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MAPPING CONSUMER EMOTIONS IN RESPONSE TO GREEN ADVERTISING: A QUALITATIVE EXPLORATION WITH NEUROIMAGING TOOLS

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ABSTRACT

Objective: This research aims to explore how Augmented Reality (AR) technology contributes to shortening the customer journey in e-commerce by enhancing product exploration, facilitating evaluation, and accelerating purchase decisions. The focus is placed on industries where product visualization is critical, namely cosmetics and furniture.

Research Design & Methods: A qualitative approach was used, involving a comprehensive literature analysis and in-depth interviews with ten active users of AR-integrated e-commerce platforms. These users were purposively selected from two sectors-cosmetics and furniture-to gain insight into real user experiences across different product types. Thematic analysis was used to identify recurring patterns and behavioral trends.

Findings: The study found that AR significantly affects three key stages of the customer journey: product exploration, evaluation of alternatives, and final decision-making. AR increases user confidence through realistic visualizations, reduces perceived risk by providing interactive simulations, and increases engagement through control and enjoyment. In addition, AR contributes to the value of the experience, leading to greater confidence and purchase intention.

Implications & Recommendations: From a managerial perspective, integrating AR into e-commerce platforms creates strategic value by shortening the buying cycle, enriching the customer experience, and strengthening brand loyalty. Businesses are advised to invest in user-friendly AR interfaces and personalize AR experiences based on user interaction data. Future research should expand to other industries and incorporate quantitative methods to validate and generalize the findings.

Contribution & Value Added: This study contributes to the literature by positioning AR not only as a visualization tool but also as a strategic enabler to accelerate consumer decision-making. It adds value by bridging the gap between immersive technologies and practical marketing applications in the digital economya.

Keywords: Augmented Reality, Customer Journey, E-Commerce, Purchase Decision, Interactive Technology.

JEL codes: M37, D91, C91.
Article type: research paper

INTRODUCTION

Green advertising has gained significant attention in recent years due to the growing awareness of environmental issues and the need for more sustainable practices (Agarwal & Kumar, 2021). Companies use green advertising to emphasise the sustainability elements of their products as a key attraction for consumers (Sun et al., 2021). Increasing attention to global environmental issues, such as climate change and the management of limited resources, is driving companies to not only create eco-friendly products but also communicate these values to consumers. On the other

hand, consumers are increasingly interested in products they perceive can help reduce negative environmental impacts (Noguerol et al., 2021). Understanding consumer emotions in response to green advertising is critical to the success of sustainability campaigns and the promotion of green products (Somerwill & Wehn, 2022). Advertising that only conveys the values of green and environmentally friendly principles, which implies a pro-environment mentality, is an effective strategy to attract consumers (Nguyen-Viet, 2022). Emotional responses are crucial in forming consumer attitudes and behaviours towards a promoted product or brand (Waris et al., 2021). The study of emotions in a marketing context shows that the emotions generated from advertising influence how consumers interpret information, feel connected to the brand, and ultimately, how they decide to buy a product (Morris et al., 2009).

Previous research has explored the effectiveness of green advertising in promoting sustainable behaviours and attitudes, but there is still a gap in understanding the emotional responses that drive consumer behaviour. Most existing research focuses on rational consumer decisions, such as the product's perceived benefits or the advertisement's environmental impact. Matthes et al. (2014) have shown that green advertising using functional and emotional approaches can improve attitudes towards brands. However, few have examined the specific emotions influencing purchase decisions (Matthes et al., 2014). Existing literature does not provide a comprehensive understanding of the emotional responses consumers experience in response to green advertising (Taufique, 2022). More in-depth research is needed to explore how green advertising triggers positive emotions such as happiness and pride, as well as negative emotions such as fear and sadness, and how these emotions influence consumer attitudes and behaviours towards sustainable products and practices. Emotional responses to advertising have great potential in shaping future consumer behaviour, especially when adopting greener lifestyles (Vezich et al., 2017). This study addresses the knowledge gap by exploring consumers' emotional responses to green advertising using neuroimaging tools. Neuroimaging, such as FMRI (Functional Magnetic Resonance Imaging) and EEG (Electroencephalography), allows researchers to map consumers' brain activity when they are exposed to certain advertisements. These tools can identify which areas of the brain are activated by certain emotions, thus providing a more scientific and in-depth insight into how green advertising affects consumers on a neurological level (Zeng & Lobo Marques, 2023). Previous neuromarketing studies have shown that emotions strongly influence the consumer decision-making process. Emotional responses measured through FMRI to television advertisements can provide deeper insight into how consumers rate those advertisements based on three key dimensions: appeal, engagement, and empowerment (Shen & Morris, 2016). However, more specific research on consumer emotions towards green advertising is lacking, despite its importance for understanding the factors influencing consumer purchasing behaviour regarding sustainable products.

