

7. Neuromarketing research

In recent years, due to the development of marketing theory and practice, traditional tools such as customer behavior research, surveys, observations, and experiments have ceased to fully meet modern realities. A significant number of consumers make purchasing decisions based on emotional impulses that arise at the subconscious and unconscious levels.

In this context, neurotechnologies are gaining more and more attention as an innovative tool capable of revealing decision-making mechanisms at deeper levels of consciousness. This trend has given marketers new opportunities for a detailed study of the target audience and potential customers. In a very short time, neurotechnology has become an important research tool not only in the scientific field but also in the commercial segment.

Most Ukrainian businesses still rely on classical marketing methods, which do not always show good results due to their stereotypical nature and limitations. In this regard, producers of goods and services are actively looking for new approaches to attract consumer attention. Modern promotion technologies have significantly expanded marketing opportunities. Whereas once the promotion of goods and services was limited to television commercials or print ads, today a variety of tools are used, from contextual online advertising to creating atmospheric sales areas with carefully selected color and sound design.

The use of neuromarketing is gaining popularity as it allows companies to promote their products and services more effectively. The results of numerous studies in this area confirm that neuromarketing offers great prospects. Its main advantage is access to in-depth information about consumers that is not available using classical methods.

This type of marketing is already widely used by the world's leading companies and is gradually gaining popularity in Ukraine. However, the issues of systematizing neuromarketing methods to maximize consumer engagement and influence their subconscious remain relevant.

Neuromarketing is a new and promising area of research that is still under development, and its subject field remains open for discussion. Modern marketing is actively researching consumer behavior and decision-making, and the development of neurotechnological tools has significantly contributed to the formation of the neuromarketing concept.

Progress in the functionality of magnetic resonance imaging (MRI) and other neurotechnologies that allow for the study of brain activity has given rise to what is known as neuroculture. Within its framework, new interdisciplinary fields have emerged, such as neuroaesthetics, neurotheology, and neuroeducation. Neuroculture reinforces neomaterialism, an epistemological approach that seeks to explain complex phenomena through fundamental biological mechanisms. The knowledge about brain activity gained through this approach is gradually transforming societal understandings of personal identity, responsibility, and cause and effect. As a part of this new neuroculture, neuromarketing is emerging as a marketing discipline based on the achievements of neuroscience.

Interest in combining marketing and neuroscience dates back to 1975, when J. Mark. Res began his pioneering research in this area. In 1990, he published the article "Conjoint Analysis in Marketing: New Developments with Implications for Research and Practice", which attracted the attention of scientists from related fields to this method of analysis. At the same time, Harvard University psychologists laid the foundations of the neuromarketing concept.

The term "neuromarketing" was first officially used in 2002 by German professor Ale Smidts from Erasmus University Rotterdam. In the same year, Bright House Institute for Thought Science, a company specializing in the study of the human brain using neuroimaging technologies and brain activity mapping, was founded in Atlanta (USA) at Emory University. At the time, Harvard University was a leader in neuromarketing research.

The term "neuromarketing" was first officially used in the United States, after which it gradually spread to the European continent. In Asia, the scientific recognition of this area took place only in 2008, when the book **Buyology**, written by Martin

Lindstrom, a partner at BBDO Interactive Media and an expert in futuristic brand management, appeared in the region.

Initially, neuromarketing was not widely accepted in Asia, mainly because Lindstrom's book was full of specialized professional slang, which made it difficult to understand. It was only after the publication of **Neuromarketing**, where the author outlined the basics of neuromarketing in accessible everyday language and supplemented the materials with real-life examples, that the term gained recognition and began to be actively used.

Thus, the emergence of neuromarketing at the beginning of the 21st century was the result of several complementary processes. Firstly, the formation of new scientific, theoretical and methodological inquiries, and secondly, the emergence of innovative technologies for the study of human behavior. Three main factors can be conditionally distinguished, the combination of which at the turn of the XX-XXI centuries contributed to the emergence of this modern field of research and practice-oriented activity.

On the one hand, the evolution of marketing theory and consumer behavior in the twentieth century has made significant strides forward, moving away from the "economic man" model to much more complex concepts that better explain the nature of economic activity and consumer behavior. On the other hand, traditional methods of marketing research based on self-reported respondents have reached their limits and can no longer fully satisfy the needs of both academic and applied marketing for reliable and accurate knowledge.



Figure 1 - Prerequisites for the emergence of neuromarketing

One of the key factors that created favorable conditions for the emergence of neuromarketing was the rapid development of neuroscience, including the introduction of modern methods and technologies for the study of nervous processes. These innovations have been applied not only in clinical practice but also in the social sciences to solve a number of important problems.

The study of nervous processes in the brain allows us to obtain fundamentally new information about preferences, motivation, decision-making mechanisms, and other hidden aspects of human behavior that affect the outcomes of market interactions. This approach opens up new horizons in understanding behavioral patterns that are not available to traditional observation tools.

