

THE APPLICATION OF EYE TRACKING AND ARTIFICIAL INTELLIGENCE IN CONTEMPORARY MARKETING COMMUNICATION MANAGEMENT

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Purpose: Paper aims to fill the cognitive gap regarding the role, importance and potential of integrating eye tracking research and artificial intelligence. The main goal of the work was to design a proposal for the synergistic use of eye tracking and artificial intelligence for marketing communication management.

Design/methodology/approach: To achieve the planned goal and answer the research questions, methods of systematic literature review, online content analysis, expert interviews and pilot eye tracking studies using the Gazeport GP3 device and Gazeport Analysis V6.9.0 software were used. The considerations are conducted in the field of behavioral economics.

Findings: During the discussion and analysis of various aspects related to the use of eye tracking, artificial intelligence and neuro research in the context of marketing communication management, the following was established: the importance, applications and synergy of eye tracking and AI in marketing communication; the future of new technologies in marketing; key benefits, challenges and potential of the tools discussed, with particular emphasis on the need for their responsible use along with continuous development in this field.

Research limitations/implications: Suggestions for future research on the issues discussed include: ethics and privacy; technological limitations; future dynamics changes. Suggestions for future research include broader analysis of user experience, integration of methods with other technologies, longitudinal research on the impact of AI-generated content personalization, measurement of consumers' emotional engagement. The indicated research areas may contribute to better use of technology in marketing and expand knowledge about non-declarative consumer behavior.

Originality/value: The value of the article lies in providing conclusions and practical recommendations as well as identifying areas for further research, which may contribute to a better understanding and use of eye tracking, AI and neuro research in the field of marketing. The entire research project allowed for the design of a proposal for the synergistic use of eye tracking and artificial intelligence for marketing communication management. The article may be valuable for marketing specialists, researchers, students and people interested in the use of modern technologies in marketing. Thanks to its comprehensive perspective, it can be a guide for people interested in introducing these technologies into marketing practice.

Keywords: neuromarketing, eye tracking, artificial intelligence, marketing communication.

Category of the paper: Research paper.

1. Introduction

Modern marketing is dynamically evolving, responding to changing consumer behavior and expectations. In this context, tools such as eye tracking research and artificial intelligence provide invaluable support for amateurs and professionals dealing with marketing communication management. Eye tracking, which allows for tracking eye movements and analyzing visual attention, and artificial intelligence, which uses algorithms to analyze large data sets, are revolutionizing the way marketers understand and respond to the needs of their audiences.

The enormous amount of information generated by consumers when interacting with marketing content opens the door to new opportunities. Eye tracking allows you to precisely monitor what recipients focus on, which allows you to better understand consumer preferences, reactions and behaviors. In turn, artificial intelligence, thanks to the ability to analyze and interpret data on a scale impossible to achieve manually by humans, enables the personalization of content, forecasting trends and optimization of marketing campaigns in a way that seemed unrealistic until recently.

This article aims to explore the topic of the role, importance and potential of integrating eye tracking and artificial intelligence in the area of marketing communication management. By analyzing their applications, synergies and prospects, the article provides a look at an innovative approach to effectively reaching audiences, creating content and making strategic marketing decisions. Understanding and using these tools not only ensures competitiveness in the market but also opens the door to new forms of interaction with consumers, adapting to the changing trends and expectations of the modern market.

2. Basic concepts and an overview of marketing practices

In forming the background for further considerations, it is necessary to define the basic concepts used in the topic discussed.

Neuro research is a field of science that studies the structure, function, development and disorders of the nervous system. It uses research methods and techniques from neuroscience, psychology, neuroscience, and other scientific fields to understand brain functions and mental processes (Bear et al., 2016; Purves et al., 2018).

Neuromarketing is an interdisciplinary field that combines neuro research with marketing to understand how the human brain responds to marketing stimuli and what the biological basis of consumer behavior is. It uses neurobiological and psychological techniques to analyze the

brain's response to advertisements, products or other marketing elements (Lee, Chamberlain, 2007; Plassmann et al., 2012).

