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## NEUROMARKETING RESEARCH: ETHICS, PROCEDURES AND PERCEPTIONS OF PARTIES INVOLVED

*Through the present article neuromarketing as a research method is discussed, starting from definitions, to instruments available, ending with an analysis of the ethical issue of the field. The novelty of the study is that perceptions and experiences of neuromarketing practitioners are presented, therefore contributing to the knowledge creation regarding this type of marketing research.*

**Key words:** neuromarketing; neuromarketing ethics; research sample.

### Introduction

As one of the main components of business management, marketing seeks to create profitable and satisfactory relationships between consumers and businesses, therefore studying and correctly managing exchange relationships. Even if sometimes the marketing is viewed as an evil an evil activity, the core of the marketing process should be meeting the needs of consumers in the most satisfactory way possible, thus paring up the right providers with the right consumers. The marketing theoreticians and practitioners may seem to be so close to decoding consumer behavior, yet so many aspects are still unknown, hard to measure and influence. While traditional marketing research and consumer research methods can analyze the expressed or proved perceptions, preferences and behaviors, the mind of the consumer and the processing leading to this behavior remain unknown. Keeping in mind the marketing objective of satisfying consumers, neuromarketing research appears to be the ace up the sleeve of marketers, enabling them to get a step closer to fulfilling this objective by studying the cognitive and affective response of consumers to marketing stimuli and therefore becoming able to improve their activity.

Through this paper, a summary of the neuromarketing concept and techniques is made, a larger part of the discussion landing in the field of ethical concerns of neuromarketing. How and how deep can we or should we go in analyzing the mind of the consumer? What is ethical and what is not? But most important, how can we take advantage of this interesting research method without causing any harm but rather increase the quality of life? These are the questions that the theoretical part of this paper seeks to give an answer to. In terms of novelty, the research presented in the present paper, seeks to contribute to increasing the knowledge about neuromarketing research by presenting the perception and experiences of neuromarketing practitioners, information provided by them within a survey.

### Literature Review

#### Neuromarketing – a revolutionary research method

Lee et al. [1, p. 200] define neuromarketing as "the application of neuroscientific methods to analyze and understand human behavior in relation to markets and marketing exchanges". Through this definition, Lee underlines that neuromarketing is not only a tool used for the commercial interest of companies, but also to understand

the role and activity of the consumer in the market and his relationship with other actors of the exchange processes. Also, even if the focus is on the consumer, neuromarketing can also provide – through the study of the consumer-valuable information regarding inter-organizational relationships and propose way to improve these collaborations so that the overall social impact increases.

If we refer to the origin of the term neuromarketing, we can say that this is a notion with more than one father. Some [2] [3] assign the role of neuromarketing "inventor" to professor Ale Smidts who, in 2002, described this activity as: "The goal of neuromarketing is to better understand the customer and her response to marketing stimuli, by directly measuring the processes in the brain and involving them in theory development and stimulation development. Although the greatest emphasis is on better understanding of the customer through theory building, it should ultimately also assist the manager in designing more effective marketing incentives. In short, neuromarketing focuses on increasing the effectiveness of marketing activities by studying brain responses." [4, p.29]. The Economists [5] name Jerry Zaltman as the first to combine neuro-imagining techniques with marketing, a relationship that seems to have started in the 90s and which is constantly evolving. Based on Zaltman's incipient work, in 2001, BrightHouse was the first marketing consultancy company to create marketing strategies based on information obtained through brain scans of consumer preferences and decision making process. What is sure is that starting the late 90s, many theoreticians and practitioners contributed to the construction of this relatively new research method through their work.