Progress in neuroscience today has largely been made possible by the emergence of functional magnetic resonance imaging, which allows us to localize and visualize nerve activity during specific tasks. However, this technology is only one of many used in modern neuroscience. New methods of collecting and analyzing data on nervous processes are constantly emerging, expanding the potential of research.

Neuromarketing specialist V. Lim proposed a classification of neuroscientific methods suitable for solving marketing problems, identifying three main groups:

- methods for measuring nerve activity directly in the brain;
- methods for measuring nerve activity outside the brain;

- methods of manipulating nervous activity.

Table 1 provides an expanded list of these methods with a description of their features and examples of application in marketing research that they can effectively solve.

The theory of neuromarketing is based on the fact that consumers make most purchasing decisions on a subconscious or unconscious level. At the same time, careful analysis and comparison of products or brands do not play a decisive role in the purchase decision process.

Studies have shown that it takes a consumer only 2.5 seconds to make a decision to purchase any product. However, marketing experts have long doubted that in such a short time a person can make a deliberate decision based on conscious analysis.

According to the research of Dr. Pradeep, CEO of NeuroFocus, people's reaction to any information can be divided into three stages. The first stage is observation, which lasts 300 milliseconds. It is followed by the brain reaction stage, which takes 200 milliseconds. The third and final stage is conduction, when the brain transmits the reaction to a certain part of the body, forming a conscious behavior or a certain expression of the consumer. This means that by the time we realize what is happening, the brain has already managed to react to the information received.

German branding and retail experts from the Nymphenberg Group have concluded that more than 50% of purchases are made unconsciously. In other words, the fundamental idea of neuromarketing is that the key participants in the consumption process are not only human consciousness, but also the brain as a complex mental system, as well as subconscious and unconscious reactions.

Neuromarketing can be described as an interdisciplinary field that uses neurotechnologies based on knowledge of the brain, clinical medicine, psychology, cognitive sciences, decision theory, and social sciences. With the help of methodological approaches from psychology and statistics, this field studies brain activity and emotional changes in consumers when making decisions and forming preferences for a brand or product. In addition, it allows to reveal the subconscious

activity and behavioral patterns of individuals in consumption by analyzing experimentally obtained data.

The scientific definition of neuromarketing is based on a number of specific approaches. For example, innovative marketing is seen as a field that uses a variety of stimuli to influence the brain to elicit desired consumer actions. This modern approach combines neuroscience, cognitive philosophy, and traditional marketing to create a new integrated discipline. Methods based on the statistical processing of data from psychophysical research serve as tools for analysis, but are not directly marketing techniques.

A similar approach to sensory marketing, which forms conditioned reflexes associated with a particular brand, can be seen as a tool for creating specific consumer reactions. The discipline that explains the mechanisms of unconscious processes in the neural structures of the brain offers a theoretical and practical basis for an in-depth analysis of unconscious behavior.

In practice, neuromarketing is often associated with neuroeconomics, an applied field of consumer behavior research using neuroscience tools. At the same time, it can be viewed as a complement to traditional marketing to improve the effectiveness of communication strategies. In particular, it explores the correlations between emotions and decision-making patterns, which allows us to better understand the connection between emotional experiences and consumer choices.

Thus, neuromarketing is a set of tools, methodologies, and approaches from various disciplines and is a science with significant practical value.

Neuromarketing tools. Neuromarketing is a powerful mechanism for influencing the minds of consumers that combines advanced marketing technologies and knowledge about the brain. In fact, it is a multifaceted approach to studying customer behavior using specific methods. The main goals of these tools include:

- analysis of human reactions to certain stimuli;
- forecasting consumer choice;
- creating a desire to make a purchase even before realizing the need for the product.

Practice shows that the neuromarketing technique is extremely effective. It contributes to a significant increase in sales, revenues, and brand or product loyalty. The main goal of this approach is to gently encourage consumers to purchase a product or service, which is achieved by influencing their subconscious.

The methods of influence vary: for example, it can be a study of eye reaction, tactile perception, the impact of colors, sounds, or smells. In addition, emotional associations that evoke pleasant memories or positive feelings are often used.

Due to the ability to influence unconscious aspects of behavior, neuromarketing technologies are sometimes perceived as a tool for manipulation. Nevertheless, the final purchase decision always remains with the consumer. The buyer is not forced to act, but only gently pushed to make a decision.

Although the overall objective of all such methods is to stimulate a purchase, their methods of implementation can vary considerably. Classical marketing uses techniques such as surveys, in-depth or expert interviews, etc. However, research usually does not involve experts in neuroscience or psychology: it is conducted by marketing department employees. They identify the target audience, form focus groups to test individual solutions, analyze the work done, and use A/B testing on large groups of consumers. Research results are summarized and analyzed to further improve strategies.