Eye tracking is an analysis method that records and monitors eye movements to understand what people pay attention to when interacting with various static or dynamic materials (Holmqvist et al., 2011; Duchowski, 2017).

Artificial Intelligence (abbreviated as AI) is a field of computer science that involves the development of computer systems capable of performing tasks that typically require human intelligence. It includes machine learning, natural language processing, pattern recognition, and decision-making (Lee, Park, 2018; Russell, Norvig, 2021).

2.1. Eye tracking in marketing communication management

Eye tracking is a research method that involves tracking eye movements to analyze respondents' perceptions of moving and stationary research objects. Eye movements are monitored using a video recorder placed on the respondent's head (mobile eye tracking) or mounted under the monitor screen (stationary eye tracking). This method can be used using various devices, from advanced laboratory equipment to portable devices that enable data collection in natural conditions. The main measures used in eye tracking research are fixations and saccades. Eye tracking enables qualitative analysis of research results, including the development of visualizations (presenting the distribution of attention directed at a given element in the form of heat maps and inverted heat maps, eye scanning paths in the form of fixation maps and bee swarms, as well as moving graphics and AOI areas for which of in turn, quantitative analysis is also possible). Importantly, the results obtained are based on the level of respondents' behavior, not just declarations. This data collection method allows you to track gaze sequences and time spent on specific areas of content, which provides valuable information about how audiences perceive marketing messages.

Eye movement technology allows you to determine what elements users pay attention to and which areas or elements are of no interest to them at all. Eye tracking is used, among others, to examine websites, advertisements, product packaging, and store shelves. As part of marketing communication management, the results of eye tracking research may prove particularly useful in the following activities:

- Consumer attention analysis – allows you to understand what the consumer focuses on when interacting with marketing materials, such as websites, video ads, or graphics. This tool allows you to identify key attention areas, which allows you to better adapt your messages to the expectations and needs of your audience.
- Layout and design optimization – eye tracking data is used to improve the layout of the website, advertising graphics or product packaging. Analyzing how people view these materials helps designers optimize visual elements and create more engaging and intuitive designs.

- Testing the effectiveness of campaigns - eye tracking allows you to assess the effectiveness of advertising campaigns by tracking non-declarative reactions of recipients. By analyzing visual attention and behavior, you can assess which elements of the campaign attract attention and which may require improvement.

The use of eye tracking in marketing enables a more precise and effective approach to creating campaigns by better understanding what attracts consumers' attention and what elements may be decisive in making purchasing decisions. This tool becomes irreplaceable in the process of improving marketing communication, enabling better adjustment of messages to the expectations and preferences of the target audience.

2.2. Artificial intelligence in marketing communication management

Artificial intelligence is used in many areas, including marketing. Based mainly on Reinforcement Learning methods (RL), they are the foundation not only of Industry 4.0 but also of modern financial markets and internet marketing. AI creates new possibilities in optimizing processes, making decisions and increasing efficiency

In internet marketing, machine learning and artificial intelligence use search engines, websites, marketing tools, web developers, conversion optimization specialists, internet marketing specialists in optimizing Google advertising campaigns, e-commerce, content creation, strategy development SEO, email marketing, and social media marketing. Examples of AI applications in marketing include, among others, automation of marketing processes, data analysis and creation of advertising content. AI can also help companies determine the best marketing channels and optimize their advertising budget.

Artificial intelligence plays a key role in today's marketing, offering a range of tools and opportunities that are changing the way marketers communicate with customers. Selected methods include:

- Data analysis and predictive analysis – AI enables the analysis of large data sets, which allows you to identify trends, preferences and consumer behavior and predict future market behavior. AI enables the automation of many processes, which translates into saving time and resources. Thanks to machine learning and natural language processing algorithms, AI can analyze large amounts of data in ways that are impossible for humans to achieve. AI in decision-making can analyze data and provide information in real-time, which helps in making more optimal decisions. AI systems can identify trends, forecast results, and support decisions in more complex issues, such as investment portfolio optimization or risk management.
- Audience segmentation – using machine learning algorithms, AI helps to more precisely define target groups and better understand their needs, which allows for more effective adaptation of messages.