As neuromarketing studies the cognitive, emotional and affective response of consumers to marketing stimuli, valuable results can be obtained through the application of different technologies and use of instruments. Calvert and Thensen [6] divide neuroimaging techniques in (1) haemodynamic/metabolic measures and (2) electrical/magnetic measures. The first category includes functional magnetic resonance imaging (fMRI) and positron emission tomography (PET), while the second one includes electroencephalography (EEG) and magnetoencephalography (MEG). To these two categories we can add the techniques that do not measure brain activity but measure the reaction of the body or mind to marketing stimuli, such as eye tracking, galvanic skin response, implicit association test or facial coding analysis. The most frequently used techniques are fMRI, which uses magnetic waves to study the activation of different areas in the brain during the presence of the marketing stimulus [7], the eye tracker, which studies the movement, position and scan paths of the eye of the consumer while looking at a visual marketing stimulus [8] [9], and the EEG, which analyses the amplitude of brain waves corresponding to different states and emotions of the consumer [10].

#### Neuromarketing ethics

The value of neuromarketing as a method of consumer research is undeniable. However, one of the first questions that comes up when discussing neuromarketing is whether or not the use of these research techniques is ethical, whether neuromarketing can promote and induce the need for harmful products, or whether minority groups such as children or the elderly can be manipulated [11]. The answer to this question may come from consumers, companies that can use this method or even from researchers, but none of these categories of people who are involved in the neuromarketing research process seem to have a clear opinion regarding the ethics of neuromarketing research.

The term "ethics" has several meanings. Usually, ethics refers to a set of values and moral principles that are

intended to guide ethical behavior. A code of ethics represents the application of ethical principles and values, which are set out in the ethical behavioral standards. An ethical code organizes within an accessible framework the expectations of a society regarding ethical behavior in all aspects of a discipline [12]. Regarding marketing ethics, we can define it as that set of moral standards, judgments and codes applied in the field of marketing [13]. Kant's conceptions of ethics [14] are utilitarian and deontological, based on reason, intention and duty. According to him, duties cannot be associated with an entity own interest and expressed in financial rewards. Thus, the social cause is essential in the behavior of economic entities, companies having a moral obligation to create benefits for the people.

Before discussing the ethics of neuromarketing, we must mention the broad field of neuroethics which works with concepts of ethics, legislation and social aspects derived from neuroscientific research [15]. As part of neuroethics, neuromarketing ethics aims to implement consumer research by analyzing brain activity and body reactions without harming and solely for the benefit of the consumer.

The issue of ethics in neuromarketing is an extended discussion, with several theorists pointing out possible problems and solutions for an ethical implementation of neuromarketing research. Ariely and Berns [16] present some of the ethical dilemmas that may arise in the field of neuromarketing research.

- How much information can be found on the subject's thoughts and preferences by applying neuromarketing techniques? Is it possible to find information about how the consumer thinks about aspects not related to the study?
- Behavior and preferences should be private and expressed by consumers on a voluntary basis. How exposed will a person be if he or she agrees to take part in a neuromarketing study? Is there a limit regarding information that can be accessed?
- By analyzing the direct reaction of the body and brain to the marketing stimulus, the researchers will then be able to market the products and services directly to the brain, passing on the analytical consciousness of the consumer. Is this true? Is it in the consumer's interest?
- The analysis of the brain and the influence of the marketing stimuli is performed both at the central level, area responsible for creating preferences based on the functional attributes (taste, quantity, calories, etc.) and at the peripheral level of the brain, the area in which the preferences are created based on secondary attributes (social position, association with the characters in the ads etc.). The results obtained through analyzing the first brain area can be used at transmitting a functional benefit to the brain, while trying to influence the peripheral level of the brain is often considered manipulative;
- The use of neuromarketing techniques can lead to negative perceptions. Even if a product or service is right for the consumer, will he not have the reluctance to choose it when he finds out that the packaging or advertisements he sees were created based on neural research? Will he not deny the benefit he can get by purchasing the product / service considering it is actually manipulated?

