NEUROSCIENCE INTEGRATION IN MARKETING: LEVERAGING BIOSENSORS FOR CONSUMER INSIGHTS AND ENHANCED CUSTOMER INTERACTIONS

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This research investigates the potential contributions of neuroscience literature and techniques to marketing management, employing biosensors such as eye-tracking glasses, facial expression analysis, and galvanic skin response (GSR). By leveraging neuroscientific methods to understand consumer reactions to marketing stimuli, marketers can glean valuable insights to enhance their marketing strategies and optimize customer interactions. The study use a qualitative analysis and aims to bridge the gap between consumer neuroscience and traditional marketing practices, utilizing neuromarketing tools to decipher customer behavior.

Key words*:* neuromarketing, eye-tracking glasses, biosensors, GSR, facial expression.

JEL Classification Codes: C91, D91, M31

INTRODUCTION

This research explores the integration of neuroscience literature and techniques into marketing management context, utilizing biosensors such as eye-tracking glasses, facial expression analysis, and galvanic skin response (GSR). By leveraging neuroscientific methods to understand consumer reactions to marketing stimuli, marketers can glean valuable insights to optimize their marketing strategies and enhance customer interactions such body language, or nonverbal communication exhibited via gestures, postures, facial emotions, and other physical clues, is an essential factor in marketing. Understanding how customers perceive and interpret body language may help guide marketing tactics, improve communication efficacy, and impact consumer behavior.

1. LITERATURE REVIEW

1.1 MARKETING AND PSYCHOLOGY

Marketers invest considerable effort in analyzing the customer journey and endeavoring to pinpoint the pivotal juncture at which a potential customer makes the decision to make a purchase. Although many facets of this decision-making process are grounded in concrete and measurable factors, an emotional and psychological dimension also exists. Emotions wield significant influence over buyers' behaviors and responses. They drive decisions and foster a sense of personal attachment between the buyer and the brand that transcends the mere act of transaction.

Psychology assumes a central position in this interplay, facilitating marketers in delving into the psyche of their intended demographic, harnessing their emotional responses, and steering desired behaviors.

1.2 COLOR PSYCHOLOGY

Colors have always greatly influenced one's moods, emotions, sentiments, sensations, and perceptions, and they appear to allow for several interpretations rather than just one. Numerous indicators merge in a person's experience of a product, given that colors do not function separately or individually but rather through multi-layered references, and can influence how customers make purchases, how they see things, their emotions, and choices, making them essential in the realm of advertising and marketing. Furthermore, color perception and application are heavily influenced by one's innate physiological and psychological predisposition, individual experiences, age, gender, personality traits, earnings, and ethnographic and demographic factors, making its practical application in the marketing domain all the more challenging. Singh and Srivastava's (2011) study explores the extensive influence of colors on marketing psychology. Their analysis encompasses various academic research findings, revealing colors' profound effects on consumer perceptions and behaviors within marketing contexts. The article underscores the strategic importance of utilizing colors in marketing campaigns to evoke specific emotions, shape brand identities, and ultimately enhance consumer engagement and purchase decisions.

Nevertheless, color can be a magnificently persuasive force for promotion. As an essential element of human vision, color may captivate attention to detail, relax or irritate the sense of sight, and alter the legibility and visibility of the text. The right colors strengthen and contribute to accomplishing a marketing campaign, a good or service, or even an interior space; in contrast, choosing the incorrect colors can be costly.

1.3 IMPLICATIONS FOR MARKETING STRATEGIES

The insights gained from understanding the impact of psychological factors on marketing campaigns have profound implications for marketing strategies. Marketers can leverage this knowledge to design campaigns that resonate with their target audience, evoke the desired emotions, and influence consumer behavior effectively. Furthermore, technological advancements and data analytics enable marketers to personalize campaigns and deliver tailored messages to individual consumers, further enhancing their effectiveness.

The effectiveness of marketing campaigns is intricately linked to various psychological factors influencing consumer perceptions, attitudes, and behavior. By understanding these psychological mechanisms, marketers can design campaigns that resonate with their target audience, evoke the desired emotions, and drive engagement and sales. Continuing research into the intersection of psychology and marketing will further enhance our understanding of consumer behavior and inform the development of more effective marketing strategies.