Unlike classical methods, neuromarketing is a much more complex phenomenon. It not only involves specialists from various fields, but also uses innovative technologies to track the body's reactions: brain activity, heart rate, eye movements, etc. Such studies require significant financial investments and time. In addition, the results may be limited due to the small sample of participants. The analysis is mainly based on the reactions of a few dozen people extrapolated to a wider audience, although such conclusions are not always universal.

In general, behavioral analysis is a long and complex process that takes into account various factors, including specific characteristics: personality type, customer pain points, desires, etc. Due to its high level of detail, neuromarketing delivers significant results if its tools are implemented correctly.

The main goal of neuromarketing research is to identify the reasons why customers prefer a particular product, as well as to develop techniques to stimulate the desire to place an order both consciously and subconsciously.

Table 1 - Groups of channels of influence on human senses

Type of channel of influence	Scope and characteristics of the impact on the consumer
Visual channel (Vision)	It is the main way to influence human behavior, so you need a clear understanding of the correct presentation of the message to distinguish it from the flow of information noise surrounding the consumer and evoke the right emotions. Design work and a competent color scheme for company logos, packaging, and websites are very important for successful branding: – When buying a product, 93% of consumers make a decision based on the product's appearance, while only 6% of them value tactile sensations and 1% want to taste the product; – 85% of consumers put color in the first place when buying goods; – The right color for a package or display case can increase demand for a product by 30%, regardless of how much the customer likes the product.
Aroma marketing, smell (olfaction)	The most powerful way to influence the human condition. It directly affects the brain system responsible for the formation of emotions and behavioral reactions: – Auchan megastores flavored their confectionery departments with the scent of Christmas pudding and chocolate, which boosted sales by 60%; – In the US, the Walmart store chain sprayed pine and tangerine scents during Christmas sales, which resulted in a 22% increase in profits; – In grocery stores, consumer demand is stimulated by the smell of cucumber and watermelon, emphasizing the freshness of products, and in furniture stores by the smell of pine needles; – Jewelry sales are facilitated by the scent of flowers, while clothing sales are facilitated by the smell of mint and basil.
Audio channel (sound)	Hearing. Background music in stores is an effective motivator for purchases: light, pleasant, rhythmic, and dynamic enough to encourage purchases. Sound design (background music) helps to increase turnover by 46%. Measured (about 60 beats per minute) melodies are more likely to encourage people to make impulse purchases. Under their influence, a person can spend 35-40% more money than he or she intended. Such music is recommended for stores in the middle and higher price categories, where customers can afford unplanned expenses. In low-cost stores, it is better to use energetic music (90-110 beats per minute), which makes people more likely to make a purchase.

For example, what seems attractive to North American customers may be indifferent or even repulsive to South and East Asians. In the context of aroma marketing, researchers believe that the right scent can significantly increase sales. However, the wrong scent can negatively affect customers in a matter of minutes, leading to a drop in sales.

As for the sound impact of marketing, experts suggest using "words of power". For example, 52% of consumers will react positively to the word "sale" and 60% will feel comfortable and inclined to buy after seeing the word "guarantee".

All of these approaches are discussed in the scientific literature, but without focusing on their potential for innovative products, with the exception of the kansei-engineering method. At the same time, the role of neuromarketing tools can be crucial in promoting innovative products, in particular to overcome consumer resistance. The success of an innovation largely depends on how well consumer reactions are predicted. The main components of consumer resistance are fears: of technical complexity, societal reaction, obsolescence, and physical danger. These fears are especially typical for innovators and early adopters, who make up about 19% of all consumers in the innovation perception classification. In this context, the use of neuromarketing tools becomes an important factor in overcoming these obstacles.

Table 2 shows marketing strategies aimed at reducing consumer resistance to innovative products through the use of neuromarketing tools. In conclusion, the focus of marketing today has shifted from product functionality to the art of creating impressions, emotions, and pleasure.

Both the product design and its features should harmoniously influence all aspects of human perception, covering the intuitive, sensory, behavioral, mental and emotional levels. In this context, marketing strategies should not only drive sales, but also effectively reflect the company's or brand's values, creating a positive emotional experience for customers and stimulating the desire to return to using the product or service.

Table 2 - Marketing strategies to overcome consumer resistance to innovative products

Type of resistance	Components of a marketing strategy	Possible neuromarketing tools for overcoming resistance
Functional: obstacles to use	Development of promising areas of modification, ensuring the appropriate level of service, development policy market and adaptation of goods to the needs of the client at the point of sale	Visual (color, packaging, merchandising, texture), aroma marketing
Service risk and fear physical damage	The use of a well-known brand policy, the introduction of quality certificates and certificates of quality, product certification, warranty service, the use of advertising information space	Presentation, advertising, information dissemination
Psychological: traditions and image	Development of product awareness in the minds of consumers, effective use of trademark policy, leasing, emphasis on communication appeals based on the ratio of quality and brand awareness	Visual (color, packaging, texture), presentations, and an audio channel.