The main ethical issues of the field do not arise in terms of the information obtained through the application of neuromarketing techniques, but the way in which this information can later be used. By using data obtained through neuromarketing techniques, marketing managers can customize marketing stimuli to influence consumers' cognitive and affective neural processes. Thus, the ethical problem arises when consumers are not motivated to buy after analyzing information about the benefits of the product or service, but as a result of a marketing manipulation

through which positive emotions, attitudes and perceptions are created without content [17]. Murphy [18] and Madan [19] argue that neuromarketing techniques can contribute to understanding consumer behavior but are not sufficient or advanced enough to predict or induce by manipulation complex consumption behavior; this is determined by far too many elements independent of marketers. However, intensive technology could offer the option of studying consumer behavior in real commercial environments, without having to bring him or her into a laboratory; the evolution of artificial intelligence and the decrease of implementation costs may be able to lead to the study of consumer reactions in a store through the surveillance cameras. How will these actions be implemented in an ethical manner? The future will tell.

Since the ethics of the neuromarketing research process depends on the conduct of the researchers, it is important to analyze their position in relation to ethical issues but also the measures and procedures that they implement in order to deliver qualitative and beneficial results. The perception regarding neuromarketing ethics among professionals in the field, theorists and neurologists has been repeatedly discussed. Eser et al. [20] conducted a study on a sample of 111 marketing teachers, 52 neurologists and 56 marketing professionals seeking to determine the extent to which neuromarketing research is evaluated as being ethical. All respondents agreed that neuromarketing is not a manipulative practice of selling unwanted products and services.

Pop et al. [21] carry out a research on the level of interest that neuromarketing companies have in relation to the ethics of the domain, the ethical problems they face and the measures proposed to solve them. Based on the analysis of the responses of 67 neuromarketing practitioners, the article presents the following interesting results.

- Comparing the level of importance given to the neuromarketing ethics by the clients of this type of research services (companies) and the subjects of the studies carried out, it was proved that neither of the two studied groups are worried and do not consider neuromarketing as being unethical; while client companies are generally interested in understanding the principles underlying neuromarketing research, the subjects involved are interested in the purpose, methods and results that neuromarketing can provide;

- Most neuromarketing specialists argue that there are no cases (or very rare) where subjects become anxious because of the procedures needed to be followed in neuromarketing studies; in order to reduce the risk of negative conditions, some researchers include medical analyzes performed by specialists in their research protocol;

- Regarding the extent to which neuromarketing companies solve ethical problems by outsourcing them to ethics experts, 80% of the respondents said that they do not use these services, only 20% of them resorting to external experts; sometimes, neuromarketing practitioners call on members of the Neuromarketing Science and Business Association (NMSBA) or consult with sociologists and psychologists to improve or guarantee compliance with the procedures ethics;

- Analyzing the extent to which neuromarketing companies adhere to and are guided in their practice by the NSBA's code of ethics of neuromarketing, most respondents stated that they strictly adhere to these ethical regulations, often adding to this a set of national or even company specific rules and regulations.

Flores et al. [22] wanted to find out consumers' perception regarding the ethics of neuromarketing research and how it differs depending on the profile of the company that uses this type of research. The study analyzed the

position of consumers (324 people) regarding two companies using neuromarketing research: one profit-oriented company that aimed to increase beer sales and a second, non-profit organization, aimed at reducing alcohol consumption. Although by neuromarketing research we refer to the study of consumers' cognitive and emotional responses to marketing stimuli, regardless of the research objectives, the perception of the respondents towards the two companies differed significantly. Thus, the perception towards the profit-oriented company that uses neuromarketing is negative, immoral and unethical, the choice to give up this type of research being considered an ethical measure. In contrast, in the case of the non-profit company, the use of neuromarketing techniques is considered ethical, the option of not using these techniques being considered unethical. In relative terms, consumers considered the use of neuromarketing research in the case of the profit-oriented company to be more ethical than the lack of these techniques in the non-profit company. As a result, consumers recognize the value of neuromarketing research in maximizing results in company -customer relationship but tend to consider them beneficial only in the context where their contribution is social and not for the profit of the company.