This study aims to map consumers' emotional responses to green advertising and identify factors influencing their attitudes and behaviours towards sustainable practices. By using neuroimaging, this research can provide a more in-depth picture of how consumers respond emotionally to advertisements that emphasise sustainability values. In addition, this study also aims to identify which emotions are most effective in influencing consumer behaviour regarding green products. It is hypothesised that consumers experience a range of emotional responses to green advertising, including positive emotions such as happiness and pride, and negative emotions such as sadness and fear. Positive emotions may arise when consumers feel they contribute to environmental protection by purchasing environmentally friendly products. This can increase feelings of pride or pleasure from engaging in behaviour that they perceive as moral or ethical. Green ads that trigger positive emotions, such as curiosity and inspiration, can influence consumers' intention to purchase the product (Balaskas et al., 2023). Conversely, negative emotions such as fear or sadness may arise when green ads emphasise the negative consequences of unsustainable actions, such as environmental damage or climate change. Ads that feature images of these negative impacts can trigger strong emotions that encourage consumers to take action, such as avoiding products that damage the environment or switching to more environmentally friendly products (Yousef et al., 2021). This emotional response will influence consumers' attitudes and behaviours towards sustainable practices. In other words, the emotions that consumers experience when viewing green advertisements can shape their attitudes towards the advertised products and, in

turn, influence their purchase intentions. The strength of the argument and the use of green symbols in product packaging significantly influenced consumer purchase intentions, suggesting that visual and emotional elements in advertising can play an important role in the formation of purchase intentions (Spack et al., 2012). As such, this study is expected to make a significant contribution to the green marketing and neuromarketing literature by offering in-depth insights into how consumer emotions are affected by green advertising, as well as how these emotions can change consumer attitudes and behaviours towards sustainable products.

LITERATURE REVIEW

Green Advertising

Green advertising has become an important topic in modern marketing studies. Amid growing awareness of global environmental issues, companies are increasingly using sustainability-focused marketing strategies to attract consumers concerned about the environmental impact of their products. This strategy aims to influence consumer attitudes and behaviour towards products that are considered more sustainable by delivering messages that emphasise the company's commitment to environmental protection (Mehta & Chahal, 2021). Green advertising conveys information about environmentally friendly product attributes and aims to build a socially and ecologically responsible brand image (Dangelico & Vocalelli, 2017). Green attitudes refer to how consumers understand and perceive the environment, how they behave, and what products and messages they prefer related to the environment (de Sio et al., 2022). Consumer attitudes towards a product are recognised as an influential predictor and explanatory factor in decision-making (Lee et al., 2021). While there have been numerous studies on the effectiveness of green marketing in changing consumer attitudes and behaviours, there is limited in-depth understanding of consumers' emotional responses to green advertising (Sharma, 2021). Neuroimaging is now being used to more accurately map emotional responses, so this research focuses on using neuroimaging tools to understand the relationship between emotions and consumer attitudes towards green products (Saarimäki, 2021).

Neuroimaging technologies, such as functional Magnetic Resonance Imaging (FMRI) and Electroencephalography (EEG), make it possible to map brain activity associated with emotional reactions to marketing stimuli (Alsharif et al., 2021). Using this approach in green advertising studies provides an opportunity to understand the relationship between the emotional stimuli evoked by advertising and the formation of consumer attitudes towards green products (Saarimäki, 2021). By identifying the parts of the brain that are active when consumers are exposed to green messages, new insights can be gained into the cognitive and affective processes that underlie sustainable decision-making. Research integrating neuroscience approaches in green advertising studies can significantly contribute to theoretical understanding and strategic practice in sustainable marketing. This is in line with the development of modern marketing science, which increasingly prioritises an interdisciplinary approach to address the complexity of contemporary consumer behaviour.

The Importance of Green Marketing in the Modern Era

Green marketing has gained more attention in recent decades due to increased public awareness regarding environmental issues such as climate change, pollution, and deforestation (Machová et al., 2022). Consumers are increasingly aware of the importance of choosing environmentally friendly products, and companies are beginning to see opportunities to position their brands as sustainability leaders through green advertising (Borah et al., 2023). These ads often focus on environmental claims and the product's benefits to nature to evoke positive emotions from consumers, such as a sense of pride and satisfaction when they buy products that support sustainability. However, this green marketing strategy is not without its challenges. The phenomenon of greenwashing, where companies claim to be environmentally friendly without any real evidence to support their claims, has caused some consumers to be sceptical of green advertising. Consumers who have a negative view of companies or advertising tend to doubt the validity of green claims, which ultimately reduces the effectiveness of the green campaign (Krstić et

al., 2021). It is important for companies to not only focus on rational green claims, but also utilise strong emotional triggers for their advertisements to be better received by consumers

The Role of Emotions in Marketing and Consumer Response

Emotions play a key role in consumer decision-making. The emotions generated by advertisements affect consumers' perceptions of the product and influence their purchase intentions (Riaz et al., 2021). When an advertisement successfully evokes strong emotions, whether positive emotions such as happiness or negative emotions such as fear, consumers are more likely to engage with the advertising message and more likely to take actions such as buying the product or sharing the information with others (Riaz et al., 2021). In the context of green advertising, consumers' emotional responses can vary widely. Balaskas et al., (2023) et al.showed that green advertising that taps into positive emotions such as pride or inspiration can increase consumers' purchase intentions towards green products. The study found that these positive emotions connect the consumer and the product. This triggers them to more actively support brands they perceive as supporting sustainability values (Balaskas et al., 2023). The influence of negative emotions in green advertising, such as fear or guilt. Ads that display the negative impacts of unsustainable actions, such as environmental damage or the effects of climate change, can trigger strong negative emotional responses from consumers. However, these negative emotions are not always bad; in some cases, consumers who feel fear or guilt tend to take proactive steps, such as switching to more environmentally friendly products or reducing consumption of environmentally harmful products (Schmuck et al., 2018).