1.4 NEUROMARKETING AND TECHNOLOGY

Artificial Intelligence (AI) has found diverse applications across various sectors within the contemporary business landscape. Professionals and scholars alike envision AI as a pivotal component shaping the future of our society. With technological advancements facilitating heightened global connectivity, there has been a notable surge in investment towards leveraging AI for big data analytics, aimed at garnering actionable market insights. Importantly, the utility of AI extends well beyond marketing, encompassing sectors such as healthcare, e-commerce,

education, law, and manufacturing. Its pervasive integration continues to drive benefits across industries. As organizations transition towards Industry 4.0, the evolution of AI and other emerging technologies progresses in tandem, underscoring their pivotal role in shaping the future trajectory of business operations.

In forthcoming times, it is anticipated that artificial intelligence (AI) will exert a profound influence on marketing strategies, encompassing aspects such as business models, sales methodologies, customer service modalities, and even customer behaviors. For instance, employing advanced voice analysis capabilities, AI agents could potentially discern unresolved issues from a customer's tone and offer real-time guidance to aid the human salesperson's subsequent approach. Marketers currently allocate substantial financial resources annually to conventional marketing research methodologies for acquiring insightful information. In contrast, neuromarketing endeavors to transcend these constraints by offering an objective methodology that disregards the subject's social milieu or context, instead accurately capturing responses and behaviors. Essentially, neuromarketing relies on disciplines such as electroencephalography (EEG), facial expression analysis (FEA), galvanic skin response (GSR), and eye-tracking, which directly measure physiological reactions from subjects, thereby furnishing objective insights into behavioral and cognitive phenomena. These methodologies yield metrics pertaining to focus levels, cognitive burden, memory retention, and emotional states, which can then be analyzed within the context of specific situations and desired objectives. Online retailers could potentially utilize AI to forecast customer preferences, leading to the development of a shipping-then-shopping business model if these predictions prove highly accurate. However, there is a relative scarcity of marketing literature concerning AI, prompting the formulation of a framework aimed at delineating the current status of AI and its anticipated evolution. The advent of new technologies has revolutionized various aspects of human life, including the methods employed by firms in marketing their products and services to consumers. In addition to established innovations such as the Internet, enhanced computing capabilities, mobile technology, and social media, more groundbreaking advancements are emerging, encompassing areas such as artificial intelligence (AI), the Internet of Things (IoT), and robotics, all of which are profoundly impacting marketing practices (Davenport, 2018).

Despite the plethora of recent research endeavors aimed at understanding customers' implicit motivations and decision-making processes, a significant portion of this research involves non-invasive electroencephalographic (EEG) analysis of brain activity (EGC). In studies utilizing functional magnetic resonance imaging (fMRI) and magnetoencephalography (MEG), participants wear electrode caps (fMRI) while undergoing scanning in a strong magnetic field to assess brain activity in pleasure centers, as well as electrodermal response tests and eye tracking, which are commonly employed by researchers. Neuromarketing extends beyond the creation of compelling advertisements and calls to action, encompassing insights into human behavior that can be leveraged across organizations to enhance employee and customer experiences, align executive strategies, and foster greater cross-functional collaboration (Baldo et al., 2022).

Introducing the variable of "emotion" adds complexity to the measurement of advertising effectiveness (Mai, Li-Wei & Schoeller, Georgia. 2009). Emotion significantly influences an individual's response to a message (Lewinski et al., 2014). Advertisements conveying emotional content capture audience attention more effectively, enhance product attractiveness, and increase brand recall (Page et al., 1990). Research by Poels and Dewitte (2006) suggests that emotion serves as a predictor of advertising effectiveness. Assessing consumer emotional responses offers a robust evaluation of the advertisement's impact on consumer attitudes, behaviors, and recall.

Wiles and Cornwell (1990) conducted a comprehensive review of the methods utilized in evaluating emotion in advertising research. Emotional responses can be measured through self-report or autonomic measures. Visual self-report methods require respondents to select a cartoon character corresponding to their emotional state, while verbal self-report methods entail answering open-ended questions or rating emotional states on Likert-type scales (Lewinski et al., 2014). Self-reports typically capture conscious states, whereas autonomic measures gauge physiological reactions beyond conscious control, providing a more accurate assessment of emotional responses (Poels and Dewitte, 2006). Autonomic measures encompass assessments of brain activity (EEG or fMRI), heart rate variability, skin conductance, eye movements, and facial expressions (Lewinski et al., 2014).