The space of sensor technologies in neuromarketing. In today's environment, classic sales promotion tools such as discounts, promotions, tastings, or lotteries are gradually losing their effectiveness. In search of innovative approaches, marketers are increasingly turning to sensory marketing. This trend, although relatively new, has already proven to be effective for hundreds of companies.

To better understand the essence of sensory marketing, it is necessary to turn to the basic concept of neuro-linguistic programming. It is a fundamental element of neuromarketing in general and sensory marketing in particular.

Neuro-linguistic programming (NLP) originated in the 60s and 70s of the twentieth century. Its founders are Richard Bandler and John Grinder, scientists at the University of California, who made the greatest contribution to the development of this field. Other researchers, such as Gregory Bateson and Frank Pucelik, also played a significant role.

The basis for the development of NLP were the methods of verbal and non-verbal behavior of three prominent psychotherapists: Virginia Satir (family therapy),

Milton Erickson (Ericksonian hypnosis), and Fritz Perls (Gestalt therapy). The creators of NLP conducted a thorough analysis of human behavior, adhering to the belief that any behavior has a certain structure that can be understood and modeled.

Today, NLP techniques are widely used in various fields, from psychotherapy and education to business and sales. This opens up new opportunities for to create more effective and efficient forms of customer interaction in today's market.

Despite its focus on analyzing human thinking and perception, NLP is not recognized as a science. Its fundamental principle is based on the assumption that an individual's perception of the world is formed through the complex interaction of consciousness, body, language, and life experience. With the acquisition of new experiences, this perception also changes. However, in addition to the natural process of change, it is possible to artificially influence the perception of the world using special techniques that allow you to rebuild a person's personal experience.

Within this approach, it is important to understand how an individual perceives the surrounding reality and what factors determine this interaction. In NLP, there are three key components of perception: sounds, visual images, and internal sensations. The combination of these elements is formed individually for each person and creates their unique picture of the world. Depending on the dominant factor, all people are conditionally classified into three categories: visuals, audials, and kinesthetics.

Table 3 - Comparison of consumer categories within NLP theory

	Visited	Audiences.	Kinesthetics
Perception of the world	Images and drawings	Sounds.	Sensations and feelings
Marketing solution	The advertising message should consist of vivid images, storylines and drawings	Advertising should call to "hear" the product	The most difficult group of consumers for advertising influence, because you need to try to get up words that will help "feel" the image
Words that can be used in an advertising message	Emphasis on visualization: "Look at this." "Take a closer look." "see"	"Words that Sound": "quiet", "loud", "rustling", "intermittent", "shimmers", "calls", etc.	"Light", "strong", "hard", "soft", "gentle", "cold", etc.

Sensory marketing is based on an approach that takes into account the impact on the key human senses to stimulate sales. This type of marketing involves the use of both external and internal sensory systems. The external systems include olfactory, visual, auditory, tactile, gustatory, and temperature sensations, which provide perception of the environment and its phenomena. The internal systems, including interoceptive, proprioceptive, motor, and pain systems, are responsible for assessing and realizing changes within the body. These two groups of sensory systems are closely interconnected, forming a holistic view of the world around us.

The use of marketing tools to influence sensory systems allows companies to establish contact with consumers, creating lasting associative reactions. This concept was first proposed by Martin Lindstrom, who identified five key areas of influence: color (visual system), sound (auditory analyzers), smell (olfactory sensations), as well as touch and taste, which require active participation of the buyer. According to Lindstrom, the effective use of sensory marketing significantly increases sales. Table 4 shows some of the results of the studies conducted to illustrate this point.

Table 4 - Impact of sensor technologies on consumer behavior

A condition for the effectiveness of the tool	Percentage increase in readiness make a purchase
The purchase was accompanied by pleasant sounds	65%
Pleasant product taste/tasting	23%
Pleasant smell	40%
The product is pleasant to the touch	26%
The product is pleasant to look at	46%

Thus, with the right implementation of sensory marketing methods, a company can achieve sales growth of up to 200%. However, this requires a deep understanding of your customers, including their psychographic profile and both conscious and subconscious preferences.

Color is one of the most common sensory marketing tools. It is actively used in interior and product design to create a special atmosphere and provide a pleasant experience for customers. Scientific research has shown that color affects the psycho-emotional state of a person, appealing more to their feelings than to logic. In particular, colors can affect the perception of room temperature, weight, and distance of objects.

It has also been proven that the harmonious use of colors creates an attractive environment that fosters creativity, improves communication between people, and provides a sense of calm.

In addition, each color forms certain subconscious associations. For example, white is neutral and does not evoke negative emotions, while black is associated with alienation and closeness. Brown evokes a sense of naturalness, routine, and stability, which gives the interior or product a sense of reliability.

The psychology of color is an important element of neuromarketing, based on managing consumer behavior through the influence of color solutions.