- Personalization of offers and recommendations – artificial intelligence is key in creating and delivering personalized offers. Customer service personalization is the use of AI to tailor customer experiences by analyzing behaviors and preferences. This allows organizations to provide personalized recommendations and solutions, which increases customer loyalty and improves satisfaction. By analyzing consumer data such as purchase histories, preferences and online behavior, it can help:
 - Creating personalized offers – based on data analysis, AI can propose products or services tailored to the individual needs of customers.
 - Recommendations and recommendation systems – using recommendation algorithms, AI suggests products to customers based on their current preferences, which increases the likelihood of making a purchase.
- Automation of marketing processes. AI is revolutionizing marketing processes by automating various activities, which brings many benefits:
 - Automation of advertising campaigns – thanks to AI, it is possible to personalize and optimize advertising campaigns, which allows for more precise reaching of recipients and better use of the advertising budget.
 - Automation of decision-making processes – which is particularly useful in situations where there are many variables to take into account. An example is the use of chatbots in the customer service area, where AI can solve simple problems and transfer more complex cases to employees.
 - Data analysis – AI can automatically analyze huge amounts of data, drawing important conclusions and trends from them, which accelerates marketing decisions. Data management and predictive analytics AI in data analytics enables the identification of patterns and relationships that would be difficult to detect using traditional methods. This allows for a better understanding of the market, customers and competition, which is crucial for effective management of the organization.
 - Content management – automatic AI systems are used to manage content on websites, social media or e-mail marketing, providing personalized and sometimes interactive content for users.

Artificial intelligence is revolutionizing the way marketers analyze data, personalize communications and automate processes, which translates into more effective and efficient marketing strategies tailored to individual customer needs.

3. Systematic review of literature and research

To clarify the research gap in the area of implemented projects on the topic of modern technologies, a deductive approach was used, based on a systematic analysis of the literature on the subject. During the research process, a system of stages was used according to the recommendations of Czakon (2011). The analysis included scientific works in the Scopus and Web of Science Core Collections databases. When building the basic database, three keywords were used in the search: "eye tracking", "artificial intelligence" and "marketing", in the research period 2013-2023.

2,962 publications from various fields were found in the entire Scopus database, and 19 in the Web of Science Core Collections.

Analysis of the number of publications (see Figure 1) indicates a further phase of development in the life cycle of the discussed issues and allows us to notice high research activity.

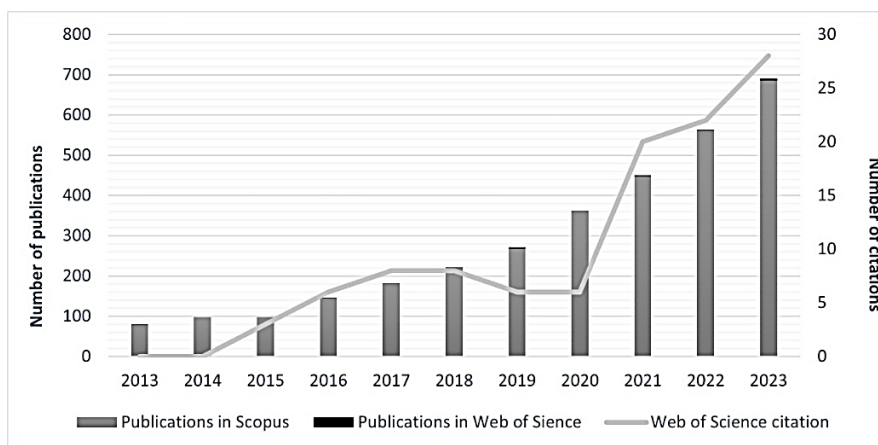


Figure 1. Number of publications and citations in the selected research area.

Source: preparation of results based on searching the Scopus and Web of Science databases; performed: December 2023.