A significant long-term trend shaping the future of marketing is the continued expansion of the service sector (Rust & Chung, 2006). The service sector's proportion of the economy has steadily increased in every developed nation since around 1900, with the current sector accounting for approximately 85% of the economy. This trend towards service orientation is even more pronounced in business-to-business (B2B) relationships, with profound implications for B2B research (Lilien, 2016). Similarly, business-to-government (B2G) interactions, characterized by long-term relationships, are disproportionately influenced by technological trends, with significant performance implications for companies heavily invested in B2G portfolios (Josephson, LeMariadoss, & Johnson, 2019).

Eye-tracking is employed in marketing research to understand consumer actions, particularly in the context of providing product information efficiently to increase awareness and identify needs. Increased awareness of product availability enhances the likelihood of purchase. Eye-tracking offers insights into consumer visual attention allocation, shedding light on its role in decision-making processes and facilitating the effective design of marketing activities utilizing visual messages (Białowąs& Szyszka 2019).

1.5 CONSUMER PERCEPTIONS OF BODY LANGUAGE IN MARKETING

According to research, consumers pay close attention to nonverbal indications in marketing messaging. Knapp and Hall (2007) and Mehrabian (2011) found that body language accounts for a significant amount of communication efficacy, with facial expressions and gestures frequently expressing more meaning than spoken information alone. Consumers use body language clues to judge marketing messages' trustworthiness, reliability, and authenticity. Furthermore, body language can elicit emotional reactions, impacting customer attitudes and purchasing decisions (Heath & Soll, 1996).

1.6 BRAND COMMUNICATION AND BODY LANGUAGE

Body language is vital to brand communication because it influences how customers perceive and remember businesses. Ambady and Rosenthal (1992) found that nonverbal cues influence brand personality features, with bodily movements and expressions helping to shape brand identity. Company mascots and spokespersons frequently use body language to communicate company values and build emotional customer relationships (Brennan and Croft, 2012). Furthermore, research indicates that consistency between a brand's visual imagery and body language improves brand recall and recognition (Aaker & Williams, 1998).

1.7 INFLUENCE OF BODY LANGUAGE ON PURCHASE DECISIONS

Nonverbal communication has a substantial impact on customer purchasing decisions. Dholakia et al. (2016) found that body language impacts consumers' judgments of product

quality, price justice, and service dependability. Nonverbal signals in retail environments, such as spatial arrangement, lighting, and shop atmosphere, can increase consumer interest and purchase likelihood. Furthermore, positive body language cues like mirroring and open gestures are linked to better sales results and client pleasure (Mehrabian & Ferris, 1967). In their 2019 study, Stefani and De Marco explore the interplay between language, gesture, and emotional communication, adopting an embodied view of social interaction. Drawing from academic research, they delve into how verbal and non-verbal cues, such as gestures, jointly contribute to emotional expression and understanding during social interactions. The study underscores the significance of embodied communication in conveying emotions effectively, offering insights into the intricate dynamics of human interaction and emotional engagement.

1.8 DESCRIPTION OF TECHNOLOGIES

- Eye Trackers And Biosensors- Light from infrared cameras is directed toward the participant's pupils, causing reflections in both the pupil and the cornea. These reflections, otherwise known as pupil center corneal reflections (PCCR), can provide information about the movement and direction of the eyes. Academic researchers use information about eye movements and fixations to assess attentional processes, compare group behavior, measure stimuli-induced visual responses, and more. Leading consumer brands use eye tracking to better understand customer experience and product performance by measuring visual attention to key messages in product advertisements, placement and branding, package design, and more. For high accuracy and precision eye tracking research that generates meaningful insights, you'll need to think about which type of eye tracker is suited to your studies and how you will analyze the collected data with software. How these systems work together will dictate the quality of your findings.
  Your eye tracking system setup may be screen based for stationary studies, glasses for ambulatory, or VR eye tracking in virtual environments. iMotions software is compatible with all three.
- Facial Expression Analysis- Our face displays our outward emotional expressions – giving a view of how we show our inner emotional state. These expressed emotional states are detected in real-time using fully automated computer algorithms that record facial expressions via webcam. Tracking facial expressions can, when used in controlled contexts and in collaboration with other biosensors, be a powerful indicator of emotional experiences. While no single sensor is able to read minds, the synthesis of multiple data streams combined with strong empirical methods can begin to reach in that direction
- EDA / GSR- Electrodermal activity (EDA, also known as galvanic skin response; GSR) measures the activity of the autonomic nervous system. Our level of emotional arousal changes in response to the environment we're in – if something is scary, threatening, joyful, or otherwise emotionally relevant, then the subsequent change in emotional response that we experience also increases eccrine sweat gland activity. EDA / GSR serves as a valuable index of emotional arousal as it offers insights into a respondent's underlying physiological and psychological processes.