Neuroimaging in Consumer Emotions Research

To understand more deeply how emotions influence consumers' responses to green advertising, neuroimaging tools such as FMRI and EEG have become important tools in neuromarketing research. Neuroimaging allows researchers to see how consumers' brains react directly to advertising stimuli and map the brain activations that occur when they feel certain emotions (Alsharif et al., 2022). This provides a more accurate and scientific insight into how emotions are formed and influence consumer attitudes and behaviours (Della et al., 2023). Used FMRI to study emotional responses to television advertisements and found that some brain regions, such as the inferior frontal gyrus and medial temporal gyrus, were active when participants felt pleasure or arousal while viewing an advertisement (Alsharif et al., 2024). This suggests that emotional responses to advertisements can be mapped specifically in the brain, and emotions triggered by green advertisements can significantly impact consumers' perceptions of products (Yen & Chiang, 2021). In addition to FMRI, EEG is also used to capture electrical activity in the brain associated with emotional responses. Incorporated the use of GSR (Galvanic Skin Response) and eye tracking along with EEG to understand how consumers react to continuous tea brand advertisements Incorporated the use of GSR (Galvanic Skin Response) and eye tracking along with EEG to understand how consumers react to continuous tea brand advertisements (Zeng and Marques, 2023). This study showed that more emotionally appealing ads had longer engagement times and stronger emotional responses, suggesting a direct link between emotions and consumer responses to green products (Zeng and Marques, 2023).

Emotional Triggers in Green Advertising

Various studies have shown that emotional triggers in green advertising can significantly influence consumer behaviour. Using green symbols, nature images, and narratives highlighting the positive impact of sustainable choices can create a strong emotional experience for consumers. Hartmann et al. (2016) found that nature imagery in advertising can trigger positive emotions, such as relaxation or happiness, increasing positive attitudes towards the advertised product. These findings suggest that positive emotional experiences associated with nature can be effectively utilised in green advertising to build emotional attachment with consumers (Hartmann et al., 2016). On the other hand, ads that use negative emotional triggers can also be effective. Kao & Du (2020) showed that ads that display the negative consequences of unsustainable behaviour, such as environmental damage, can motivate consumers to care more about the environment and choose

greener products. This negative emotional response, although it may be unpleasant, can trigger stronger pro-environmental behaviour (Kao & Du, 2020).

METHODS

Research Design and Subjects

There are so many interesting models out there that have been proposed to explain the influence of advertising on consumers. The most popular model is the economic rational choice model, which considers advertising a powerful tool to influence consumers. These models focus on the influence of information and exposure frequency as the basic persuasion mechanisms. Other models position advertising as a signal of product quality or ad processing. These models recognise the importance of a clear hierarchy between emotional and rational information processing. We have reviewed and explained various models for studying the impact of advertising on consumers. We have also developed a taxonomy for classification and finally arrived at a common framework. This framework is an excellent and comprehensive guide to green advertising! It explains in three simple steps how advertising influences consumer attitudes, perceptions, and ultimately behaviour towards products. We believe that this framework is perfect for understanding consumer information processing. Specifically, the three phases are: (1) the advertising message as input received by the consumer, (2) the filters that determine the consumer's attention level, and (3) the consumer's cognitive and emotional processes. It is important to note that this framework recognises two distinct processes: cognitive and emotional information processing. This implies that consumers form perceptions of advertised products by creating rational cognitive representations of the information presented and developing affective and emotional responses. In this study, we use an adapted version of this framework to investigate the effectiveness of green advertising. Specifically, we extend the framework by using heuristics to describe consumers' cognitive and affective processes towards adverts.

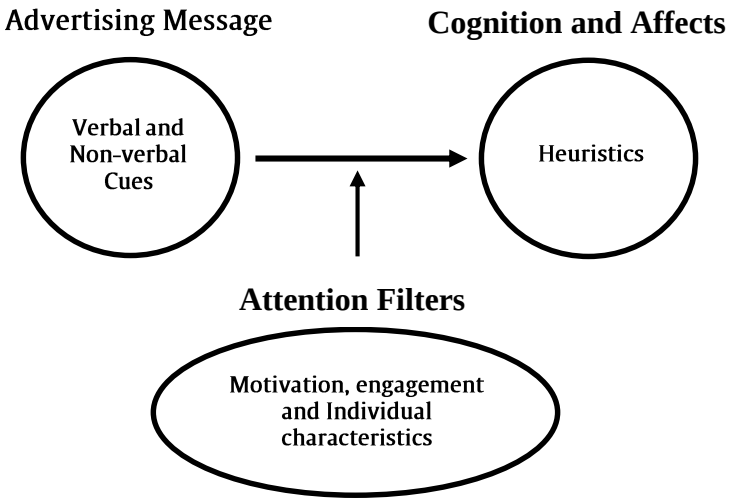

Figure 1: A framework that describes the effects of advertising in terms of consumer heuristics