Consequently, an alternative in ensuring an ethical practice of neuromarketing is to apply this research method to the benefit of the consumer, assuring consumers that this possible manipulation is achieved only in a positive sense, to increase the level of education, induce a healthy life style or reducing harmful consumption and behaviors [23].

There is wide range of neuromarketing research showing how the use of these techniques can be of great benefit for the society at large. Hamelina et al. [24] used facial emotion recognition software to analyze the reaction of subjects to low and high emotional content of advertising promoting safe driving. By correlating the obtained results with the expressed perceptions of the subjects and by re-testing the effect after a two-week period, the study showed that high emotional advertising impacts people on a longer term, thus inducing safer driving. Another study [25] showed how using Functional Magnetic Resonance Imaging (fMRI) to analyze subjects' reaction to an anti-smoking campaign can predict the result of the same campaign applied to a larger population. A study presented by the NMSBA [26] shows how neuromarketing research can prevent an unwanted outcome of social campaigns. The study analyzes by fMRI technique the reaction of 24 subjects to a video that presents people drowning, these images being a metaphoric representation of young people with mental health issues facing their situation. By analyzing the results it can be concluded that the lack of involvement, the strong activation of memory and the significantly negative emotions generated by watching the video, contribute to increasing the stigmatization of young people with mental health problems, rather than reducing them, which is extremely worrying. Without the possibility of testing this video, the non-profit organization that created it, risked obtaining a negative response, aggravating a social problem that they were trying to alleviate. Smokefreebrain [27] is project supported by the European Union through the Horizon 2020 program, which aims to analyze the brain reaction of smokers when they receive messages from social campaigns which encourage them to quit smoking. The ultimate goal of such a study is to better understand the effects of the elements contained in an anti-smoking message, so that the final result, the communication that will be funded by the EU, will be one with the most positive impact. In terms of food safety and healthy eating habits inducement, Koenigstorfer et al. [28] study the impact of

information on food labels in the purchase of healthy products. Using the eye tracking device, the researchers note that the use of a consistent system of labels by which the nutritional content and ingredients are clearly specified, combined with the application of semaphore colors system (green, yellow and red, depending on the amount of ingredients such as salts, sugars, fats) may increase the likelihood of taking healthy eating decisions.

Hansel et al. [29] present the 5 dimensions of ethics proposed by Murphy to be pursued and respected in neuromarketing practice: (1) protecting subjects involved in neuromarketing studies, (2) protecting market segments that may be vulnerable to exploitation, (3) clear and transparent statement of the objectives, risks and benefits of each marketing research, (4) fair representation of the methods and results in the media and (5) ensuring the internal and external validity of the data. Starting from these five basic directions, in order to prevent ethical problems, the Neuromarketing Science and Business Association has developed the code of ethics of neuromarketing activity [30] that all members of the association must follow in their activity.

Among the ethical regulations implemented by NMSBA through this code, the following principles define the basic framework of the ethics of neuromarketing research. Regarding the integrity of the neuromarketing activity, researchers are required to notify subjects about the subject of the research, the procedure to be performed and to assure them that their participation in the study does not pose any danger. Following the detailed information provision, the subjects of the neuromarketing studies must give their consent to participate in the study, after this stage being free to withdraw from the study at any time they wish. The process of neuromarketing research must be transparent; the clients of these services need to be informed about how the data is obtained and its usefulness. With regard to subjects' personal data, this must be kept confidential, not even the client of the study being able to receive information about the subjects without their consent; the data obtained cannot be used for any purpose other than that for which the subjects gave their consent. Neuromarketing studies with minor subjects can only be performed with the consent of their parents.