AG Retailbranding conducted a study of consumer color perception, which identified four types of people depending on their life motivations: alpha, security, innovation, and sociality.

Taking into account the patterns of color perception by consumers and target market segments, leading international companies in various spheres of economic activity are actively introducing color identification into their corporate symbols (Table 1.8). Regarding the use of sounds as one of the sensory marketing tools, research has recently confirmed that any sound has a psychological impact and can shape human behavioral reactions. Sound semantics is a science that studies associations that arise in the mind under the influence of certain sound combinations. For example, studies have shown that low-frequency growling or grinding sounds evoke an instinctive sense of threat, even if a person does not understand the source or cause of these sounds.

High pitched sounds, unlike low ones, rarely evoke vivid associations, although sometimes they can be not very pleasant. Scientists conducted an interesting experiment in which participants were asked to color different letters of the alphabet. The surprise was that their choices were almost identical. This emphasizes the power of sound as a tool that is used quite effectively. Some companies actively implement this approach when creating their musical slogans or logos. The main goal of this approach is to establish an additional emotional connection with the consumer. As music is more memorable than text and expresses emotional tone more strongly, it is becoming an important element of branding. Audio marketing is a branch of

neuromarketing that studies the impact of sounds on consumer behavior. A person begins to encounter the interaction of sounds in the womb, forming a basic associative series that continues to develop throughout life. It is interesting that mothers usually address their children with emotional messages, while fathers use rational statements. Therefore, in audio advertising, emotional messages are often delivered by female voices, while rational messages are better conveyed by male voices. Choosing the right music in a retail space can affect sales. For example, in Carlo Pazolini salons, well-chosen music contributed to a 7% increase in sales. General recommendations for music are as follows: classical music of moderate tempo, close to the human heartbeat, is suitable for car dealerships; pop music with a tempo of 90-100 beats per minute is effective for clothing stores. Another area is aroma marketing, a strategy of using smells to influence customer behavior. This method is now gaining popularity among marketers and is used in a variety of areas: from confectioneries to furniture stores. It has been proven that smells can shape a person's emotional mood: they can relax or, on the contrary, stimulate. In , the scent can remain in the memory for a long time and evoke emotions upon repeated contact. On a subconscious level, smells are associated with specific situations or memories. The task of marketers is to determine what emotions a particular scent can evoke in a consumer, taking into account their personal experience. One solution is to use so-called universal scents, which evoke similar feelings in most people. However, in such cases, it is more about physiological reactions than psychology. According to Martin Lindstrom, for a brand to be successful, it must have its own unique smell. For example, Hugo Boss clothing stores use the scent of flowers, most often lilies. Leather goods stores often spray the scent of genuine leather.

Studies show that items with a pleasant scent can improve mood by 40%. For example, consumers are 10% more likely to buy shoes with a leather scent. Brands associated with a certain smell are better remembered and perceived by the audience. Nestle has run several advertising campaigns that flavored newspaper issues. Unique branded flavors are used by companies such as Bang & Olufsen, Holiday Inn, BMW, Honda, Opel, and British Airways. In the United States, major newspapers, including

USA Today and the Wall Street Journal, have decided to regularly place flavored advertising materials their pages. SPAR, BMW, British Airways, Opel and Honda have also set up special departments to develop unique flavors. The aromatization of sales areas has a positive impact on customer behavior: the time spent in the store increases by 16%, the willingness to make purchases by 15%, and the number of impulse purchases by 6% (Table 5).

Table 5 - Recommended flavors for different business areas

Business areas	Flavors
Furniture stores	Green tea, coconut cocktail, coffee with cakes, herbs Provence, fresh cut of Canadian spruce and sandalwood
Food retail	Fruit, citrus, fresh cucumbers, coffee, fresh pastries, vanilla
Cafes, fast food at shopping centers	Green apples, flavors that neutralize cigarette smoke, kitchen odors
Clothing stores and accessories	Vanilla, lavender, basil, mint, lemon, tobacco, sandalwood, leather
Travel agencies	Sun-warmed sand, exotic flowers, fruits, and complex seasonal compositions: "Summer Dream", "Ocean breeze with the scent of tropical fruits", "Aroma of leaves and hay", "Christmas seasonings"
Entertainment centers, game rooms, bowling alley	Floral smells of spring, "warm" smells of comfort in winter (the aroma of chocolate or vanilla), neutralizers of unpleasant odors
Specialized shops and boutiques	Mint, lemon, basil, lavender
Fitness center, sports center hall	Odor neutralizers, menthol, fresh grass

There are several main areas of aroma marketing:

- flavoring rooms with pure fragrances
- aroma design of interiors using mixed fragrances (compositions);
- professional selection of fragrance, taking into account the specifics of the business
- aroma cleaning, i.e. neutralization of unwanted odors;
- seasonal flavoring of the space;
- flavoring events;
- Aroma branding is the creation of an association between a scent and a specific brand or organization to identify products, as well as to emphasize the uniqueness of goods or services compared to competitors.