Advertising messages refer to informative content and narrative structure, including product information, sustainability claims, usage applications, visual elements, labels and other nonverbal cues. These components are processed through a "filter" of individual characteristics, such as consumers' motivation, knowledge and interest in the product, which influence their attention to the ad's content. Next, the cognitive and emotional processing stage covers how consumers mentally process advertising messages, including the attitudes and perceptions formed. Within this framework, researchers evaluate how cues from green advertising trigger consumers' affective and cognitive responses, and how these processes result in heuristics or mindsets in

assessing products. The section on actual consumer behaviour was not focused on, given the limited empirical research evaluating direct purchase actions. This literature review organises the literature based on three main categories of the analytical framework: (1) advertising message content (verbal and nonverbal), (2) attention filters such as motivation and engagement, and (3) cognitive and emotional processing. The studies covered include green product advertisements, labels and packaging, as these visual elements are important to sustainable brand communication. A literature search was conducted through the Scopus database, using keywords such as "green advertising", "information", "message", "appeal", "motivation", "engagement", "cognition", "emotion", and "heuristics". From the selection results, 117 empirical studies published between 1990 and 2024 were analysed and grouped based on their fit with the framework categories. Some studies were categorised into more than one aspect because they covered more than one element, such as advertising messages and consumers' emotional responses.

Green advertising aims to convey the pro-environmental attributes of a product or a company's commitment to environmental issues (Dangelico & Vocalelli, 2017). The messages in these ads usually combine product information, such as its characteristics and environmental impact, with visual elements such as colours, music, and images. Combining these elements can attract consumers' attention and form positive perceptions of green products, thereby increasing the effectiveness of advertising (Agarwal & Kumar, 2021). In the literature, there are two types of cues in green advertising: verbal cues (information and claims) and nonverbal cues (images, colours, etc.). This distinction is important as each cue plays a different role in consumer processing. Terminology used in green advertising, such as "biodegradable", "eco-friendly", "green", "natural", "organic", "recycled", and "sustainable", helps consumers understand environmental issues (Sdrolia & Zarotiadis, 2019). However, some of these terms are technical, while others are ambiguous and can lead to various interpretations, which can lead to misunderstandings about the actual environmental impact of the product. Consumers' motivation and ability to process information are important factors in the response to advertising. Individual differences in processing styles, receptivity to advertising appeals, and preferences may moderate the effects of advertising. However, generalisations about these variables are difficult as green advertising covers many products and consumers. Nonetheless, some general insights can be gained. Consumers' motivation towards green advertising depends on their awareness of environmental threats and their involvement with environmental issues (Bhaduri & Copeland, 2021). In addition, product knowledge and brand reputation regarding its environmental impact influence the ability to process information. The credibility of the ad and its delivery channel also play an important role in attracting consumer attention to green advertising (Hartmann et al., 2017).

RESULT AND DISCUSSION

The Role of Neuroimaging in Assessing the Effectiveness of Green Advertising

This study combines a heuristic approach with a neuroimaging-based qualitative exploration to expand our understanding of how consumers emotionally process and respond to green advertising. The heuristic framework used divides the consumer perception process into three main stages: (1) advertising message as input, (2) attentional filter based on individual characteristics, and (3) cognitive and emotional processing. Results from the literature review and content analysis show that green messages that combine verbal cues such as sustainability claims with nonverbal elements such as green colours, nature symbols, or soothing music can increase consumers' attention to the information conveyed (Chandon et al, 2019). This response is not only cognitive, but also emotional, depending on the personal engagement and environmental values held by the individual (Buchholz & Schymura, 2012).

This study uses a neuroimaging approach as an exploratory instrument to further explore the affective processes behind the response to green advertising. Findings from previous studies using tools such as functional Magnetic Resonance Imaging (FMRI) and Electroencephalography (EEG) showed significant activation in emotion-related brain areas, such as the amygdala and insula, when participants viewed ads conveying sustainability messages (Alsharif et al., 2021). Such activations indicate the involvement of both positive emotions and concerns that drive the intensity

of attention to environmental issues (Slåtten et al., 2021). In addition, parts of the brain such as the ventromedial prefrontal cortex (VMPFC) involved in value evaluation and decision-making also show active engagement when consumers assess the credibility of green claims (Rips et al., 2006; Leeuwis et al., 2022). The integration of neuroimaging data and the heuristic framework shows that the emotional effects of green advertising often occur earlier than rational processes, indicating affective primacy (Tan et al., 2021). This points to the importance of ad design, which can create an immediate emotional connection before consumers cognitively elaborate on the message. In this context, touching visual experiences, narratives touching prosocial values, and the messenger's credibility are key components in shaping positive responses. These results suggest that neuroimaging-based approaches can enrich the understanding of how consumers unconsciously internalise sustainability messages and provide strategic insights for marketers to design more empathetic, effective, and ethical communications (Millagala, 2023).