Adjacent to ensuring the ethics of neuromarketing by adhering to the NMSBA code of ethics, we can name several parties that, through their activity, can contribute to increasing transparency and confidence in neuromarketing as a research method, while promoting a positive perception towards this field. These actors are scientists, neuromarketers, practitioners, market research service providers, communication agencies and journalists [31]. In a period when information represents power but also when fake news can be very easily created and disseminated, it is the duty of the knowledgeable people to contribute to increasing the awareness of marketing research, objectively presenting the opportunities and limitations of this research method. Thus, this desideratum can be fulfilled through scientific publications, public workshops and demonstrations, interviews with experienced persons, participation in conferences and public events or by the use of social media.

### Methodology

Neuromarketing research always involves people, because their behavior, perceptions and attitudes are studied by using the specific techniques. This is why, in order to understand the process of neuromarketing research, it is vital to find out how practitioners establish the research samples, how they interact with companies which can benefit of this type of research and with subjects and how they approach the ethical issue that might arise.

In the preliminary phase of the research, the scope, objectives and hypothesis of the research were established. The purpose of the research is to provide a detailed description of the neuromarketing practitioners' activity and the way they interact with the subjects, by analyzing the perception of neuromarketing service providers.

Derived from the research purpose, 6 research objectives were established. The present paper will present the findings and conclusions of three objectives, the other 3 being discussed in a paper published before [32].

- Objective 1 – determining the specificity of the sample in case of neuromarketing research;
  - ✓ Hypothesis H1: the sample for neuromarketing studies varies according to the applied technique.
- Objective 2 – identifying ethical issues that neuromarketing service providers encounter;
  - ✓ Hypothesis H2: neuromarketing practitioners encounter different ethical issues during the researches they conduct.
- Objective 3 – identifying the attitude of the beneficiary companies and the attitude of subjects participating in neuromarketing research, from the point of view of the neuromarketing specialists.
  - ✓ Hypothesis H3.1: The attitude of the companies benefiting from neuromarketing services is a positive one;
  - ✓ Hypothesis H3.2: The attitude of the participants in neuromarketing studies is a negative, reluctant one.

The sources of information, the means to obtain them, an evaluation of the existing data and a schedule of the proposed research were made during the design phase of the research. Thus, the information was obtained from external sources, namely neuromarketing practitioners from different countries. The study is based on primary information, obtained through the survey method, the questionnaire being the used data collection instrument. The information was provided by individuals free of charge, the members of the sample being randomly selected. The actual data collection was done by direct field research during 12.02.2018–20.03.2018.

The present research is an exploratory one; therefore, the size of the sample was not determined by calculation and is not statistically representative.

The questionnaire was designed in English on the online "Free Online Surveys" platform and was distributed by e-mail to 220 neuromarketing practitioners from all over the world. Out of the 220 persons targeted, 10 persons fully completed the questionnaire (4.5%). The respondents are neuromarketing practitioners working in France, Croatia, Poland, Austria, Belgium, Finland, Central America, USA, Brazil, China, New Zealand, Australia, Chile and Mexico. In terms of demographics, the respondents are aged 16 to 65, 2 are female and 8 males.

In the following part the topic, responses and interpretation of the neuromarketing specialists' perceptions will be discussed for each of the three objectives.

### Results

#### Objective 1 – determining the specificity of the sample in case of neuromarketing research

In order to correctly manage a neuromarketing study, first a correct sample for the research needs to be established. When asked about this topic, neuromarketing practitioners seem to have different opinions.

Most specialists claim that 30-40 respondents would form the ideal sample. Other respondents limit the sample to 20 respondents or differentiate the sample size according to the technique used: for eye tracking – 25 people, for implicit associations test – 50 people, for face coding analysis – 25 people, for electroencephalography (EEG) – 40 people. It is true that there is no rule in the calculation of

the sample size and that, often, this aspect will depend on the marketing stimulus studied, the homogeneity of the population and the researcher's previous knowledge regarding the behavior of the studied population.

An important clarification made by one of the respondents refers to the accuracy of the data obtained through neuromarketing techniques. It is important to remember that this method must be applied correctly, on sufficiently large samples and that the results must always be transparent and correctly extracted from the data obtained, not analyzed subjectively according to the researcher's own hypotheses.