The main element of aroma branding is the development of an aroma type - a unique scent that becomes part of the corporate style and serves as a distinctive feature. In addition, sensory marketing involves tactile sensations as an important tool of influence. Physical contact with a product plays a crucial role in the buying process, helping to get a better idea of its characteristics, such as shape, material, texture, or temperature. It is the lack of the ability to touch and test a product that often causes online retailers to fail, especially when it comes clothing or accessories. It's important for customers to be able to feel the material or adjust the product to fit. It's worth noting that all of the above touch marketing tools can be used individually or in combination. As a result, any company can develop its own set of sensory technologies depending on the characteristics of its target audience and the properties of its product.

Neuromarketing is a new field of research that is still in its infancy. Its subject area is still somewhat controversial in its definitions. Modern marketing pays considerable attention to the study of consumer behavior and decision-making. The growing demand for this knowledge was stimulated by the development of neurotechnologies, which gave rise to the concepts of neuromarketing. This industry is a combination of theory and practice of influencing the subconscious mind of consumers. Neuromarketing technologies are focused on stimulating sales growth by influencing the senses of customers with positive stimuli (smell, sound, color, touch). All these stimuli contribute to the effective promotion of goods. Nevertheless, the use of neuromarketing technologies requires taking into account the social and ethical aspects of the activity. Thanks to the knowledge of the neurophysiology of emotional and cortical reactions of consumers, marketers are able to design more effective campaigns. So, neuromarketing is an interdisciplinary field that uses neurotechnologies and is based on such fields of knowledge as neuroscience, psychology, cognitive science, clinical medicine, and social sciences. Its methodology is based on psychological research, experiments, and statistics. Neuromarketing analyzes brain activity and changes in consumers' emotional reactions when making decisions and forming preferences for brands and products. It also allows to identify subconscious

behavioral patterns and individual consumption habits based on the collected experimental data.

Analysis of neuromarketing research on the elements of the marketing mix: product, price, sales channel The product is the key element of the marketing mix, the main object of consumer choice and purchase decision. From the perspective of customer relations, the perception and evaluation of a product, its functionality, design, quality, etc. cannot be considered separately from other components, such as price or brand. Nevertheless, neuromarketing research allows us to identify certain factors and algorithms that influence the process of product perception and evaluation. The product as an element of the marketing mix became the focus of one of the first neuromarketing experiments. A group of scientists from Princeton University used functional magnetic resonance imaging (fMRI) to study the neural processes involved in the perception of taste of two popular drinks: Pepsi-Cola and Coca-Cola. Despite their similar flavor, the drinks represent different brands, and scientists have suggested that brand perception may influence the evaluation of a drink's taste. In marketing, the so-called "Pepsi Paradox" has long been known, which means that consumers prefer the taste of Pepsi Cola to Coca-Cola in blind tests. However, if they are provided with information about the brands, most participants begin to consider Coca-Cola tastier and choose it. As part of the experiment, each participant also indicated their personal preferences (explicit preferences). The tests were conducted outside and inside the fMRI scanner. In the latter case, a time delay was added to the procedure between the display of information about the drink (anonymous or branded) and the delivery of the drink itself through a special system. This approach ensured a more accurate distinction between the neural mediation of brand information processing and activity related exclusively to taste effects. The results of the experiment partially confirmed the Pepsi Paradox. It turned out that there was no significant difference in the group results regarding the perception of the taste of drinks in the blind test. Moreover, the behavioral preferences (i.e., the actual choices of drinks in the blind test) did not coincide with the explicit statements of the participants. The actual decision to choose between Pepsi and Coca-Cola turned out to be closely related to the activity of the ventromedial prefrontal cortex (vmPFC).

From a marketing point of view, this means that neural processes in this area can reflect the true taste preferences of individuals, opening up prospects for improved methods of predicting consumer preferences independent of conscious verbal statements. An experiment by American scientists has clearly demonstrated the mechanism of influence of a more successful brand on the perception of the product's taste characteristics. Despite the possible limitations of this study, the results indicate that a brand can not only influence the purchase decision but also change the process of perception of the product during its consumption.

The practical conclusion is that a strategy focused exclusively on creating a quality product, with an emphasis on satisfying consumer demands, may not always correlate with the actual mechanisms of product evaluation. Having a strong brand is not only a communication tool, but also a lever to increase the perceived quality of the product in the eyes of the consumer.

Experiments conducted with popular beverages became the basis for the development of neuromarketing as an empirical discipline and identified one of the most successful areas of its use. The most striking results are observed in the food sector, due to their biological nature. Taste, as the main marketing attribute of food, is the result of neurocognitive processes.

Research into neurophysiological reactions provides a deeper understanding of how taste is perceived, helping to identify hidden consumer preferences and provide new approaches to product development.