Table 1: Representation of neuroimaging techniques on green effectiveness

Analysed Aspects	Associated Brain Regions	Response Type	Strategic Implications
Sustainability value judgment	Ventromedial Prefrontal Cortex (vmPFC)	Subjective value judgments	Use narratives that build social value and meaning
Emotional response to ethics	Insula, Amygdala	Empathy, anxiety	Avoid excessive emotional manipulation
Processes of empathy and collective responsibility	Temporoparietal Junction (TPJ)	Social perspective, responsibility	Focus on collective impact and community value
Activation of the reward system	Striatum	Favorability and potential purchase decision	Combine sustainability messages with the aesthetic appeal of the product

In the realm of neuromarketing, neuroimaging techniques such as FMRI (functional Magnetic Resonance Imaging), EEG (Electroencephalography), and FNIRS (functional Near-Infrared Spectroscopy) have been widely used to understand how consumers' brains respond to marketing stimuli, including in the context of green advertising. These approaches allow researchers to observe neural activity in real-time without relying on consumers' often biased or unconscious verbal reporting (Plassmann et al., 2012; Lim, 2018). In the context of green advertising, neuroimaging can identify brain areas that activate when consumers see green messages, such as the ventromedial prefrontal cortex (vmPFC) area associated with subjective value judgments and purchase decisions, or the insula that plays a role in emotional processing of ethical and sustainability issues (Covino et al., 2021). Activation in these areas indicates emotional and cognitive engagement with sustainability messages, which is important for driving environmental value-based purchase intentions. Research has also found that green ads that present prosocial messages or emphasise collective responsibility tend to activate the temporoparietal junction (TPJ) area, which is associated with empathy and social perspective (Lim, 2018). In contrast, green messages that take the fear appeal approach to the extreme can increase amygdala activity, which can lead to anxiety or avoidance responses if not balanced with solutive information (Plassmann & Karmarkar, 2015; Simonetti et al., 2024).

Table 1 explains how integrating neuroimaging in green marketing studies provides an advantage in understanding consumers' unconscious mechanisms. Objective data from brain activity can bridge the gap between intention and actual behaviour, while supporting the design of advertising messages that are not only emotionally appealing but also cognitively impactful (Egamberdieva, 2024). If used ethically and proportionately, this technique can increase the effectiveness of sustainability campaigns and shape more responsible consumption behaviour. The application of neuroimaging in green marketing has several strategic implications for advertisers and marketing practitioners. First, companies can identify the green messages that are most emotionally and cognitively resonant with target audiences. For example, ads that emphasise the

social impact of pro-environmental behaviours are more effective for consumers with a prevention-type regulatory focus. In contrast, messages highlighting green innovations and modern lifestyles are better suited for segments with a promotion focus (Beličková & Kusá, 2023). Second, neuroimaging can be used to fine-tune the pre-testing of advertisements before they are launched to the public. Compared to conventional survey techniques, this approach is more objective as it measures the brain's reaction directly to the ads' visual, verbal, and emotional elements (Plassmann & Karmarkar, 2015). By doing so, companies can minimise the risk of ineffective or counterproductive campaigns, such as ads that inadvertently trigger reactions of green fatigue or scepticism towards sustainability. Third, neuroimaging results can be utilised to refine communication design across cultures. In collectivistic cultures like Indonesia, green messages that emphasise community values and spirituality are more likely to trigger activation of brain regions related to empathy and social responsibility (TPJ), while in individualistic cultures, personal health or prestige values may be more dominant (Loy & Spence, 2020).

Context of Advertising Exposure: Passive Processing by Consumers

In the reality of everyday life, advertisements are not always received under ideal conditions where consumers are fully focused on the content of the message. Instead, advertisements are often consumed in a multitasking context, such as when individuals are watching television, listening to music, browsing social media, shopping online, or reading news on the internet. Under these conditions, consumers' cognitive attention is divided between the primary activity and the ad exposure, which leads to limited mental capacity to process the message deeply and analytically (Chinchanachokchai et al., 2020). Research in cognitive psychology has explained that humans have limited information processing capacity, so when two or more stimuli compete for attention, only the most relevant or interesting stimulus will be processed consciously and deeply (Drigas & Mitsea, 2021). The Elaboration Likelihood Model (ELM) explains that there are two pathways of message processing, namely the central route and the peripheral route (El Hedhli & Zourrig, 2023). Under low motivation and ability conditions, such as when consumers are unfocused, processing is done through peripheral pathways. This means that messages are only superficially analysed based on simple cues such as colours, celebrities, or music, rather than the substantial content of the ad itself. In the context of green advertising, this passive processing poses a challenge. Consumers who are not fully focused on or engaged with environmental issues tend to only grasp the visual surface of the ad, such as green colours, images of trees, or recycling icons, without further examining the environmental claims (Du Plessis, 2005; Li and See-To, 2024). This can lead to misinterpretation of the message or even the formation of false assumptions about how much the product contributes to environmental sustainability. An experimental study by Rosbergen et al. (1997) using eye-tracking showed that visual attention to important elements in advertisements is strongly influenced by the context in which the exposure occurs. Under multitasking conditions, the duration of attention to text and logos containing key information in the ad is significantly lower than when consumers are fully focused (Muñoz-Leiva et al., 2021). These findings confirm that the effectiveness of advertising communication is highly dependent on the context of exposure and the consumer's affective and cognitive state at the time of receiving the message.