A review of available information sources made it possible to obtain research reports covering scientific projects carried out in various thematic areas. In a further step, the author also decided to get acquainted with the results of commercial work by conducting an online analysis of the content posted on the websites of marketing agencies and research agencies dealing with market and public opinion research.

The results of the systematic literature review indicate the importance of the discussed issues in management practice and allow us to conclude that this topic is still a current and important research area.

A critical review of available reports by various scientists also became a direct contribution to clarifying the research gap in the field of research on the possibilities of using eye tracking and artificial intelligence in the process of marketing communication management to optimize the activities of marketers in the current market conditions

4. Research methodology

As a result of a review of the literature on the subject, it can be concluded that eye tracking and artificial intelligence are important and current issues. However, there is a paucity of comprehensive scientific studies treating these areas synergistically, more broadly and from different perspectives. Marketing strategies using methodically selected eye tracking methods, tools and procedures in connection with data generated by artificial intelligence have not been identified.

This research paper therefore aims to fill the cognitive gap regarding the possibilities of using eye tracking and artificial intelligence in contemporary marketing communication management.

The literature review prepared by the author, the analysis of available projects on the discussed topic and the exploratory research conducted became the basis for the preparation and implementation of empirical research. The adopted basic research problem included learning how, in current market conditions, a marketer can and should use eye tracking research and artificial intelligence in the marketing communication process.

The main goal of the work was to design a proposal for the synergistic use of eye tracking and artificial intelligence for marketing communication management.

The following research questions were identified:

- P1. How and to what extent do marketing entities and agencies use modern technologies to optimize marketing activities?
- P2. How do entrepreneurs/marketers use artificial intelligence to create marketing value for offered products and influence buyer behavior?
- P3. What impact does eyetracking research have on the value of various promotional materials in the marketing communication process as perceived by customers?

To achieve the planned goal and answer the research questions, the following research methods and measurement tools were used:

- analysis of online content of marketing agencies' websites, including information on the tools and services in the field of eye tracking research they use in practice;
- semi-structured expert interviews with 9 marketers working in marketing agencies. Cooperation with people professionally dealing with the discussed issues was considered particularly important in the context of developing and verifying the author's proposal for the synergistic use of eye tracking and artificial intelligence to market communication management;

- exploratory eye-tracking research of promotional materials generated using Microsoft Bing AI artificial intelligence. The selected research method involved tracking eye movements and analyzing respondents' perception of stationary research objects presented to them on the screen - stimuli in the form of samples, which were elements of the brand's visual identification, the product and promotional materials in the form of posters and leaflets. As a result of the research, information was obtained about the areas and elements noticed by the respondents first, those that focused attention for the longest time, and those that were partially or completely omitted. A particularly important addition in the context of this work is the fact that the results are based on the level of behavior and actions, and not on the respondents' declarations, so they are objective. The research tool used was a stationary Eyetracker Gazepoint GP3 device and Gazepoint Analysis V6.9.0 software.

5. Results of empirical research

By triangulation of research methods, the considerations included identifying opportunities among experts, verifying the use of identified activities and good practices among marketers, and ending with the analysis of the perception of recipients of the activities, including their behavioral reactions. This part of the work will present the most important results of the obtained empirical research.

Firstly, it was established that modern marketing communication management requires the use of various tools, including eye tracking and artificial intelligence. Thanks to them, you can learn about customer preferences, understand their behavior and adapt the offer personalized to their needs.

The synergistic use of technologies such as artificial intelligence, eye tracking or neuro research in general in marketing brings many benefits but also carries certain limitations and challenges.

The benefits include mainly:

- A better understanding of consumer behavior. Eye tracking allows you to track what the consumer pays attention to, which helps to better tailor the content to their needs. AI analyzes this data in the context of preferences, which allows personalization and delivery of more relevant offers. Eye tracking provides information about what consumers pay attention to, while AI can analyze this data in the context of preferences and purchase history, providing more insightful and comprehensive data about customer behavior.

