neurological Sciences*, 36(5), 683–688. <https://doi.org/10.1007/s10072-015-2076-6>
- Reutskaja, E., Nagel, R., Camerer, C. F., & Rangel, A. (2011). Search Dynamics in Consumer Choice under Time Pressure: An Eye-Tracking Study. *American Economic Review*, 101(2), 900–926. <https://doi.org/10.1257/aer.101.2.900>
- Rim, N. W., Choe, K. W., Scrivner, C., & Berman, M. G. (2021). Introducing Point-of-Interest as an alternative to Area-of-Interest for fixation duration analysis. *PLOS ONE*, 16(5), e0250170. <https://doi.org/10.1371/journal.pone.0250170>.
- Sands, S. F. (2009). Sample size analysis for brainwave collection (EEG) methodologies. *Sandsresearch.com*.
- Sharafi, Z., Soh, Z., & Guéhenec, Y. G. (2015). A systematic literature review on the usage of eye-tracking in software engineering. *Information and Software Technology*, 67, 79–107. <https://doi.org/10.1016/j.infsof.2015.06.008>
- Sima, V. (2014). Green Behaviour of the Romanian Consumers. *Economic Insights – Trends and Challenges*, (3), 77–90.
- Towal, R. B., Mormann, M., & Koch, C. (2013). Simultaneous modeling of visual saliency and value computation improves predictions of economic choice. *Proceedings of the National Academy of Sciences*, 110(40), E3858–E3867.
- Vehlen, A., Standard, W., & Domes, G. (2021). Computer-generated facial areas of interest in eye tracking research: A simulation study. *PsyArXiv*. <https://doi.org/10.31234/osf.io/nam3x>
- Wan Adnan, W. A., Hassan, W. N. H., Abdullah, N., & Taslim, J. (2013, July). Eye tracking analysis of user behavior in online social networks. In *International Conference on Online Communities and Social Computing* (pp. 113–119). Springer, Berlin, Heidelberg.
- Yang, Y., & Wang, C.-C. (2015). Trend of Using Eye Tracking Technology in Business Research. *Journal of Economics, Business, and Management*, 3(4), 447–451.
- Young, W., Hwang, K., McDonald, S., & Oates, C. J. (2008). Sustainable consumption: green consumer behaviour when purchasing products. *Sustainable Development*, 18, 20–31.