When consumers are engaged in dual activities, the part of the brain that functions for decision-making (prefrontal cortex) shows decreased activity (Halkiopoulos et al., 2022). This means that even if the ad is successfully displayed, its impact on memory, attitude, and purchase intention will be very limited if the consumer is not focused or interested. Conceptually, this phenomenon can be explained through the Limited Capacity Model of Motivated Mediated Message Processing (LC4MP) theory. This theory emphasises that attention, memory and information processing are limited resources allocated based on the level of involvement and urgency of the information received (Lang, 2000). If an advertisement is unable to compete with other stimuli in an information-dense media context, then it is likely that the message will not be deeply internalised. Thus, in designing green advertising, marketers must realise that exposure alone is insufficient. The advertising message must be designed in such a way that it can penetrate the limited attention of consumers. This can be done, for example, by using visuals that trigger emotional reactions, personally relevant narratives, or powerful symbols that are intuitively associated with sustainability.

Advertising message processing occurs at both cognitive and affective levels (Martinez-Levy et al., 2022). Cognitive processing is usually associated with the rational analysis of product information contained in the advertisement. In the case of green advertising, cognitive processing is further associated with the assessment of a product's environmental claims. Other attention filters are related to socio-demographic characteristics, such as country, age, or gender (Matthes, 2019). Individual characteristics, such as values, beliefs, or intentions, can predict attitudes towards green product advertising (Groening et al, 2018). A good example illustrating their moderating role is the difference in consumer response to messages framed as advantages versus disadvantages. While both frames in green advertising can trigger consumer attention, individual differences determine whether consumers respond more to gain or loss-oriented messages (Gómez et al., 2021). This is referred to in the literature as regulatory focus theory. Some information may be more or less appealing depending on people's goals. While some people pursue goals with a promotion focus (achievement of gains, hopes, ideals), others are more sensitive to a prevention focus associated with loss or pain (Bhatnagar & McKay-Nesbitt, 2016). On the other hand, affective processing refers to the emotional and non-rational processing of specific appeals, images, music, or other cues used in an advertisement. Since attention is limited, only consumers who engage with environmental issues rationally process environmental claims in green advertisements. Otherwise, attention is largely fixated on cues such as the colour green or images that can trigger emotions (Du Plessis, 2005). Secara khusus, pemrosesan heuristik terjadi ketika konsumen tidak menganalisis informasi secara rinci karena mereka tidak fokus, terburu-buru, atau didorong oleh respons emosional.

In other words, heuristics are decision-making rules that simplify people's everyday decisions (Gigerenzer, Reb, & Luan, 2022). Therefore, when analyzing the limited affective and rational processing of green advertising, it is important to see which heuristics are triggered by specific cues. Although the literature on green advertising has not previously been structured through the prism of heuristics, studies on general advertising often use heuristics to describe the way consumers analyze message content. Through an in-depth review of relevant literature, we were able to identify five main forms of heuristics that often influence consumers' responses to green advertising, four of which are common types of heuristics that have long been recognised in the consumer behavior literature, namely the affective heuristic by Moore, (1983) which refers to the use of emotions as a basis for evaluation without the involvement of rational analysis. The familiarity heuristic (2003), in which preferences are formed based on stimulus recognition or repetition. The halo effect (2020) is the tendency to generalise positive attributes from one aspect of the product to another, and the expected social identity activation by Reed (2004), which shows how advertising messages can trigger associations with identity values desired by individuals.

However, specifically in environmentally-focused promotions, we observed the emergence of one more specific form of heuristic, the footprint illusion (Holmgren et al., 2018). In contrast to the previous four heuristics, which are more general and can be applied in various marketing contexts, the footprint illusion is a cognitive phenomenon exclusively related to perceptions of sustainability. In this heuristic, consumers exhibit a cognitive bias by assuming that the presence of green elements in a system, for example, an eco-certified building, automatically reduces the environmental impact of the entire system, even though this may not be the case. This section will discuss in more detail how these various heuristics shape consumers' cognitive and affective processes towards messages in green advertising. The main focus will be understanding how each heuristic can direct consumers' perceptual and attitudinal patterns, and how these cognitive biases alter how advertising messages are received and processed. This analysis forms an integral part of exploring the heuristic dimension within the information processing framework of green advertising.

Table 2 discusses how heuristics evoked by exposure to green advertising can be opportunities but (mostly) barriers to emissions reductions from consumption. We do so by relating the heuristics triggered by green advertising to the potential behaviours that may result from it. We identify three potential spillovers from green advertising relevant to consumption emissions: defaults and habits, green misbeliefs from greenwashing, compensatory green beliefs, and rebounds. We consider these three types of spillovers particularly relevant for the context of green advertising, but note that other types of spillovers can occur. The heuristics consumers use when

processing green advertising reflect consumers' interest in more sustainable consumption (Thøgersen et al., 2012; Gómez et al., 2021). This is reflected in emotional arousal and moral associations driving consumers' processing of green cues (Balaskas et al., 2023). While this should be an opportunity to reduce consumption-related emissions, the indiscriminate use of green advertising has led to systematic misperceptions about the environmental impact of products, moral licensing, and greenwashing. Therefore, the consequences of green advertising regarding emissions reduction may be nil or even negative. Consumers cannot overcome the difficulty of responding to currently available information and have considerable problems identifying what constitutes greenwashing and what does not. However, as discussed above, such claims and signals are difficult to regulate.