In recent years, a number of studies have been conducted to investigate the neurophysiological aspects of food consumption. One of the focuses has been the study of the nervous system's reactions to various odors and tastes, both pleasant and unpleasant. This allowed us to identify certain neural markers of taste perception that can be used in the development of new products. It was also found that the emotions associated with specific flavors are similar both during their direct consumption and when recalling them. Such data indicate that it is possible to use past experience to create emotional states. For example, Dutch scientists measured skin conductivity at different stages of the consumption process and found that the lowest values are

observed during visual contact with the product; they increase with the appearance of olfactory and gustatory stimuli.

Spanish researchers analyzed the nervous system's reactions to various stimuli during a gastronomic experience in restaurants. In addition to the taste characteristics of dishes, contextual factors were also taken into account: the presence of staff, table setting, and cutlery design. Several methods were used for such studies: measuring skin conductivity to assess emotional reactions, EEG to analyze brain activity, i-tracking to study the dynamics of visual attention, as well as traditional approaches. The analysis confirmed that gastronomic experience is a multilayered phenomenon. The taste of food is only a part of the overall consumer satisfaction: for example, the presence of a chef causes a positive resonance and is remembered for a longer time. At the same time, the effects of serving are manifested mainly at the initial stage of interaction and slowly lose influence over the course of the subsequent stay.

Italian experts have identified four neuromarketing techniques that have proven to be most effective in the food and beverage industry. Within the product component of the marketing mix, several scenarios of their successful application have already been identified, which demonstrate significant potential for further development (Table 6).

While the use of product neuromarketing strategies in the food industry has shown the best results, new research approaches have also proven useful for other product categories. The focus has been on design and packaging as critical factors that influence consumer perceptions and purchase decisions.

The special role of packaging is due to its significance in retail sales, which are still the main distribution channel. Packaging is the first point of contact between the consumer and the product, initiating physical interaction and engaging several sensory channels. However, a full understanding of the mechanisms of this interaction is still partly a "white spot" for many marketers. The use of neurophysiological research methods can help fill this gap in both theory and practice.

**Table 6 - The most effective neuromarketing methods for food and
beverages (product component)**

Method.	Potential scope of application (marketing tasks)
Ai-tracking	Remote and non-invasive tracking of customer interest in a product in real conditions. Evaluation of the impact of various packaging and design elements and product information on attention and interest in the product, purchase decisions, and perceived product quality and taste, and customer satisfaction.
ECG	Assessment of emotional reaction to a product with high temporal resolution. A special index of frontal asymmetry of alpha rhythm (FAA) is effectively used to assess the attractiveness of a product, especially its flavor, and even basic behavioral "approach-avoidance" tendencies
Electrical conductivity skin	A portable way to assess the emotional reaction of the consumer
Recognition facial expressions	Remote identification of emotions during perception or consumption of the product

One of the fMRI studies conducted by M. Stoll and his team demonstrated that packaging with positive and negative appeal triggered different activity in the nervous system associated with positive and negative emotions, respectively. In particular, attractive packaging stimulated the activity of those parts of the brain responsible for attention and the reward system. In contrast, unattractive packaging activated areas associated with avoidance reactions.

In another study, neuromarketers found that aesthetically pleasing packaging significantly lengthens consumer decision-making time and increases the likelihood of choosing such a product, even compared to a more affordable product in standard packaging from a familiar brand.

To date, existing research confirms the potential value of neuromarketing for improving the product component of the marketing mix and increasing its effectiveness. The greatest consensus has been reached on its role in studying and evaluating consumers' emotional and subconscious reactions to both the product itself and its extended elements, such as packaging, information support, brand, or point-of-sale atmosphere. Unlike traditional approaches, neuromarketing allows for a more

accurate and differentiated analysis of the impact of various product components and packaging on consumers' emotional perception and their approach or avoidance behavior.

The practical significance of such knowledge is obvious: a detailed understanding of the process of product perception allows for the improvement of the product to ensure maximum appeal. In addition, the capabilities of this approach can be further enhanced by taking into account differences in product perception among different consumer groups.

The price component in the marketing mix is one of the most convenient elements for neuromarketing research. Price is a universal quantitative variable that has a clear meaning for both buyers and sellers, making it easy to interpret. Thanks to the price, products can be easily compared with each other, which is why it is actively used in experimental studies of behavioral economics to study decision-making mechanisms. Neuromarketing tools allow you to analyze in detail the reaction of consumers to the price of a product and its impact on the purchase decision-making process.

Research shows that price not only acts as an element of calculating benefits and costs in the decision-making process, but also directly affects the structure of these mechanisms, so it cannot be considered an independent or unchanging factor. While in traditional economic theory money is a universal means of measurement (an interval value), this statement is not always true in the context of subjective perception of value. The subjective value of a price often depends on numerous contextual and even individual factors.