Regarding the limitations in sampling, practitioners say that generally, if the subjects are related to the topic of research, there are no limitations in creating the sample for neuromarketing research, or no more than those known in traditional research. Although one of the respondents stated that he refuses to conduct research with minor subjects, the main problem that could exclude a subject from a study would be if he or she had injuries or any kind of brain problems.

It is also interesting to know what the drop-out percentage is in the case of neuromarketing studies. The responses provided by the specialists based on their experience vary from country to country: Costa Rica: under 1%, Chile: approx. 5%, Finland: under 5%, Mexico: under 2%, Belgium: under 10%, Poland: under 3%.

A common suggestion coming from the neuromarketing practitioners is that it is always recommended to over-sample; because neuromarketing research usually implies the use of medical or technical apparatus, you never know when information might be lost or even not recorded properly.

Finally, the respondents talked about how they ensure compatibility between the members of the sample and the research topic. Most of the respondents said that they mainly use stratified sampling. Others said that they have a guide for each research, with scanning questions that they apply to potential respondents before the start of the study but that in general, only people who are related to the product / service (consumer vs. non-consumer) are taken into account when creating the sample. Another specialist revealed that in his company, the sample, in terms of subjects' profile, is established by the company that requests the neuromarketing research and that the neuromarketing specialist only attracts that type of people in the study.

Based on the information presented above, **hypothesis H1 is confirmed**, the sample for neuromarketing studies varying according to the applied technique

**Objective 2 – identifying ethical issues that neuromarketing service providers encounter;**

Ethical issues are always sensitive and need to be treated with care, especially when talking about neuromarketing research, where technology interacts directly with the subject and where there is a fear of intrusion into the personal (physical and mental) space of the subject. Thus, we wanted to find out what are the ethical principles that practitioners consider in the process of neuromarketing research. Some aspects that the specialists mentioned as rules of ethical conduct are:

- Ensuring the veracity of the data, not modifying it, respecting the client's requirements and needs;
- Clearly state the responsibilities, rights, obligations of the parties;
- Any member of the sample may quit at any time of the study;
- Data analysis is performed as group of data and not correlated with personal data;
- Compliance with the ESOMAR and NMSBA code;

- Obtaining the participation agreement from each subject, following a clear and complete information;
- Data confidentiality;
- Refusal to carry out research for products that are harmful to the population;
- Refusal to carry out research on alcoholic products or for the armaments industry;
- Conducting research for NGOs at real costs.

When asked if they faced ethical problems in their work and if so, to detail them, the neuromarketing practitioners said that generally they do not face ethical issues. It may happen that sometimes, as soon as the consent form is signed by the subjects, some of the respondents get frightened at the sight of the equipment and decide to withdraw. An ethical issue that raises questions in the community of neuromarketing specialists is how the researcher should address the issue with the subject when, by analyzing the brain, they discover a medical problem in the subject's brain.

In terms of ethics of research method itself, one respondent says that this method can be manipulative only when it is used incorrectly. Neuromarketing does not allow "mind reading" but allows the researcher to understand the consumer's cognitive responses, thus not intruding in his or her personal life.

Based on the information provided by the respondents, **hypothesis H2 is not valid**, neuromarketing practitioners rarely having ethical issues during the researches they conduct.

**Objective 3 – identifying the attitude of the beneficiary companies and subjects participating in neuromarketing research, from the point of view of the neuromarketing specialists**

When talking about neuromarketing research we can consider three parties involved: the practitioners (research suppliers), the company – clients (research demanders) and the subjects (research object or mean). Previously we have talked about practitioners' perception about neuromarketing research; now, we will analyze how practitioners evaluate the attitude of company-clients and subjects, the other two actors of the neuromarketing research process, regarding this type of activity.