- Personalization and better targeting. The use of AI enables the personalization of marketing content and offers, which increases the effectiveness of communication with customers by providing more relevant messages. Combining data from eye tracking and AI allows for more precise personalization of marketing communications. It is possible to provide content that not only meets consumers' preferences but is also constructed in such a way as to attract their attention based on the analysis of visual clusters.
- More effective advertising campaigns. Eye tracking and AI can support the creation and optimization of advertising campaigns, enabling better use of advertising budgets and increasing campaign effectiveness.
- Optimizing user experience. Integration of eye tracking with AI enables a dynamic response to user behavior. By analyzing visual clusters, you can instantly adjust content and interfaces in real-time to ensure optimal experiences.

About the limitations, the key aspects turned out to be:

- Privacy issues. The use of technologies such as eye tracking and AI collection of consumer data may raise privacy and ethical concerns, which may be limiting for some consumers.
- Costs and availability. Implementing advanced technologies can be expensive, which may be a barrier for smaller companies. Moreover, they are not always easily accessible to all industries or markets.
- Adapting to change. Rapid technological development means the need to constantly adapt to new tools and methods, which can be a challenge for marketers.

Barriers and challenges were also identified, focusing primarily on:

- Data interpretation and analysis. Large amounts of data generated by eye tracking and AI require advanced analysis and interpretation, which can be difficult and time-consuming.
- Education and skills. Implementing these technologies requires appropriate knowledge and skills. The challenge may be providing adequate training for employees to use these technologies effectively.
- Maintaining a balance between innovation and ethics. The introduction of advanced technologies in marketing requires attention to ethics and responsible use of data, which is extremely important to maintain consumer trust.

5.1. An integrated approach of eye tracking and AI in marketing communication management

The combination of eye tracking and artificial intelligence opens new horizons in analyzing consumer behavior and improving marketing strategies. Integrating these technologies brings many benefits. The development of both technologies indicates even more advanced possibilities in marketing communication management. The future of eye tracking and AI in marketing indicated by experts in interviews includes:

- The evolution of visual analysis accuracy. Eye tracking may become even more precise and more accessible across devices, enabling more accurate monitoring of user responses in different conditions and contexts.
- Development of AI algorithms. Artificial intelligence is becoming more and more sophisticated. Machine learning algorithms and data analytics are expected to become more advanced, enabling an even better understanding of consumer behavior and more effective personalization of communications.
- Integration of other technologies. There is a trend of integrating eye tracking and AI with other technologies, such as augmented reality (AR) or virtual reality (VR), which may create completely new opportunities for customer interaction and personalization of experiences.

The integrated use of eye tracking and artificial intelligence is the key to improving marketing strategies, allowing for more precise understanding and better interaction with audiences. The future of these technologies in the area of marketing is directed towards even more advanced methods of data analysis, which will allow companies to better adapt to the changing needs and expectations of customers. The interlocutors emphasized that the aspect of creating multisensory experiences, focusing on experience design, with the comprehensive involvement of all possible human senses, is extremely important. Five respondents mentioned, including one (Respondent Number 3 - abbreviation R3) strongly emphasized the need to create unique and original experiences, not only "positive" ones, which the recipients have already encountered many times and to which they are accustomed. One of the interlocutors called such a process "developing the concept of sensory experiences" (R5) as if it were a more complex idea resulting from previously adopted assumptions and a plan. Not an ordinary idea, but an "unforgettable experience" (R1), and also an "emotional and engaging event" (R4) and, in other words, "immersive" (R6). One of the respondents even mentioned "creating multisensory and virtual concepts" (R9), and another indicated a recommendation resulting from his own experience: "We use various available tools and installations, such as the appropriate selection of scents, special sounds, tastings, visual and interactive shows or innovative technologies to provide a full sensory experience related to the brand and product. Artificial intelligence helps to properly personalize the content created" (R2) when creating unique consumer experiences. Opinions overwhelmingly prevailed that there is a great need to