Table 2: Five main heuristic elements of green advertising

Heuristic	Description	Conceptual Illustration	Reference
Affect Heuristic	A judgment process that is intuitive and driven by spontaneous emotional reactions, without engaging in a systematic search or evaluation of information.	Green color in advertising produces positive emotions, to the point that environmental labels are less persuasive without green color.	Moore, (1983) ; Seo & Scammon, (2017)
Familiarity effect	Preferential tendency towards familiar objects or messages often reduces the need to re-evaluate information in depth.	Ads featuring visually familiar landscape representations tend to trigger positive affective responses compared to those featuring landscapes that are unfamiliar to the audience.	Hartmann & Apaolaza-Ibáñez, (2010)
Green-halo effect	Perceptual bias that associates eco-labelling with an increase in overall product quality, even though there is no underlying objective difference.	Consumers rated food labelled "eco-friendly" as having a better taste than identical products that did not bear the label, even though the quality was not different.	Untilov & Ganassali, (2020)
Identity effect	The tendency to selectively process information to affirm values and beliefs that are closely related to an individual's self-identity	By purchasing products labelled as green, individuals can see themselves as contributing to positive environmental outcomes.	Reed (2004)
Footprint illusion or quantity insensitivity	Adding a green option to a Choice-set reduces the overall perceived emission of the whole choice-set	Individuals believe that introducing environmentally certified buildings to a community would decrease the total carbon footprint of the community	Holmgren et al., (2018)

Negative Spillover Effects in Response to Green Advertising

The results of the literature review indicate that green advertising does not always result in an entirely positive impact on consumer behaviour. Some studies highlight negative spillover effects, i.e., unintended consequences of receiving pro-environmental messages, which can hinder sustainable behaviour change. While green advertising has the potential to shape a positive image of a product and trigger favourable emotional responses in the short term, there is a risk of negative spillover effects on overall consumption behaviour. These effects are often triggered by heuristic message processing, where consumers make quick judgments based on emotional or visual cues, without conducting a thorough rational assessment of the product's ecological impact. One form of this effect is default behavior and habit patterns, where consumers feel that one "green" action they have taken - such as buying a product with an eco-label - is enough of a contribution to the environment, so they do not feel compelled to change other consumption behaviors that may hurt the environment (Goh & Balaji, 2016). In addition, there is also a phenomenon called the green belief fallacy, which is the false assumption that all products that claim to be environmentally friendly must have a large and significant ecological impact (Delmas & Burbano, 2011). Many of these claims

are hyperbolic or not supported by strong scientific evidence. This is exacerbated by greenwashing, where companies strategically manipulate information to give the impression that their products are more sustainable than they are. This practice often involves unverifiable claims or misleading environmental symbols, hindering genuine sustainability efforts (Koch & Denner, 2025). As a result, consumers are trapped in moral licensing, a psychological state in which individuals feel they are doing the morally "good" thing by purchasing green products, and therefore feel justified in unsustainable consumption in other aspects. The rebound effect is also an important consequence to consider. In this context, when a product is marketed as energy efficient or environmentally friendly, consumers are encouraged to use it more often or in larger quantities, ultimately negating the expected environmental benefits. For example, excessive use of energy-efficient LED lights because they are "less wasteful" actually increases total energy consumption (Sudarmaji et al., 2022). Therefore, communication strategies in green advertising should be carefully designed so as not to create the illusion of contribution or misunderstanding of the impact of consumption on the environment.

Table 3 Types of Negative Spillover Effects in Response to Green Advertising

Jenis Efek	Description	Implications for Consumer Behaviour
Default Behaviour & Habituation	Consumers feel that one green action (e.g., buying green products) is enough as a contribution to the environment.	Consumers are not encouraged to change other habits that negatively impact the environment.
Green Belief Fallacy	Consumers mistakenly believe that all green-labelled products significantly impact the environment.	The emergence of false perceptions and product purchases based solely on labels without a deep understanding of their impact.
Greenwashing & Moral Licensing	Consumers feel that they have "done good" by buying green products, so they feel justified in overconsuming in other aspects.	There is moral justification for consumptive behaviour that is not environmentally friendly.
Rebound Effect	Product efficiency or sustainability encourages increased consumption, as consumers feel that using these products does not harm the environment.	Total consumption increases, offsetting or even exceeding the product's environmental benefits.

Even though a heuristic approach to green ad processing can instantly evoke positive emotional responses, the long-term impact of these perceptions is not always in favour of broader sustainability goals. In certain situations, rapidly formed affective responses can trigger counterproductive consequences, such as the tendency to stop taking green actions after performing one symbolic action. This phenomenon is known as the negative spillover effect, where perceived small successes in green consumption decrease the intention to adopt other sustainable behaviours. To clarify this phenomenon, a conceptual representation outlines the different negative spillover effects of green advertising and how they affect consumer mindsets and behaviours.