Today, the potential of neuromarketing in the study of the price component is only partially utilized. The research work conducted contributes to a better understanding of the fundamental mechanisms of price perception, its impact on the subjective value of goods and the formation of willingness to buy. However, the applied use of neuromarketing approaches in the pricing of a specific product is still more of a prospect. The main limitations are the methodological and practical difficulties associated with the use of tools such as fMRI (functional magnetic

resonance imaging), which is currently considered the most valuable source of data on the subjective assessment of the value of a product. In the short term, neuromarketing is unlikely to compete with other methods of pricing optimization, such as big data analytics.

As for the choice of channels and sales outlets, the marketing tools in this component have limited potential for using neuromarketing approaches. Many tasks, such as organizing a distribution network or optimizing logistics, are loosely related to the psychological aspects of consumer behavior and are more effectively solved by traditional methods. At the same time, in some cases, neuromarketing can offer interesting solutions.

The most promising area of neuromarketing application in this aspect of the mix is the organization of physical space and the design of points of sale - places where consumers have direct contact with a product or seller. In such circumstances, neuromarketing technologies can provide a number of advantages over traditional approaches:

1. The impact on the consumer at the point of sale is multisensory and mostly indirect. In the physical space of a store, showroom, or shopping center, a customer is exposed to numerous factors that shape their perception of the space itself, as well as of individual products or product categories.

2. Interaction with the consumer at the point of sale is time-consuming, actually covering the entire period of the customer's stay in the sales area. This process can be viewed as ongoing communication, and the task of the seller is to ensure its optimization. This involves taking into account the amount and content of information, as well as the effective and timely use of feedback. For example, prompt detection of negative reactions of visitors to certain aspects of design or work organization (fatigue, information overload, staff intrusiveness, insufficient space, etc.) can serve as an important signal not only for strategic changes but also for immediate adjustments during the visit.

Among the most promising neuromarketing tools for optimizing points of sale are remote technologies for analyzing consumer attention and emotional reactions. The

main role here is played by i-tracking and biometrics systems, in particular, technologies for recognizing emotions by facial expressions.

One of the few experimental studies in this area was conducted by a Slovakian-Taiwanese interdisciplinary team that examined the impact of lighting on consumer behavior. In a laboratory setting, researchers at used electrocardiography (ECG) and i-tracking to analyze the impact of different lighting parameters and color schemes on consumer preferences for fresh fruits and vegetables. The study confirmed the significant dependence of automatic emotional reactions on lighting: warm colors of halogen lamps caused the maximum emotional response, while the cold light of LED lamps caused the minimum. At the same time, the correction for color temperature indicated that LED lamps evoked the most positive emotions. Thanks to their energy efficiency and design variability, they have a high potential for use in lighting retail spaces. Experiments with atypical color schemes for illuminating fruits and vegetables showed interesting results: for example, magenta evoked more positive reactions than yellow, red or green, which may be due to increased attention of customers.

Overall, the experiment not only confirmed the significant impact of lighting parameters on the emotional state of visitors, but also demonstrated the benefits of neuromarketing methods for choosing optimal design solutions that create a positive atmosphere at the point of sale.

Another interesting example is the study by Taiwanese marketers L. Hsu and Y. Chen, which examined music priming as a factor influencing choice at the point of sale. Using ECG, they investigated how different music genres change the perception of tasted wine. Participants were offered to taste two types of wine - French and Spanish - of the same price category. During the first stage, they chose without external factors of influence, but before the second stage, priming was activated: French or Spanish music was played. The results showed that the music influenced the change of choice: after the French melodies, participants switched to French wine more often.

It is important to note that different music genres have different effects on the activity of certain brain structures, including the γ rhythm, which plays a key role in attention and memory processes. One possible explanation is that Spanish songs during

the experiment contributed to a greater activation of the γ rhythm, thereby increasing the participants' concentration. French chanson, on the contrary, had a relaxing effect, increasing subconscious sensitivity to priming.

Music, like the level of lighting or other elements of the retail space organization, are contextual factors that can be relatively easily modified. Data from neuromarketing research shows the significant potential of such tools to influence customer preferences and manage demand at points of sale. The prospects for dynamic adaptation of the retail environment to specific situations, for example, when it is necessary to stimulate demand for certain categories of goods, look particularly interesting.

In addition to optimizing merchandising and other marketing aspects in physical retail outlets, neuromarketing shows significant potential in e-commerce. Although traditional sales channels still dominate the retail industry, e-commerce is gradually increasing its market share. This growth accelerated under the influence of the global COVID-19 pandemic in 2020, as well as the war in Ukraine, which has been going on since February 2022.

E-commerce opens up great opportunities for customizing customer experience and personalizing the interface to meet individual consumer needs. Thanks to the powerful analytical tools of digital technologies, such personalization can significantly increase sales efficiency even without the use of complex neuroimaging methods. Digital analytics allows you to study real consumer buying behavior with less time and resources compared to neuromarketing research tools.