2. RESEARCH METHODOLOGY

This study will contain qualitative research methodology which relies on concrete facts and data driven research, from various literature such are books, research papers and articles about neuromarketing. Moreover the research methodology relies on non-data-driven research, such as a study in the laboratory in Imotion lab to have concrete data how is costumers reaction and analyzing the main factors that this study aims such are body language, eye tracking and

galvanic skin reaction of the costumers in the digital area, which includes presentations and negotiations.

2.1 APPLICATION OF THE TECHNOLOGIES

With the rapid proliferation of the Internet, the utilization of e-marketing tools has become imperative to analyze consumer behavior within the digital realm. This necessity is particularly pronounced in contemporary academia, where there is a growing emphasis on holistic innovation processes rather than solely focusing on diagnosing physiological reactions and preferences in the purchasing journey. Understanding the cognitive processes of consumers, such as attention and perception, can significantly inform marketing strategies, ensuring that information is conveyed to recipients in the most impactful manner possible. In contrast to conventional methodologies, neuromarketing approaches enable researchers to gauge subconscious reactions to stimuli, thereby offering insights into decision-making processes, consumer preferences, and motivations. Among the various neuromarketing techniques, eye-tracking stands out as one of the most widely employed methods, garnering increased popularity in recent years due to its ability to provide valuable insights into visual stimulus processing. Eye-tracking encompasses a suite of research techniques and methodologies designed to measure, analyze, and interpret data on the position and movement of the eyeballs (Białowąs& Szyszka 2019). This method facilitates the tracking of where a subject's gaze falls at any given moment, the duration of gaze fixation on specific points, and the trajectory of gaze movement (Schall & Bergstrom, 2014). Within visual activity, two primary types of eye movements are discernible: fixations and saccades. Fixations entail relative pauses in eye movement, during which the retina stabilizes at a specific point in the visual field, whereas saccades represent rapid eye movements occurring between fixations, facilitating the swift transfer of sight to relevant points in the visual environment where information pertinent to the ongoing cognitive task is available (Białowąs& Szyszka 2019. Fixations typically last between 150 ms to 600 ms and account for 90% of total gaze duration, encompassing minute eye movements such as tremors, drifts, or microsaccades.

3. RESULT INTERPRETATION

Our experiment includes 15 people between ages 15-33 who will be shown 2 picture with graphics and text. People will not know the content of a presented slides/pictures before. We will try to analyze what attracts the attention more, colors, pictures, or just the content. We can use this one, in marketing and sales to attract customers. Furthermore we want to understand the focus and importance of the designs, colors, animation and text in the presentation/ advertising. This time the technology which is used is the computer-based screen eye tracking and GSR device. We prepared 2 slide of the presentation and uploaded them to the imotion system. Then we asked our participants to sit in front of the computer. We explained the whole process, that there would be shown two pictures and they would have only 15 seconds to observe/ read through them. After 15 sec, the participant must leave the room to continue with the next one. Before showing the picture, since it was a computer-based experiment and sensors are connected to the computer a calibration of eye tracking was needed, which lasts around 3-5 minutes and checks the performance of the eye. Each participant had the chance to read through the two slides as shown below:

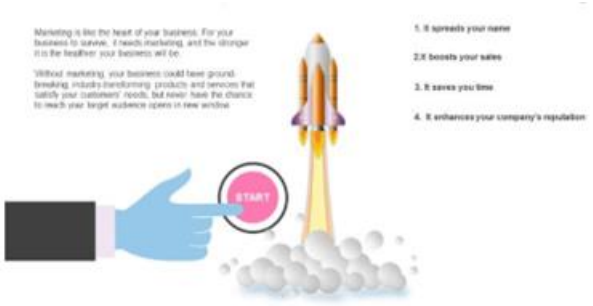

Fig.1 First sample of the importance of marketing

Fig.2 Second sample of risk of poor marketing

Focusing on the image for 15 seconds can give us some insights of where people were looking at first sight, how their eyes react towards an image in our case a slide. Where the eyes moves it really depends, 10 out 15 people who were part of the experiments looked at the same direction, they started from left to right, trying to understand the text which distracted them a lot due to the length of the text. 5 other people started from right to left, is interesting to know that all these 5 people have middle east background. What arise a question does culture influences the way we perceive the world? There are a ton of research on this. The culture undoubtedly has an impact, but so do individual personalities and brain development. The colors of the picture and visuals were crucial in helping people understand the content of the text right away. The impact of color on consumer satisfaction with product appearance is important. It may influence brand assessment and purchasing choices, attract visual attention, and strengthen psychological identity and enjoyment. Numerous topics are covered in this research, including trend prediction, picture color reuse, product color planning, assessment, emotion, imaging, and aesthetics (Hua, Ni, and Lu 2023). Participants acclaim that they were trying to relate the text and image because most of them didn't understand the text. Another interesting findings here, is what marketing has taught us: find your target audience. Even the range of the participants were between 20-35 years. 2 of them were younger than that, which lead us in the conclusion that younger people focus more on the images, and older one are more focus on the text, this could be because of the difference generations from millennials to Gen Z and of course the system education which has evaluated through years. Another interesting finding is people don't look at the corners at all, they focus directly at the middle image if there is anyone and then go through text. 9 of 15 has avoid reading the title at all, and the rest were focusing to the title less than a second, just to read it because it was there. Regarding generations, culture and the type of the person , the colors do attract the attention, as much colors and graphics a slide, advertisement has, it will reach the desired audience. Eye-tracking heat zone maps are a useful substitute for intricate calculations like color clustering since they don't require as much knowledge of color re-use for dynamic visuals and increase the effectiveness of product color design (Hua, Ni, and Lu, 2023).

In addition, the method of color scheme analysis based on eye tracking technology and multilayer perceptron neural networks (MLP) is not just applicable to fake pictures but can also

be used on actual photos. Real photos, such those of animals, plants, and objects frequently have higher levels of complexity, which can make using conventional color extraction techniques difficult. However, considerations like complexity have less of an impact on eye-tracking approaches. Some participants showed a strong preference for graphics, finding joy and excitement when text and graphics were well-connected and made sense. Bright colors, especially red, attracted their attention. However, an overload of text led to confusion, decreased attention, and even increased feelings of anger. Others also found graphics to be more engaging and attention-grabbing than text. They tended to read the title at the end of the presentation and were quick to focus on the "Start" button. Red colors consistently attracted their attention.

4. CONCLUSION

Body language in marketing refers to various nonverbal indicators that impact consumer impressions, brand communication, and purchasing choices. Understanding the function of body language in marketing may help marketers develop more effective communication methods, strengthen emotional relationships with customers, and achieve better business results. Future study areas may include investigating the relationship between body language and digital marketing platforms and cultural variations in perceiving nonverbal cues in marketing scenarios. Body language is a significant marketing technique influencing customer perceptions, brand communication, and purchasing choices. Knapp and Hall (2007) found that nonverbal cues frequently transmit more meaning than spoken material alone. Mehrabian (2011) endorses this viewpoint, emphasizing the importance of facial expressions and gestures in communication success. Consumers use body language to judge marketing communications' trustworthiness, reliability, and authenticity (Mehrabian & Wiener, 2018). Body language elicits emotional reactions, influencing customer attitudes and purchasing intentions (Heath & Soll, 1996).

First and foremost, the use of eye-tracking in marketing research stems from a desire to comprehend consumer behavior. The goal of marketing efforts is to effectively communicate product information to potential customers in order to raise their awareness and determine their needs that the product can meet. As a result, raising consumer knowledge of a product's availability increases the possibility that it will be bought. The allocation of visual attention to various types of advertising and presentations is one area of the consumer's internal attention model that eye tracking provides useful insights into. Additionally, the analysis of consumer behavior using eye-tracking glasses is crucial because it provides insightful information about how people make decisions. Understanding the importance of visual attention enables marketers to create marketing materials like slides, presentations, or advertisements that successfully use visual messaging to capture customers' attention and have an impact on their decision-making. Marketers may create strategies that maximize the use of visual stimuli to engage customers, raise awareness of products or services, and ultimately motivate desired consumer behaviours by exploring the complex link between visual attention and consumer behavior. This in-depth knowledge of visual attention enables marketers to design effective marketing campaigns that connect with customers and provide positive results.

Limitations and future research

Future studies should examine the relationship between body language and digital marketing channels and cultural differences in perceiving nonverbal clues in marketing scenarios. The research might propose avenues for future research, such as exploring additional psychographic dimensions, investigating cross-cultural differences, or examining the role of psychographics in emerging marketing channels like social media.

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