Given the relatively new nature of the neuromarketing field, it is not surprising that companies' attitudes toward neuromarketing as a relevant research technique vary. In some markets, companies are still ignorant and distrustful of neuromarketing services, especially due to lack of information and insecurity about the data this method can provide. However, most respondents argue that the situation is improving, companies being often open to find out more about this method, even getting to appreciate the results (not necessarily the method).

One respondent says that there are companies at both extremes of attitude, but the vast majority wants the researcher to explain them in a simple and very clear language what neuromarketing implies, how it is used and what results it can generate. In general, companies, although curious, are still divided: "some love neuromarketing, others would not approach it!"

If the attitude of the companies towards neuromarketing as a research method generates the demand towards these services, the attitude of the respondents is important in terms of their interaction with the equipment and with the specialists. Surprisingly, from the answers of the specialists the general attitude of the participants in neuromarketing studies is favorable, as they are curious, enthusiastic and interested in the methodology. Although sometimes there is little hesitation, the respondents are cooperative, especially after they are explained the whole procedure and concept.

Some participants are initially curious, but not quite relaxed, and the mission of the researchers is to make them feel comfortable in order to have a good data collection process. One respondent said that most subjects find the procedures fascinating, often taking pictures during the study or wanting to find out if their brain is okay.

By analyzing practitioners' perception about the attitude of parties involved in neuromarketing research process, it can be concluded that **hypothesis H3.2 is invalid**, subjects having a positive attitude towards neuromarketing research, while **hypothesis H3.1 cannot be either confirmed or infirmed**, as the attitude of companies who can benefit of neuromarketing research is not a consistent one.

### Conclusion & Discussion

The theoretical part of the article presents the concept of neuromarketing and its component techniques but also the ethical aspects of conducting neuromarketing research. We see that using equipment such as fMRI, EEG or eye trackers in order to study consumer behavior can generate many questions and insecurities regarding the privacy violation and possible manipulation of consumers. In order to overcome these fears, solutions such as the implementation of the NMSBA codes of ethics, the application and promotion of neuromarketing research for social benefits and increasing awareness about what neuromarketing can and cannot do can be implemented.

The second part of the article present a study based on primary data, where 10 neuromarketing practitioners shared their experience regarding 3 topics: the sample of neuromarketing studies, the ethical aspects of their work and the attitude of persons involved in neuromarketing studies. Regarding the sample of the neuromarketing studies, we can conclude that the size of the sample varies depending on the used technique, that the dropout rates in case of neuromarketing study is usually low and that the compatibility of subjects with the research topic is ensured through stratified sampling or the use of personalized research guides.

In terms of ethical issues faced by the respondents, it seems that it is very seldom that these types of problems arise. The issue that may appear is that subjects choose to quit the study because they become reluctant to using the equipment. In order to reduce the chances of ethical issues, researchers follow a strict set of rules regarding privacy, transparency and correctitude in their relationship with clients and subjects. Last but not least, the study shows some interesting results regarding the attitude of companies and subjects towards neuromarketing: while companies are a bit reluctant and their attitude varies from trusting and being interested in this method to totally refusing it, subjects seem to be exited, curios and willing to find out more about this method.

Even if not statistically representative, the present study is in line with the academia and researchers objective of increasing the visibility and knowledge about neuromarketing research method, bring to light the perception of neuromarketing practitioners and their experience in designing neuromarketing studies and dealing with people involved in the research process.

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### НЕЙРОМАРКЕТИНГОВІ ДОСЛІДЖЕННЯ: ЕТИКА, ПРОЦЕДУРИ ТА ПЕРЦЕПЦІЯ УЧАСНИКАМИ

*У цій статті обговорюється нейромаркетинг як метод дослідження починаючи з визначень та наявного інструментарію і закінчуючи аналізом етичних проблем в даній області. Новизна дослідження полягає в тому, що представлені перцепції і досвід практиків нейромаркетинга, що сприяє формуванню знань про цей тип маркетингових досліджень.*