use innovative technologies and tools that are effective from the recipient's point of view in marketing strategies. Marketers paid attention to modern solutions and interactive technologies, such as touch screens, interactive presentations, virtual reality, and augmented reality. Artificial intelligence was presented as an opportunity to create the most intense sensory engagement possible for recipients and provide them with unique experiences on many levels. One of the respondents (R3) cited an example of a solution using Digital Signage technology, which is additionally connected to active digital systems and with appropriately synchronized devices that release, among others, scent notes specially selected by the AI algorithm, attracting attention and having an appropriate impact on passers-by in a public place. The interlocutors also emphasized the possibilities and resulting opportunities of implementing innovative solutions when shopping online, by creating appropriate incentives and stimulants. The respondents' statements mainly presented examples and good practices in the space of remote shopping, including shopping via mobile applications. The need for: visual attractiveness of websites and applications was repeatedly emphasized; satisfying and precise materials presenting a given product: accurate and detailed photos and/or recordings, the ability to zoom in on graphics, product presentation in 3D and details visible in various forms. An example of the exemplary practice was the opportunity to virtually try out a particular cosmetic product directly on the face in real-time, using the customer's camera and AI technology, for example on a mobile phone or laptop (R9). The next practice concerned an intelligent system that allows, after creating an example fashion composition on one's figure, to directly publish photos on social networking sites through automatic AI functions available in the application (R8).

In summary, the recommendations obtained during the interviews and data from the analysis of online content of marketing agencies' websites allowed us to generate sample promotional materials for the brand, in the form of proposals for a new visual identification, a new product and proposals for three ready-made variants of promotional posters and leaflets. The graphics generated by Microsoft Bing AI were subjected to eye-tracking tests in a sample of 10 respondents. The obtained results indicated that the respondents focused their attention the longest on the poster that contained a clear and distinct advertising slogan, as well as on the product that was placed in the central part of the poster. In turn, a leaflet that contained a lot of text and few graphics was the least effective in attracting the respondents' attention. In the design of product packaging and promotional materials, the presence and location of sensory stimuli (such as intense colour, fruit, face/skin, hair, product - packaging) that attract the greatest attention of respondents (due to the longest average exploration time and relatively short average time to reach the elements). Respondents were interested in the presented materials, and in a later interview, they assessed them as visually attractive. No one expressed any doubts or comments that the visualizations were created not by humans, but by artificial intelligence.

The entire research project allowed for the design of a proposal for the synergistic use of eye tracking and artificial intelligence for the needs of real-time marketing communication management, as illustrated in Figure 2.

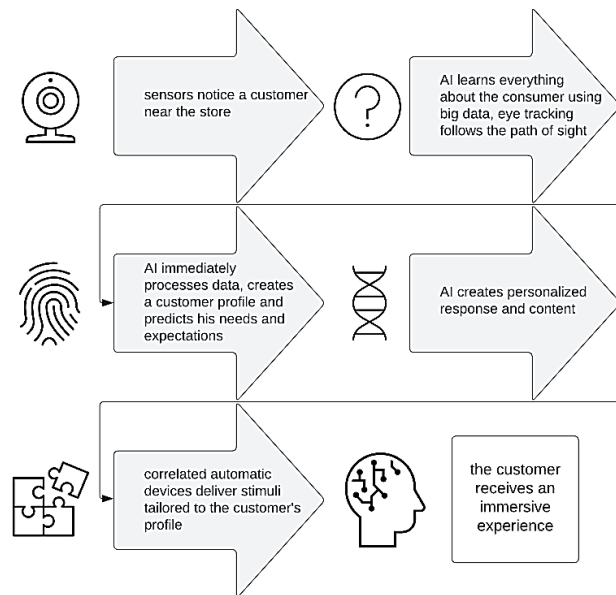


Figure 2. Mechanism of synergistic use of modern technologies to implement marketing activities.

Source: own study based on research.

Good practices in planning the form of marketing communication influencing the generation of the value of the market offer are also summarized:

- communicating directly (verbally) the unique values of products,
- communicating the values expected by the client at a subliminal level,
- synesthetic information and communication,
- sensory and immersive experiences,
- personalization of created content and selected tools for transmitting it,
- adjusting the content and offer in response to the observed customer reactions to the stimuli used,
- creating a feeling of inaccessibility, including time and quantity limitations,
- emphasizing the uniqueness of the offer,
- adapting the form and structure of promotional tools to high standards and expectations,
- proper product display according to merchandising principles,
- storytelling with a coherent and interesting structure.