The Role of Individual Factors and Regulatory Focus Theory

The results of this literature exploration suggest that green advertising can generally trigger a broad spectrum of emotional responses from consumers, which range from positive emotions such as pride, hope, and happiness, to negative emotions such as guilt, fear, and sadness. Several articles highlight that positive emotions arise when consumers feel that they can contribute to environmental conservation through more responsible consumptive actions (Koenig et al., 2014 ; Wang et al., 2022; de Sio et al., 2024; Asante et al., 2023). Consumers' responses to green advertising are highly dependent on various inherent individual characteristics, such as personal values, pro-environmental intentions, beliefs on ecological issues, and demographic aspects such as age, gender, and cultural background. These characteristics shape the cognitive and affective frameworks through which consumers process environmentally-oriented messages. For example, individuals who hold altruistic and biocentric values tend to pay greater attention to advertisements that carry themes of sustainability and ecological responsibility (Groening et al., 2018). In contrast, consumers with materialistic or hedonistic values are more likely to resist green messages, especially if the

advertisements are perceived as interfering with their comfort or lifestyle (Lee & Ahn, 2016). In addition, individuals' beliefs about the effectiveness of personal actions in addressing environmental issues, known as perceived consumer effectiveness, also play an important role in determining whether messages in green advertising are perceived as relevant and worthy of a positive response (Antonetti & Maklan, 2014). Age and life experience can also moderate the perception and interpretation of green messages. Younger generations, such as Gen Z and millennials, tend to be more responsive to sustainability messages due to higher levels of environmental literacy and greater exposure to global issues through digital media (Confetto, et al., 2023). However, these preferences may differ across cultures. In collectivistic cultural contexts, for example, messages that emphasise contributions to the community or family are more effective than messages that highlight individual benefits (Han & Shavitt, 1994 ; Huang et al., 2022). Therefore, green communication strategies should consider audience differentiation based on specific and contextual individual characteristics to achieve maximum effectiveness.

In explaining variations in responses to green advertising messages, the Regulatory Focus Theory (RFT) developed by Higgins (1997) is one relevant theoretical approach. This theory distinguishes two main motivational orientations within individuals: promotion-focused and prevention-focused. A desire for positive aspirations and achievements drives promotion-focused individuals. Thus, They are more responsive to messages highlighting the benefits or advantages of pro-environmental behaviour, for example, "use green products for a brighter future". Meanwhile, individuals with a prevention focus are motivated by the need to avoid loss or failure. They are more attracted to messages emphasizing environmental indifference's negative consequences, such as "if you don't choose green products, you are damaging the earth". Message effectiveness depends on the fit between the message frame and the audience's dominant regulatory focus. When this fit exists, individuals experience regulatory fit, which increases affective engagement and strengthens the persuasive impact of the ads (Bhatnagar & McKay-Nesbitt, 2016). In green marketing, it is important to understand that message framing cannot be uniform, as audiences have different regulatory preferences. Promotion-based framing is more effective for young and innovative market segments, while prevention framing is more suitable for conservative or environmentally concerned segments (Turedi et al., 2021). Therefore, advertisers need to segment based on motivational tendencies to deliver messages that best suit the psychological characteristics of the target audience.

Integrating individual characteristics and regulatory focus frameworks into green advertising communication strategies carries significant strategic implications. Companies need to understand that not all consumers respond uniformly to green messages. For example, applying promotion focus-based framing in a social media campaign may generate high engagement among urban millennials who favour innovation and change. However, the same strategy may not work with more conservative segments, who are more influenced by risk concerns and a preference for stability (Paluch et al., 2020). Message development should therefore be based on in-depth psychographic segmentation research, including measurement of levels of regulatory focus, ecological values, and communicative preferences (Atkinson & Rosenthal, 2014). Furthermore, ethical and practical challenges arise in tailoring messages to the regulatory focus, as overly manipulative framing may be perceived as exploiting consumers' emotions or fears. Advertisers must be careful not to fall into the trap of excessive fear appeals, as this can create counterproductive resistance or anxiety (Shin et al., 2017). Instead, messaging should emphasise transparency, education, and empowerment, so that green messages are not only emotionally appealing but also facilitate positive long-term behaviour change (Atkinson & Rosenthal, 2014). A more holistic understanding of the interaction between individual factors and regulatory focus theory not only enriches academic studies on green advertising effectiveness but also contributes to developing sustainability communication strategies that are more inclusive and adaptive to the complexities of modern audiences.

CONCLUSION

This research shows that the use of neuroimaging in evaluating the impact of green commercial advertising is gaining attention, as advances in neuroscience technology enable the mapping of brain activity to more accurately understand consumer preferences. This approach offers great potential for future marketing, particularly in shaping perceptions and responses to green advertising. However, heuristic message processing can lead to negative spillover effects, such as default behaviour, green belief fallacy, moral licensing, and rebound effect, which weaken consumers' intention to adopt sustainable behaviour. Therefore, green communication strategies must be carefully designed to not create a false perception of sustainability. In addition, the effectiveness of green advertising messages also depends on individual characteristics and the dominant regulatory style. As per the Regulatory Focus theory, alignment between message framing and consumer motivation, both promotional and preventive, is required to form an emotional response that is not only instantaneous but also sustainable.

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