*Ключові слова: нейромаркетинг; етика нейромаркетинга; дослідний зразок.*

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### НЕЙРОМАРКЕТИНГОВЫЕ ИССЛЕДОВАНИЯ: ЭТИКА, ПРОЦЕДУРЫ И ПЕРЦЕПЦИЯ УЧАСТНИКАМИ

*В настоящей статье обсуждается нейромаркетинг как метод исследования, начиная с определенных и существующего инструментария и заканчивая анализом этических проблем в данной области. Новизна исследования состоит в том, что представлены перцепции и опыт практиков нейромаркетинга, что способствует формированию знаний об этом типе маркетинговых исследований.*

*Ключевые слова: нейромаркетинг; этика нейромаркетинга; исследовательский образец.*

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### NEURO-FUZZY MODELING THE RATE OF INTERNATIONAL MIGRATION IN UKRAINE

*This article presents a new methodological approach for estimating the rate of international migration in Ukraine based on the experience of other territories and the application of neuro-fuzzy modeling. Firstly, using the results of previous studies, the factors affecting the decision of the person to migrate are determined. Following that, the most vital features found by regression-correlation analysis are used for grouping the countries into clusters in order to determine the list of states, which are similar to Ukraine with regards to migration climate. Based on the data of analogous countries, this study demonstrates the process of developing an adaptive neuro-fuzzy inference system (ANFIS) for modeling the migration rate in Ukraine and provides some recommendations for further research.*

*Keywords: international migration, migration modeling, clustering, fuzzy logic, neuro-fuzzy modeling.*

**Introduction.** Migration processes, as a result of demographic growth, economic needs, climate change, lack of educational opportunities, military conflicts and other reasons, have always been a part of human history and played an essential role in shaping the population of individual countries and territories. However, since the middle of the nineteenth century, in terms of intensification of globalization, development of transport, information and communication technologies, growing demand for cheap labor in economically developed regions, the nature and directions of migration flows began to change radically. From the irregular movement of people, migration turned into a stable and large-scale public process that involves, as a rule, representatives of the labor force. Thus, according to the International Organization for Migration (IOM), over the past 20 years, the total number of international migrants has increased by 49%, accounting for one-thirtieth of the world's population, or 258 million people. Moreover, the issue of external migration is particularly crucial for Ukraine, where in recent decades, in comparison with other countries, increased migration activity is observed.

Undoubtedly, a growth in the mobility of the population guarantees the effective allocation of labor forces between territories, the exchange of labor skills and production experience, the accumulation of knowledge, which generally contributes to boosting the standard of living of the world's society. At the same time, migration tends to change the overall size and structure of the territory's population, the level of availability of resources, which may have a negative impact on the economic, social, political, cultural and other aspects of society.

Considering the global nature of modern migration, its intensification and adverse impact on the national development of the participating countries by changing their labor-power potential, today the crucial task is to study the causes and patterns of migration as a phenomenon, constantly monitor its trends in order to develop and implement the migration policy both at the global and national levels. In turn, the implementation of this task requires the use of economic and mathematical methods, information technologies and models that increase the efficiency of such systems.

Today in the scientific literature there are many models and approaches have been formed, which allow not only to estimate the number of migrants, but also to identify the main reasons influencing the individual's decisions to migrate, to analyze the migratory attitudes of the population and to develop forecasts of potential migration flows in the future. In this case traditional qualitative approaches (questionnaire surveys, expert assessments) and mathematical models, including gravity models and their modifications, econometric, stochastic, agent-oriented and neural network approaches, play a vital role. However, the lack of data, the large degree of abstraction and the unrealistic model assumptions, the incorrect assessment of uncertainty, the calculations complexity and the need of specialized software, the lack of a logical interpretation of the modeling process and other disadvantages still make it impossible to choose the generalized methodology to evaluate the migration, so encourage researchers to look for alternative approaches.

**Literature review.** There are many research papers of foreign and domestic specialists of various scientific fields