Signalling the actions and their effects also motivated attention to the need to use big data technology (Wieczorkowski, Pawełoszek, Chomiak-Orsa, 2022), artificial intelligence and other solutions to optimize stimuli for generating an appropriate set of product values for the customer. Contemporary conditions are heading towards blurring the boundary between the online and offline worlds, where digital technologies are an essential element of everyday life, and the digital world is perceived as a natural extension of the physical world. New generation

technologies, such as artificial intelligence, voice control or robotization, create the opportunity to match the planned stimuli to the created customer profiles as precisely as possible based on collected data sets. Modern society is characterized by inclusiveness and pro-social activities, and the expectation of interactive consumer experiences at every point of contact with the brand is a universally expected value. The obtained results motivated to propose a graphical summary of sensory stimuli selected and designed using artificial intelligence, which creates appropriately personalized marketing activities, based on the created consumer profile (see Figure 3). These values may subsequently influence the customer's reactions and behaviors precisely defined and expected by the marketer.

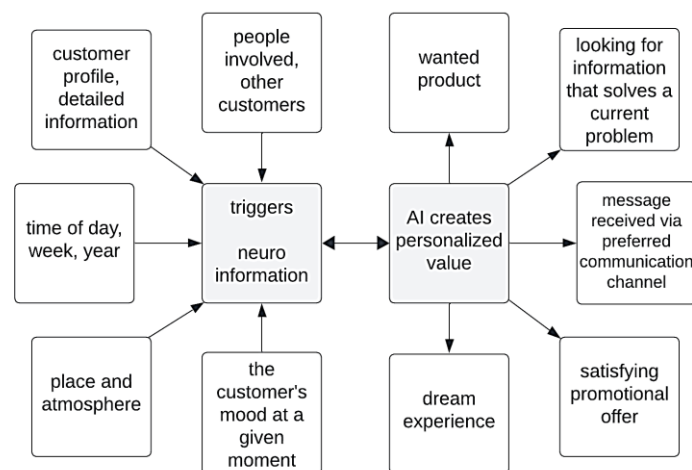


Figure 3. Sensory stimuli that create personalized value for the customer.

Source: own study based on research.

6. Summary and Conclusions

In recent years, a revolution has been observed in the approach to data analysis in the area of marketing. Traditional methods of collecting information and assessing the effectiveness of marketing campaigns have begun to give way to modern technologies that enable a more precise understanding of consumer behavior. Eye tracking and artificial intelligence have emerged as key tools that not only provide information about customer preferences and reactions but also enable dynamic adaptation of marketing strategies.

Eye tracking, initially used in research on visual perception, quickly found application in marketing. Thanks to advanced eye tracking technologies, it allows you to record, analyze and interpret what consumers pay attention to when interacting with marketing content. This tool not only reveals which elements of the campaign are more attractive or attention-grabbing but also helps understand what emotions they evoke and how they influence purchasing decisions.

In turn, artificial intelligence, based on machine learning algorithms and data analysis, enables a deeper understanding of consumer preferences and behavior. AI allows you to personalize your shopping experience by providing personalized offers and recommendations that are more effective and precisely tailored to the individual needs of customers, but also to the situation and mood in which the recipient is at a given moment.

The increasing importance of these tools also results from the increasing amount of data generated by consumers in the digital world. Analyzing this data using traditional methods becomes impossible due to its huge amount and complexity. Eye tracking and AI address this challenge by offering the ability to process and interpret large data sets in real-time, enabling faster responses to changing consumer preferences and behavior.

Therefore, eye tracking and artificial intelligence are not only changing the way data is analyzed but also revolutionizing the approach to marketing communications management. Their growing importance is an undeniable indicator of the future direction of marketing strategies, enabling marketers to better understand their audiences and reach them with the right messages more effectively. Eye tracking and artificial intelligence (AI) are currently key tools in the field of marketing communication management, allowing you to create and optimize marketing strategies more and more effectively.

However, it should be noted that the use of modern technologies in marketing communication management is not without challenges. This requires appropriate infrastructure adaptation, understanding of technology and employee training. Additionally, there are also concerns about data privacy and ethics surrounding automation and machine learning. Nevertheless, the benefits of using eye tracking and AI in organizational management are very motivating. This gives organizations a competitive advantage, allows for more efficient use of resources, reduction of costs, and improvement of the quality of services. As AI technology develops, its role in marketing can be expected to increase. Eye tracking research and the use of artificial intelligence in marketing communication management open up new opportunities for understanding consumer behavior and improving marketing strategies.

To sum up, the synergy between eye tracking and artificial intelligence is an extremely promising direction in the field of marketing communication management. Implementing these technologies will allow companies to better understand customers, reach them more effectively with appropriate automatically generated messages (without human intervention), and dynamically adapt marketing strategies to changing market expectations.

Prospects for further research in this field include the pursuit of even greater precision of visual analysis in eye tracking, the development of more advanced AI algorithms and the integration of these technologies with others, such as AR and VR. This research will focus on an even better understanding of consumer behavior and creating more effective and personalized experiences for customers.

In the face of these challenges, marketers must improve their analytical skills, ensure data protection and at the same time use these technologies responsibly to reap the full benefits of their use in marketing.

References

1. Bear, M.F., Connors, B.W., Paradiso, M.A. (2016). *Neuroscience: Exploring the Brain*. USA: Wolters Kluwer.
2. Chen, Y., Liu, H. (2021). Integrating Eyetracking Data and Artificial Intelligence for Dynamic Ad Personalization. *Computers in Human Behavior*, Vol. 10, Iss. 2, pp. 317-331, doi: 10.1016/j.foar.2021.01.002.
3. Czakon, W. (2011). Metodyka systematycznego przeglądu literatury. *Przegląd Organizacji*, No. 3, pp. 57-61, doi: 10.33141po.2011.03.13.
4. Duchowski, A. (2017). *Eye Tracking Methodology: Theory and Practice*. Springer.
5. Holmqvist, K., Nyström, M., Andersson, R. (2011). *Eye Tracking: A Comprehensive Guide to Methods and Measures*. Oxford University Press.
6. Lee, N., Chamberlain, L. (2007). Neuroimaging and Psychophysiological Measurement in Neuromarketing Research: A Systematic Review. *International Journal of Psychophysiology*, Vol. 63, No. 2, pp. 159-168.
7. Lee, S., Park, J. (2018). Enhancing Customer Experience through Eyetracking and Machine Learning: A Case Study in Online Retail. *Journal of Interactive Marketing*, Vol. 43, pp. 123-137.
8. Patel, R., Gupta, M. (2019). Application of Eyetracking and AI in Optimizing Website Design for E-commerce. *Journal of Marketing Research*, Vol. 55, No. 6, pp. 789-805.
9. Plassmann, H., Ramsøy, T.Z., Milosavljevic, M. (2012). Brand Preferences: Neuroscientific Insights. *Journal of Consumer Psychology*, Vol. 22, No. 1, pp. 7-18.
10. Purves, D., Augustine, G.J., Fitzpatrick, D. et al. (2018). *Neuroscience*. Oxford University Press.
11. Russell, S., Norvig, P. (2021). *Artificial Intelligence: A Modern Approach*. Pearson.
12. Smith, A., Johnson, B. (2020). Eyetracking in Marketing: Recent Advances and Future Trends. *Journal of Marketing Analytics*, Vol. 8, No. 3, pp. 215-230.
13. Wang, C., Li, X. (2019). The Role of Artificial Intelligence in Personalized Marketing: Opportunities and Challenges. *International Journal of Information Management*, Vol. 49, pp. 22-35.
14. Wiczorkowski, J., Pawełoszek, I., Chomiak-Orsa, I. (2022). Big data w marketingu – narzędzie doskonalenia relacji z klientami. *Marketing i Rynek*, pp. 3-9.